The Financing of High-Tech SMEs: Investigating the Effects of Capital Structure on Performance

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Declaration

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Summary

The thesis examines the capital structure of small and medium-sized enterprises (SMEs) which are based in the high-technology sector. Little analysis so far has investigated the impact of financing on this crucial sector and the influence different financing options have on the firms' performance. The importance to job growth and the economy are critical as within the EU, SMEs encompass 99 percent of the total businesses and 67 percent of total employment, while high-technology sectors have been vital to economic strength and demonstrated considerable growth in the past decade (Eurostat 2012; Eurostat 2013). The analysis is discussed in three separate studies, comprising of two different datasets. The first study implements secondary financial data of European high-tech SMEs during a 10-year period from the Orbis database. Two studies use primary data from a questionnaire that was produced with a sample of 100 high-tech SMEs based in Ireland. The country is very suitable for such in-depth survey analysis as it possesses the highest percentage of innovative businesses at 36 percent between the years 2012 and 2014 and measures strongly against European SMEs and innovation markers (Eurostat, 2017d). This data is novel and provides a foundation for research in areas not previously analysed. Four key research questions are answered throughout the thesis, encompassing three different studies, each examining critical areas of capital structure for high-tech SMEs.

The first investigation is undertaken using panel data that encompasses over 7,300 high-tech SMEs based in Europe for 10 years. The study consists of three separate sections, through the use of regression analysis. The first section analyses the influence of capital structure on financial performance through six separate dependent variable measures. Support for a modified high-tech pecking order theory exists for firms that want to improve their financial performance, with debt having a negative relationship on the financial performance measures, while equity has a positive effect. The second section examines the determinants of capital structure, and firm size is found to have a positive relationship with the ability to obtain external capital. The third section investigates the impact of capital structure on internationalisation, via exports for high-tech SMEs, where patents are found to have a substantial positive effect on exports.

The second study implements the questionnaire data, which first provides insights into the determinants of capital structure for high-tech SMEs. The results find that key determinants such as the size of the firm, the number of employees, the proportion of intangible assets and the R&D expenditure can all affect the capital structure. An investigation regarding the influence of capital structure and firm characteristics on the

generation of EBITDA and profitability takes place. Internal finance is found to have a positive effect, while possessing a target debt demonstrates a positive influence on the financial performance of high-tech SMEs. Previous experience in an incubator or accelerator programme has a negative relationship with the financial performance and profitability of these firms.

The third study first examines how the challenges and objectives of high-tech SMEs are influenced by the capital structure. This topic is limited with a lack of previous analysis resulting in the creation of novel results and investigation added to the literature. Multinomial logistic regression analysis is undertaken to investigate the relationship between financing options and the challenges and objectives of the firms. Such research discovers that the use of debt finance increases the risk of being unable to obtain adequate future capital. Results demonstrate that high-tech SMEs rely heavily on internal finance, but internal finance can raise the challenge of meeting future expenses. An increase in experience improves the likelihood of selling the business, after 5 years, as the primary objective. The findings produced within this investigation are novel and provide additional understanding regarding the importance of capital structure to the literature.

This investigation also examines internationalisation through an analysis of exporting and the impact of capital structure and key characteristics on their outcome. Logistic regression, illustrated through the odds ratio and further analysis utilising predicted probability encompass some of the econometric analysis undertaken. The research enquires into the topic of international business and combines it with capital structure literature to provide robust analysis and understanding. The use of equity finance has a substantial negative relationship with exports and a considerable positive influence on domestic sales. When information asymmetry is limited, due to the strong knowledge which the bank lender possesses regarding the high-tech sector, exports revenue will significantly increase. The study produces original findings on a new important topic, where no analysis existed for high-tech SMEs or many other businesses.

The thesis investigates and examines the relevance of capital structure for high-tech SMEs. Various capital structure theories are implemented in the analysis and discussions of the results. The findings demonstrate that high-tech SMEs should acknowledge their financing options as they can affect the businesses' performance through a multitude of different means.

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List of Abbreviations and Acronyms

AIM	Alternative Investment Market
BOI	Bank of Ireland
BPFI	Banking & Payments Federation Ireland
CAPM	Capital Asset Pricing Model
CEO	Chief Executive Officer
CFO	Chief Financial Officer
COSME	The Competitiveness of Enterprises and Small and Medium-Sized Enterprises
COV	Covariance
CSO	Central Statistics Office
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortisation
EC	European Commission
ECB	European Central Bank
ECSIP	European Consortium for Sustainable Industrial Policy
EFG	Equity Facility for Growth
ESRC	Economic and Social Research Council
ESMA	European Securities and Markets Authority
EU	European Union
FAME	Financial Analysis Made Easy
FDI	Foreign Direct Investment
FE	Fixed Effects
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
GP	Gross Profit
GVA	Gross Value Added
IP	Intellectual Property
IPO	Initial Public Offering of Common Stock
IV	Instrumental Variables
LGF	Loan Guarantee Facility
LT	Long-Term
MiFID	Markets in Financial Instruments Directive
MNE	Multinational Enterprise
MTF	Multilateral Trading Facility
NACE	Nomenclature of Economic Activities
NDTS	Non-Debt Tax Shields
NPV	Net Present Value
NSSBF	National Survey on Small Business Finances
NTBF	New Technology Based Firms
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Squares
PE	Private Equity
PM	Profit Margin
POT	Pecking Order Theory
PSM	Propensity Score Matching
R&D	Research and Development

RE	Random Effects
ROA	Return on Assets
ROE	Return on Equity
ROI	Return on Investment
ROW	Rest of The World
SAFE	Survey on Access to Finance for Enterprises
SIC	Standard Industrial Classification
SME	Small and Medium-Sized Enterprise
ST	Short-Term
TA	Total Assets
TBSF	Technology Based Small Firm
TCD	Trinity College Dublin
TOT	Trade-off Theory
TSLS	Two Stage Least Squares
UK	United Kingdom
USA	United States of America
VC	Venture Capital
VIF	Variance Inflation Factors

Chapter 1. Introduction

1.1 Topic Overview

Small and medium-sized enterprises (SMEs) have an important role in the global economy due to their strong economic output and the large employment they provide. Such businesses can be the lifeblood of economies around the world, but often they face difficulties relating to obtaining resources, an issue not heavily experienced by large and multinational enterprises. One crucial issue that SMEs must overcome is the obtainment of adequate capital to ensure they can continue in business and for future growth. The high technology (high-tech) sector is becoming critical for European economies as they move away from low-technology manufacturing employment. This resonates with the development of significant innovation from such high-tech activity, the solid economic output the sector produces and the generation of good quality jobs. The analysis encapsulates a critical and thriving business area, but obstacles such as a lack of both investor and lender understanding of the business and the size of such SMEs can have a negative impact on their attainment of capital. The core element of the thesis is to investigate the effects of capital structure sources on the firm performance of high-tech SMEs, encompassing a variety of different analysis measures, hypothesis testing and a combination of statistical tests.

The majority of previous research in this area focuses on business within the United States of America (USA), with a limited amount of prior research focusing on Europe. Given the importance of this sector within Europe, the thesis examines the financing and effects of capital on the high-tech SME sector through two separate datasets. The first dataset comprises of the financial data of European high-tech SMEs from a secondary data source. To provide a greater understanding of this topic and present insights into areas previously not researched; an in-depth analysis of high-tech SMEs in Ireland, which is a strong representative of the sector in Europe, is undertaken and analysed. Such data and corresponding results are not available from secondary financial datasets. The second dataset consists of novel, primary data produced from a questionnaire completed by CEOs, CFOs, founders, owners and other critical roles within Irish high-tech SMEs. This ensures high-quality information regarding the firms' relationship with a variety of financing aspects. The use of both data sets provides a strong overview of high-tech SMEs' relationship with capital structure in Europe and a magnified approach to obtain findings with little previous analysis on topics of significance to the firms, lenders, investors and Governments. This chapter provides a contextual overview regarding the crucial aspects of the thesis, discusses the motivation, declares the objective, describes the research question, and finally summarises the research contributions and output.

1.2 Research Context

1.2.1 Capital Structure

Capital structure has been analysed for over half a decade yet no true optimal theory has been in existence during this time. Contrasting results and insufficient analysis have resulted in a lack of guidance for businesses seeking to adjust their capital structure. Such analysis has a major emphasis on the USA but less on the rest of the world (Drobetz & Fix, 2005). Firms do not follow a sole capital structure, since the type of business, the size and the industry can all affect the role of debt and equity and its financing ability. SMEs have a different optimal capital structure compared to technology-based small firms (TBSFs) (Brierley, 2001). Even though neither are large businesses, it illustrates the differences which exist between capital structure, given the variety of diverse firm characteristics. Key theories have been introduced, and while many firms follow certain aspects of them, this may be due to circumstance. The correct use of finance can have a strong positive association with a business' success, as debt can result in bankruptcy if not implemented properly (Thomas, 2013). Capital structure is more significant than an afterthought or combination of events for a business, and firms will need to recognise this. Debt finance should not be taken on lightly; businesses must also be aware that self-financing may not be sustainable or the best choice for future growth. Many firms fall into a capital structure, which consists of low debt, high equity with retained earnings saved as a contingency. However, for firms to operate and perform to their potential, it is crucial that the appropriate amount of capital is available to them (Cassar, 2004). Finance can have a critical role to play in the success or failures of any business.

1.2.2 Small and Medium-Sized Enterprises (SMEs)

An SME is defined as a business which employs less than 250 staff members and has annual revenue of less than €50million or a balance sheet not larger than €43million (European Commision, 2015), SMEs, as per this EU definition, account for over 99 percent of businesses within the EU, demonstrating their importance to the economy (Eurostat, 2012) Delving further, 90 percent of businesses employ less than 10 staff members and are defined as micro firms. While large firms may take many of the headlines, it is SMEs that support economic growth and provides more employment than their larger counterparts provide Indeed, SMEs have an extensive contribution to make to national economies (Amini, 2004). The total number of people employed throughout the EU in non-financial business consists of 133,767,000, whereby a prominent majority of 67 percent of employees work for SMEs (Eurostat, 2012). This figure alone illustrates the importance of SMEs to the European economy and relevance toward the livelihood of millions of their citizens. It is imperative that these businesses are adequately financed and any such issues are addressed by all stakeholders who can influence these businesses. As of 2009, 14.8 percent of the EU workforce were self-employed (European Commission, 2010b). Such figures further emphasise the vital importance of SMEs, in comparison with the big multinational enterprises (MNEs) based in Europe. Further discussion of this topic is presented in Chapter 2. MNEs are viewed as a significant aspect in the growth of economies and provide strong employment with 33 percent total (Eurostat, 2012), but these discussed figures also illustrate how SMEs should not be ignored for economic growth and success and have a vital role to play towards prosperity and growth.

In order for SMEs to supply jobs, economic output and growth, it is imperative that they are financed correctly and able to obtain the finances they need. They should monitor their capital structure and aim for financing targets, not utilise whatever options are simply available, however, SMEs access to external sources of capital is a considerable issue (European Commission, 2006; OECD, 2006). The capital structure for small firms can be optimal, dependent upon the business growth cycle which encapsulates mainly their age and firm size (Berger & Udell, 1998). Additional research has found that capital structure decisions are influenced by firm size, measured by employees, but not age (Gregory, Rutherford, et al., 2005).

1.2.3 High-Tech Sector

Technology-based businesses operate in engineering and science more than the average industry (Chapple et al., 2004). The high-tech sector is depicted as businesses which have a greater percentage of employees working in research and development (R&D), combined with a higher than the industry average of R&D expenses compared to revenue (Butchart 1987). The Standard Industrial Classification (SIC) codes can be used to define which businesses are high-tech by the implementation of a categorisation system (Cassia & Minola, 2011). 19 such high-tech SIC codes for high-tech SMEs exist for firms based in the United Kingdom (UK) (Butchart 1987). More recent research into high-tech firms assesses the industry's R&D employment percentage and then positions the firms into technology groups relating to the SIC codes (Minola, Cassia, & Criaco, 2013).

The high-tech sector and innovation in SMEs are vital to the future economic position of the EU. A significant increase of 26 percent occurred in high-tech manufacturing production within the EU between 2005 and 2012 (Jaegers, Lipp-lingua, & Amil, 2013). Contrary to this, both the medium-low-technology and low-technology sectors have decreased in production value output since 2008. While high-tech firms have a growth lifecycle, it is unlike other sectors, particularly regarding the aspect of capital (Berger & Udell, 1998). Recent research has found that small businesses in the high-tech sector primarily use internal finance to pay for new projects and investments (Revest & Sapio, 2012).

Furthermore, small innovative firms do not deem debt as a financing source of capital when in comparison with other industries (Calcagnini, Favaretto, & Giombini, 2011). A key point relating to high-tech SMEs is that they are different to most SMEs due to the substantial proportion of intangible assets they possess. Little evidence currently exists regarding why high-tech businesses take less debt than equity due to information asymmetries (Minola et al., 2013). Capital structure has a critical influence on firm performance and economic future for many countries. It should not be an afterthought for management. The importance of the high-tech sector and SMEs to the economic future of the EU and all of its' citizens are shown to be significant, in particular, high-tech SMEs are of substantial importance. Therefore, the influence of capital structure and the ability to obtain financing options is a topic worth investigating for high-tech SMEs given this background.

1.3 Research Motivation and Objectives

The thesis covers a selection of crucial topics that have previously lacked analysis in little or no detail relating to high-tech SMEs and their capital structure. The following section will provide an overview of these areas and focus on the motivation regarding their importance for research. As previously discussed, the importance of capital structure should not be taken lightly and can have a distinct impact on the present and future of many businesses. Research has looked at many aspects of capital structuring, focusing heavily on the determinants of capital choices, as well as whether firms follow certain capital structure theories. A detailed analysis of this is discussed in Chapter 3. Recent analysis has suggested that; firm size, asset structure, profitability, growth opportunities, asset tangibility, inflation, impact of tax shield, non-tax debt shields, tax rate and bankruptcy-related costs have an effect to varying degrees on the capital structure (Bayrakdaroglu, Ege, & Yazici, 2013; Chen, 2004; Kayo & Kimura, 2011). Research on capital structure relating to both SMEs and the high-tech sector has been undertaken, with contrasting results. Given the limited quantity of analysis in existence until recently, the analysis of high-tech SMEs capital structure is in an early research stage. These firms represent a sector and firm type that are of critical importance to the economy, and the analysis of their capital structure is of important academic value.

The study aims to increase the knowledge of this engaging subject by analysing significant aspects of high-tech SMEs and capital structure throughout the investigation. 2 datasets are employed within this research, one of which consists of a range of financial and business data from private high-tech SMEs throughout Europe. The other is a novel, original dataset of Irish high-tech SMEs comprising a variety of topics and findings that are not available for such firms through secondary databases. The combination of separate analysis undertaken using both datasets within the thesis will provide a unique perspective on the landscape of high-tech SMEs and capital structure. An initial, broad approach providing a solid overview of the high-tech SME landscape is then combined with a more in-depth, focused process. This study's aim, via the combination approach, is to produce novel research and results that offer insights into this engaging and critical topic through between-methods triangulation

1.3.1 Intangible Assets and Future Growth

High-tech SMEs possess intangible assets, which are strongly associated with innovation and research and development (R&D). Subsequently, intangible assets are the major components for the future growth opportunities of a firm, given that they often possess market-changing possibilities. Intangible assets are not physical assets, such as buildings and machinery, but do have a value which is often positively related to the specific business. For high-tech firms with information asymmetries, a strong correlation with intangible assets exists due to the reluctance to distribute capital amongst lenders and investors with little collateral, resulting in a premium cost for external finance (Garnsey, 1995). Given this overview, intangible assets are hard to value correctly due to their more complex nature. When analysing their importance, it is discovered that they can be the crux of success or failure for many firms in the future (Clarysse, Heirman, & Degroof, 2003). However, it is innovation which has a procedurally negative impact on obtaining external finance (Freel, 2007). Most high-tech SMEs possess a limited amount of capital and cannot take advantage of these opportunities provided by innovation and intangible assets without external finance.

Without intangible assets, in combination with intellectual capital, it can be hard for a business to produce and sustain value (Chaminade & Roberts, 2003). Further analysis illustrates how the use of external finance is imperative for innovative businesses to reach full potential in the commercial market (Beck and Demirguc-Kunt, 2006). High-tech SMEs, such as new technology-based firms (NTBFs) can generate remarkable growth and market value in a short period, yet, many other firms are not as fortunate. Therefore, the use of capital sources must be addressed for high-tech SMEs that are seeking to capitalise on their capabilities. Since high-tech SMEs are critical to future job creation and economic growth, this study seeks to reduce the deficit of knowledge as to how they should best finance themselves to improve performance.

1.3.2 Export Revenue, Growth and International Market Share

Internationalisation is no longer solely associated with larger businesses as it is now more accessible for SMEs to enter international markets. Due to their fluid structure and smaller size, SMEs have an advantage in adapting to global markets, especially younger firms which are more open to learning different procedures (Autio, Sapienza, & Almeida, 2000). Start-up experience is an attribute which has a significant influence on the objectives of firms, such as exporting and can result in better growth opportunities (Westhead, Ucbasaran, & Wright, 2003; Westhead, Wright, & Ucbasaran, 2001). Indeed, the availability of finance is found to be one of the three main influences when deciding if SMEs will plan to sell their products on a global scale (Graves & Thomas, 2008). Small firms seeking growth will begin exporting due to the lack of intensity it has on business resources compared to other measures in gaining international market share (Bonaccorsi, 1992; Lu & Beamish, 2006). While other research finds that exporting can have a negative correlation with smaller firms due to a lack of adequate external finance and this remains consistent with the findings by Bellone et al. (2010). Furthermore, banks often reject loans from young SMEs which utilise a growth strategy whereby exporting is the fundamental method for robust returns (Riding et al., 2012).

Innovative activities, which encompass R&D amongst others, have a positive relationship with exporting (Alvarez & Robertson, 2004). If such firms are successful in international markets, revenue should increase, and internal finance should be bolstered over time. Autio, Sapienza, & Almeida (2000) note that the quick adaptation to international markets can produce improved firm growth and stronger profits for SMEs. Innovation has productivity benefits for firms involved in services, which can result in an intense improvement in exports (Love, Roper, & Hewitt-Dundas, 2010). Exporting, while not the sole method towards global market share, is a vital tool for high-tech SMEs to gain international growth, but may need help via beneficial corporate action (Jones, 2001). Previous investigations into SMEs and exporting analysed the firm determinants that influence whether SMEs would export. Exporting can provide high-tech SMEs with new markets and opportunities. However, the influence of capital structure on exporting is a topic not previously researched for these firms. It is a topic of critical importance for business growth and economic prosperity and while prove an investigation of benefit for all stakeholders of these firms. Very little, limited research on the topic of exporting and capital structure exists, particularly about high-tech SMEs. The implementation of exporting and the influence of capital structure will provide some engaging results and interesting academic findings.

1.3.3 Objectives and Challenges

It is crucial to allow different interpretations of a firm's performance due to the various manners and methods in which performance is evaluated (Delios & Beamish, 2001). Some businesses may deem improving the return on equity as a success. Other firms may possess a preferred objective of increasing employees, gaining market share or lowering costs and so it is imperative to analyse this topic. The type of business and its size can have a significant impact on its objectives. SMEs seeking to improve their skill set must deal with an array of challenges, which can be comprised of inadequate access to finance, the current SME culture and a lack of training opportunities (Lange, Ottens, & Taylor, 2000). An issue with SMEs is that they often do not possess considerable sums of money to invest in all objectives and so they must rank their objectives in order of importance. SMEs which possess limited resources such as capital and knowledge are more susceptible to damaging changes in the market (Buckley, 1989). This is critical to note, particularity for high-tech SMEs, given their substantial proportion of intangible assets. A lack of collateral and a considerable amount of information asymmetry further negate an opportunity for external capital. Human capital is essential for business success and experience has a substantial impact on a firm's survival, growth and the ability to gain finance. Better experience allows new firms to gain adequate finance and improved valuations from venture capitalists when seeking investment (Hsu, 2004). Indeed, the likelihood of strong business performance depends on both the internal attributes of the firm such as intangible assets but also the external environment and importantly, the specific competitive advantage (Barney, 1991).

This study will investigate and acknowledge the importance of both human and financial impacts when researching the goals and challenges of high-tech SMEs, a topic with little previous analysis. Many prior investigations of capital structure seek to analyse the determinants of financial sources used, but this research will examine a topic not previously researched. The subject is of substantial importance; as the findings will provide an insight into the financial status of these firms combined with their long-term objectives. Further research will demonstrate the influences of capital sources on the challenges faced by high-tech SMEs. The results will benefit the academic world by providing insights into a new area of research and assist high-tech SMEs, investors, lenders and Governments in minimising their challenges and maximising their attainment of objectives.

1.4 Research Questions

Relying solely on internal finance is often viewed as a simpler method to run a business, whereby profit is generated and then used for expansion and investment. Internal finance often consists of personal savings and retained earnings, while external comprises both of informal and formal finance, such as through friends and family but also banks or private investors, respectively (Atherton, 2009). Publicly unknown businesses, which encompass the majority of SMEs, have higher capital costs and limited access than more publicly known firms (Brito & Mello 1995). When businesses have the correct finance in place and ensure their capital structure is reviewed, this provides a greater opportunity to achieve their objectives. Indeed, SMEs can risk serious capital difficulties if not financially successful, as they are more susceptible to financing limits than larger businesses (Mata, Portugal, & Guimarães, 1995). The role of finance, particularly in high-tech SMEs is something which should never be overlooked, as an inadequate capital structure can result in an adverse or even detrimental impact on the firm. Investors and lenders investing in innovation is a risky approach as a great disparity exists between the fortunes of innovative projects (Coad & Rao, 2008). Without adequate and appropriate finance to support them, many future growth opportunities may never be realised. Previous literature examining high-tech SMEs demonstrates that they typically rely heavily on internal finance, such as retained earnings and personal finance (Colombo & Grilli, 2007; Scellato & Ughetto, 2009).

This research will examine the role and importance of capital structure amongst Irish and European high-tech SMEs, analysing key criterion such as the impact on the financial performance, challenges, objectives and exporting. It will shed new light on areas not previously covered in the literature of capital structure while providing updated findings using new databases and analysis on new and innovative topics. Given the previous discussion of the current status of the research topic, the following four key questions are proposed to provide a distinct contribution to the literature:

1. *What are the sources of finance utilised by high-tech SMEs and how are they influenced by firm characteristics?*

2. *What effects do the capital structure, firm characteristics and human capital have on the goals and challenges of high-tech SMEs?*

3. *How do key firm characteristics and financing sources impact the exporting of high-tech SMEs?*

4. *What effects do the financing sources of high-tech SMEs have on their financial performance?*

The 4 questions are answered throughout the thesis and are revisited in the concluding section when reviewing the findings in reference to the research objectives.

1.5 Thesis Structure and Contribution

The thesis structure contains 10 distinct chapters and the appendix, which comprises three studies examining the capital structure of high-tech SMEs. Chapter 1 introduces the thesis and covers the concepts and motivation behind the analysis. The structure and outline of the research and an overview of the analysis is undertaken. Chapter 2 inspects and scrutinises the current practicalities of SMEs and the high-tech sector from both a European and Irish perspective. The importance of SMEs are analysed, and their impact on the economy is discussed. The characteristics of firms based in these countries and the influence of innovation and high-tech manufacturing are also examined. The issue of access finance is developed, addressing this issue from both an Irish and European perspective, noting many similarities, and the policies to attempt to deal with this issue. The listing status of SMEs and public markets are investigated along with alternative finance options. Finally, the importance of exporting to firms and SMEs is investigated. This chapter provides a thorough investigation into the importance of high-tech SMEs towards future Irish and European economic prosperity and notes the challenges of obtaining adequate finance.

Chapter 3 contains the literature review, which first examines capital structure theories such as Modigliani and Miller's research, the trade-off theory, the pecking order theory, signalling theories and the market timing theory. The theories are examined in detail and support for their findings amongst other researchers is provided. The next section provides a discussion on the main determinants of capital structure within the literature. The chapter then provides a detailed review focusing on the relationship between high-tech SMEs and capital structure, including a discussion of topics such as the modified high-tech pecking order theory, signalling theories for SMEs, and the financing of innovation. The chapter then examines the literature of exporting and focuses on such key areas for this study: exports, innovation and high-tech SMEs, exporting and finance. The chapter concludes with a theoretical background overview that contains a detailed meta-analysis review of academic research over 60 years relating to capital structure and the theories, consisting of four specific businesses in four tables: large firms, technology firms, SMEs and finally high-tech SMEs.

Chapter 4 builds upon the previous analysis and findings within the literature review chapter to produce the hypotheses that will be tested and discussed within the analysis chapters of the thesis. The hypotheses are categorised into 5 specific areas for analysis: determinants, financial performance, challenges, goals and objectives and finally, exporting. The relevance of implementing a research process that utilises two separate datasets consisting of a quantitative dataset and a qualitative dataset are debated. This triangulation of multiple research methods is known as between-methods triangulation (Denzin, 1978) and the advantages are discussed which include the production of richer, more developed data and more comprehensive results (Jick, 1979). The use of Ireland and Europe as the complementary regions for the two distinct datasets and subsequent between-methods triangulation are then examined. The reasons are categorised into 3 main sections by demonstrating the similarities through the implementation of the analysis throughout Chapter 2. The first justification relates to the importance of SMEs in both Europe and Ireland. The second section relates to the importance and implementation of innovation and high-tech productivity within SMEs in Europe and Ireland. The final topic that verifies both Ireland and Europe as comparative locations for this research relates to finance and the financing issues. The next section discusses the variables used throughout the analysis and their definitions. The variables are categorised first by their dataset type and then both an independent and dependent variable table for each dataset is provided.

Chapter 5 describes the research philosophy, methodology, research design, questionnaire design, data, panel data and the economic models used in the analysis. Firstly, the epistemological and ontological approach of this research philosophy is detailed, and a discussion on mixed method research is undertaken. The previous uses of primary and secondary datasets in the literature are then examined. The creation of the questionnaire and its design, the research boundaries and the development and importance of question styles are demonstrated. The implementation of the questionnaire and the cleaning up of the data and its implementation is then discussed. The chapter then provides an overview of the 2 datasets used in the study, the discussion of panel data and its benefits are provided, and both fixed and random effects are considered in detail. Finally, the discussion and production of the econometric models that are used to test the created hypotheses are presented.

Chapter 6 examines the influence of capital structure and innovation on financial performance through 6 key metrics, which include the ROA, ROE and profit margin. The analysis investigates the determinants of gearing values, the value of equity and 3 types of debt, as a robustness check. Finally, the influence of debt and equity on exports is examined, in this relatively new topic. The research incorporates the quantitative dataset of 7,300 European high-tech SMEs over a 10-year period, collected from the Orbis database. By implementing panel data, the fixed effects regressions, random effects regressions, instrumental variables regressions and dynamic panel models are used in undertaking the analysis, with some results presented in the appendix. 6 individual regressions for each of the 4 capital structure variables under analysis are implemented to test the relevant hypotheses regarding financial performance. The Hausman tests state that the fixed effects analysis models should be used in this analysis and the Dickey-Fuller tests find that no unit roots exist. Some interesting results denote how the use of external debt has a negative influence on the financial performance of high-tech SMEs. The use of equity in the capital structure provides a positive effect on the financial performance measurement variables. The findings demonstrate that these firms should implement the modified high-tech pecking order theory to improve their financial performance. It provides an important contribution to the capital structure literature and reinforces previous analysis that high-tech SMEs are different to both SMEs and large firms. The findings support the belief that debt has a negative relationship with financial performance (M. Harris & Raviv, 1991; Margaritis & Psillaki, 2010; Smith & Watts, 1992; Titman & Wessels, 1988). The results also demonstrate that management should not solely accept a source of capital just because of their availability. Management should view the contribution of capital structure as an essential business aspect to manage given the relationships different sources have with financial performance and firm characteristics.

Chapter 7 analyses the high-tech SMEs based in Ireland using the dataset produced from the primary questionnaire and provides a detailed analysis of their capital structure and financing use. The analysis uses both descriptive statistics and multiple ordinary least squares (OLS) regression analysis to investigate the effects of internal finance, debt and equity on the financial performance. Key variables and their impact on the source of finance used by high-tech SMEs are examined, through the testing of the produced hypotheses. 45 percent of high-tech SMEs possesses intangible assets valued at 85 to 100 percent of their total assets. The importance of internal sources, particularly retained earnings, is found amongst older firms. A change from equity finance to debt occurs within high-tech SMEs over time. Regression analysis finds that when firms possess a target debt ratio, it will positively affect their financial performance. This provides a chief contribution to the literature, with an interpretation that noting how capital structure can improve their financial performance. Subsequently, management should ensure that the financing of high-tech SMEs is reviewed and adequately employed. A negative relationship exists between the use of incubators and accelerators with profitability, while firms that take on more employees have a positive relationship with equity finance. The literature contribution provides a novel result for this new aspect of capital structure analysis as a foundation for additional research.

Chapter 8 examines the effects of the capital structure on the objectives, challenges and exports of high-tech SMEs. This chapter also provides insight into the long-term goals, alternative sources of finance, the breakdown of the largest shareholders in the firms and capital structure using descriptive statistics. Multinomial logistic regression analysis is employed, whereby the relative risk ratio (RRR) is used to comprehend the results. This is incorporated in the analysis of capital structure effects on both the objectives and challenges of the firms. The novel results find that capital structure has a significant impact on the outcomes of the challenges and objectives. Additional debt increases the challenge of obtaining adequate finance, while the increased use of internal finance results in the inability to meet expenses in comparison to preserving and growing the customer base. The additional use of equity decreases the challenges of meeting expenses and regulatory issues. Therefore, this analysis offers support for the modified high-tech pecking order theory and contributes to the implementation of this to improve performance. Another result finds that use of debt increases the challenge of obtaining future staff. The use of internal finance increases the likelihood of an initial public offering (IPO) becoming the primary objective for high-tech SMEs, while previous start-up experience negatively affects the likelihood of selling the business after 5 years. This analysis is particularly interesting given how these firms have a substantial challenge in securing adequate finance (North, Baldock, & Ullah, 2013). The contribution to the high-tech SME financing literature demonstrates that different finance options can improve or hurt the objectives and challenges and further strengthens the importance of capital structure research. It illustrates how the capital structure should be a priority for the management of high-tech SMEs to address effects on performance, while this novel analysis provides a base of knowledge for further research.

The export section investigates the effects of capital structure and firm characteristics on domestic sales, exports and a breakdown of different global regions. The analysis then examines a logistic regression on the determinants of high-tech SMEs that export, the results are provided in both log odds and the odds ratio. Tests of collinearity are undertaken to ensure the results are robust. The use of debt is found to have a negative relationship with exports and a positive relationship with domestic sales and according to predicted probabilities the greater the debt amount, the smaller the exporting probability. An increase in R&D expenditure has a positive, but small, impact on export revenue and can demonstrate how innovation improves the revenue generated from exports. The analysis notes that as firms grow bigger a positive relationship with exports in high-tech SMEs and when limited information asymmetry exists, this produces a positive effect on exports. A key contribution of the findings notes that unprofitable firms may export as an option to generate revenue, while profitable firms are content with creating revenue streams domestically. The research provides novel contributions to the literature regarding the relationship between capital structure and exports particularly for high-tech SME, given the innovative nature of the analysis.

Chapter 9 discusses the findings and additional knowledge the investigation provides to current academic literature and compares them to the objectives of the thesis. The contribution towards the capital structure of high-tech SMEs is developed, while the practical implications of the findings are considered in regards to the management, owners, lenders and investors. Finally, the limitations and future areas of research are briefly discussed.

The final chapter is the bibliography, and Chapter 10 provides details of the over 400 references used throughout the thesis. Finally, the Appendix consists of 5 separate sections, whereby Appendix A provides the original results from the primary questionnaire, which consists of over 40 individual questions and responses. Appendix B provides an illustrative breakdown of the sources of finance for high-tech SMEs through the data gained from the primary questionnaire. Appendix C relates to additional regression analysis and tests undertaken for the research throughout Chapter 6. Appendix D undertakes additional regression analysis for robustness through the implementation of dynamic panel model analysis. Appendix E provides further robustness tests and misspecification tests for the analysis throughout the thesis. Appendix F provides additional analysis regarding the survey dataset with the implementation of the Rosenbaum Bounds analysis, Mantel-Haenszel analysis, propensity score matching analysis and the Heckman 2 Step analysis.

1.6 The Output of the Thesis

A number of papers based on the research conducted for this thesis were accepted for presentation and discussion at subsequent conferences and events. Four research papers have been produced as part of the thesis and are in various stages of the publication process for small business and financial management journals. The following details the current output of the thesis:

Neville, C (2015), Optimising Capital Structure: Financial Performance in the Technology Sector. Poster presented at Discover Research, Trinity College Dublin. 25th September 2015.

Neville, C and Lucey, B (2015), Irish Technology Sector Insights, Research presented at Bank of Ireland Technology Sector Briefing 2015, Bank of Ireland, 13th November 2015.

Neville, C and Lucey, B (2016), Capital Structure, Banks and Intangible Assets: Examining Financial Performance on Irish Tech SMEs. Paper presented at the 14th INFINITI Conference on International Finance. Trinity College Dublin, Ireland: 13-14 June 2016.

Neville, C and Lucey, B (2016), The Capital Structure of High-Tech SMEs and Future Goals, Challenges and Priorities. Paper presented at the 2016 Irish Academy of Management Annual Conference. UCD Michael Smurfit Graduate Business School, Dublin, 31st August - 2nd September 2016.

Neville, C and Lucey, B (2017), The Capital Structure Conundrum: The Future of High-Tech SMEs' Exports, Challenges & Goals. The 15th INFINITI Conference on International Finance Universitat de València, Valencia, Spain 12-13 June 2017.

Neville, C and Lucey, B (2018), European High-Tech SMEs: The Influence of Capital Structure on Financial Performance and Exports. The 16th INFINITI Conference on International Finance, Poznan University of Economics and Business, Poznan, Poland 11-12 June 2018.

Chapter 2. Contextual Background and Significance of High-Tech SMEs

2.1 Break down of Businesses' Size and Contribution in Ireland and Europe

In the current economic situation, SMEs account for 99 percent of all businesses within Europe, as defined by the European Union (EU). Delving further, 90 percent of these firms possess less than 10 staff members and are defined as micro businesses (Mettler & Williams, 2012). The figures presented in Table 2.1 illustrate an in-depth analysis of the 28 EU countries regarding the size of businesses and also the employment provided and value generated which the different types of businesses supply. Over 22million SMEs are currently in operation in the 28 countries, a significant amount compared to just 44thousand large firms. The sheer scale difference offers an overview of the importance SMEs have within the EU, particularly regarding the value they produce for the countries involved. For Canadian firms, the change in size from medium to large occurs for only 1.4 percent of the businesses, with a key challenge facing such SMEs is a decrease in innovation due to limited R&D finance (Herman & Williams, 2013). The low proportion of large businesses in major western countries is established, and the importance of SMEs to their respective economies is further demonstrated.

Given the high proportion of micro businesses in operation, the merit of the large businesses come to fruition regarding employment, where nearly one-third of all people are employed in such firms per Table 2.1. A comparatively minuscule amount of large businesses are active, and this finding demonstrates their influence upon governments due to the employment they provide. Indeed as of 2009, 14.8 percent of the EU workforce was self-employed, a 1 percent decrease from 2000 (European Commission, 2010b). Table 2.1 demonstrates how both SME and large firms contribute from both a labour and a value-added perspective. While large businesses have an effect on the entire economy of the EU, given the significant number of SMEs, they can considerably influence whether the EU will have future economic growth and prosperity or stagnation and decline. Ensuring these firms are financed correctly and able to operate at their optimum, is critical for the livelihood of over 89million employees and the growth of these firms and the countries in which they operate.

Table 2.1: Key size class indicators regarding different firm sizes of the non-financial business economy within the EU-28 countries in 2012

	Number of enterprises	Number of persons employed	Value-added	Apparent labour productivity
			(EUR million)	(EUR thousand per head)
All enterprises	22, 347,000	133, 767.000	6, 184, 825	46.2
All SMEs	22, 303,000	89, 690,000	3, 557, 448	39.7
Micro	20, 718,000	39, 000,000	1, 300, 000	33.3
Small	1, 362,000	28, 000,000	1, 100, 000	39.3
Medium	224,000	22, 967,000	1, 128, 743	49.1
Large	44,000	44, 078,000	2, 627, 377	59.6

Notes: The table shows a breakdown of the four separate business types categorised into sizes: Micro, Small and Medium, which combined comprise SMEs and finally large firms. The table provides statistics regarding the 28 member states within the EU in 2012. Information relating to four distinct categories: number of enterprises, number of persons employed, value-added and apparent labour productivity are provided for each firm size, including their combined values. (Eurostat, 2012)

Table 2.2 provides a parallel breakdown of employee and business indicators for Ireland compared to the EU-28 countries for 2015, with similar results to the EU, comparable in almost all of the statistics. This demonstrates that Ireland is a reliable country for an in-depth analysis of European SMEs, given the statistics. The sole differing figure regards the value added whereby large firms provide a higher overall percentage for Ireland. An interesting perspective is that smaller, younger firms tend to create a range of employment to fulfil their objectives, while larger firms tend to remove roles to advance their cost efficiency (Mettler & Williams, 2011). This raises an interesting perspective, particularly given that a large number of job losses are due to the implementation of technology and automation (Whitehouse, Rojanasakul, & Sam, 2017). A key reason is that smaller firms are more agile and adaptable to changes in an compared to their larger counterparts. Consequently, such firms can introduce innovative, new products and follow that path if successful, compared to larger businesses that enact plans slowly.

Table 2.2: Employees and Business indicators for Ireland compared to the European Union

	Number of enterprises			Number of persons employed			Value added		
	Ireland		EU-28	Ireland		EU-28	Ireland		EU-28
	Number	Share	*Share*	Number	Share	*Share*	Billion €	Share	*Share*
Micro	138 823	88.9 %	*92.7 %*	297 656	25.5 %	*29.2 %*	13	14.7 %	*21.1 %*
Small	14 143	9.1 %	*6.1 %*	276 516	23.7 %	*20.4 %*	14	15.1 %	*18.2 %*
Medium-sized	2 785	1.8 %	*1.0 %*	253 848	21.7 %	*17.3 %*	15	16.9 %	*18.5 %*
SMEs	**155 751**	**99.7 %**	***99.8 %***	**828 020**	**70.9 %**	***66.9 %***	**42**	**46.7 %**	***57.8 %***
Large	464	0.3 %	*0.2 %*	339 113	29.1 %	*33.1 %*	48	53.3 %	*42.2 %*
Total	**156 215**	**100.0 %**	***100.0 %***	**1 167 133**	**100.0 %**	***100.0 %***	**90**	**100.0 %**	***100.0 %***

Notes: The table illustrates statistics of a comparison of Ireland with the average of 28 member states within the EU in 2015 concerning the percentage shares of each. The table provides a breakdown of the four separate business type broken down into sizes: Micro, Small and Medium, which combined comprise SMEs and finally large firms. Information relating to three distinct categories: number of enterprises, number of persons employed and value added are provided for each firm size. (European Commission, 2015)

2.2 High-tech sector, SMEs and High-tech SMEs

2.2.1 High-tech firms

The high-technology (high-tech) sector is described by Butchart (1987) as firms which possess higher than the industry average of R&D expenses compared to revenue and have a higher percentage of employees who work in R&D. Technology-based businesses are those which utilise engineering and science more than the average industry (Chapple et al., 2004). The types of businesses which are high-tech can be defined as those that have been categorised into groups according to the Standard Industrialization Classification (SIC) codes (Cassia & Minola, 2011). For firms based in the United Kingdom (UK), there are 19 high-tech SIC codes for such firms to be categorised (Butchart, 1987). This working definition is supported by Hadlock, Hecker, & Gannon, (1991) who argue that analysis of R&D employment is critical in defining high-tech firms and sorting such businesses into categories is the correct method to follow. Recent use of high-tech firms in research compares the industry's R&D employment percentage and then places the firms into technology groups in relation to the SIC codes (Minola et al., 2013). The classification of firms in Europe is undertaken by the Nomenclature of Economic Activities (NACE) Rev. 2 codes, which have been used by the European Commission (EC) about the survey on firm financing issues (European Commission, 2016). They provide the statistical classification of economic activities in the european community and using this classification, Vanacker et al. (2014) analyses venture capital (VC) and the financing of technology-based firms. The NACE Rev. 2 is used by the EC in examining small firm performance (European Commission, 2015) and also in the analysis of industrial growth within the EU (Jaegers et al., 2013). The breakdown of the high-tech sector according to the NACE Rev. 2 codes are presented in Table 2.3.

Table 2.3: NACE Rev. 2 codes associated with the high-tech sector

High-technology Manufacturing Industries	NACE rev 2. codes - 3 digit Level	
	21.	Manufacture of basic pharmaceutical products and pharmaceutical preparations
	26.	Manufacture of computer, electronic and optical products
	30.3	Manufacture of air and spacecraft and related machinery
High-technology knowledge-intensive services	**NACE Rev. 2 codes - 2 digit level**	
	59.	Motion picture, video and television programme production, sound recording and music publishing
	60.	Programming and broadcasting activities
	61.	Telecommunications
	62.	Computer programming, consultancy and related activities
	63.	Information service activities
	72.	Scientific research and development

Notes: This table provides a breakdown of categorisation used to define the high-tech sector through nine specific NACE Rev. 2 codes. The high-tech sector consists of two separate areas, the first is the high-technology manufacturing industries, which contains three codes, and the second is the high-technology knowledge-intensive services, which contains six codes. (Eurostat, 2014)

2.2.2 SMEs

SMEs are defined as a business which employs less than 250 staff members and has annual revenue of less than €50million or a balance sheet not larger than €43million (European Commision, 2015). A further breakdown of the three types of business that encompass SMEs is described in Table 2.4. This definition is used in the analysis throughout the thesis when discussing SMEs.

Table 2.4: SME breakdown of key criterion regarding three types of enterprise

Enterprise category	Headcount: Annual Work Unit (AWU)	Annual Turnover	or	Annual Balance Sheet Total
Micro	<10	≤ €2million		≤ €2million
Small	<50	≤ €10million		≤ €10million
Medium	<250	≤ €50million		≤ €43million

Notes: This table provides a breakdown of the definition used by the EU for micro, small and medium firms. The first measure is the number of employees, headcount, which is used in conjunction with the annual turnover or annual balance sheet totals, to categorise the firm type. Any firm with 250 or more employees, an annual turnover greater than €50million or an annual balance larger than €43million are identified as a large business type and not an SME. (European Commision, 2015)

2.2.3 High-Tech SMEs

High-tech SMEs are SMEs based in the high-tech sector, and such firms often possess an educated workforce, strong technological knowledge and the ability to adapt quickly (Crick & Spence, 2005). These firms will follow the guidelines of both the international codes regarding sector categorisation when defining the enterprise. In relation to Table 2.3 and Table 2.4, a high-tech SME should be associated with one of the given NACE Rev. 2 codes and fall into one of the three SME types. High-tech firms will seek to maximise their potential by not only gaining market share in their domestic market but also internationally. Speed is a crucial element for success in gaining market share, given the nature of the business (Saarenketo et al., 2004).

2.2.4 TBSFs and NTBFs

Technology-based small firms (TBSFs) are described as small businesses which use scientific and technological knowledge to create a product or service (Allen, 1992). They have often been in operation for a short time period and possess a large number of intangible assets in proportion to tangible assets, which are easier to value and use as collateral (Revest & Sapio, 2012). New-technology based firms (NTBFs) do not possess one sole definition which all researchers agree upon and this is supported by Storey & Tether (1998). While it is difficult to provide a description which all parties support, Rickne & Jacobsson (1999, pg. 203) describe an NTBF as a business "whose strength and competitive edge derives from the know-how within natural science, engineering or medicine of the people who are integral to the firm." The specific ability of the people is not only important, but Rickne & Jacobsson (1999) declare that transferring the ability to products and services is a key component. NTBFs can have a significant impact on the economy and long-established companies alike (Zoltan J. Acs & Mueller, 2007; Storey & Tether, 1998). They are also defined as businesses which undertake R&D expenditure to a greater extent than the national average which includes possessing a higher employee number of scientists and engineers (Paytas & Berglund, 2004).

In summary, little comes from possessing great ideas if a company does not turn them into a tangible offering. Minola & Giorgino (2011) note that the "new" in the name is associated with age and this is supported by previous research. It is suggested that it relates to firms less than 25 years in operation, but they follow a definition provided by Colombo & Grilli (2007) which recommends that "new" relates to 20 years or less in operation. Previous analysis suggests that NTBFs relates to start-ups based in the high-tech sector and must be 10 years or less in operation (Burgel et al., 2000). Subsequently, the time differences are substantial between the definitions and so to ensure all is encapsulated NTBFs will consist of high-tech start-ups of 20 years or less in operation.

2.3 Technology Sector and Production Growth

Since SMEs are key drivers for job creation and generate the highest overall value for the EU, it is important to investigate which sectors are supporting industrial growth. The information in Figure 2.1 illustrates that both the high-technology and medium-high-technology manufacturing sectors have been vital over the 8 years. Their importance has grown since 2010, and as of 2012, they are the two key sectors providing strong, considerable growth within the EU. Regarding the economic pressures of the financial crisis, a substantial increase of 26 percent in high-tech manufacturing production occurred within the EU between 2005 and 2012 (Jaegers et al., 2013). Contrary to this, both the medium-low technology and low-technology sectors have decreased in value since 2008, and the decline is relative to the increase for the previously discussed sectors. The EU now relies upon high-tech and medium-high-tech firms for industrial growth more than ever before. Ensuring adequate funding and research is undertaken in this sector should be paramount for the EU to ensure continued growth. A key concept for both sectors revolves around the implementation of innovation and the R&D, which accompanies this process. Smaller firms possess an advantage towards the advent of innovation yet the risks, such as financial distress, remain large (Mettler & Williams, 2011). Therefore, providing a contextual background of this will allow for an inclusive understanding for use in further research.

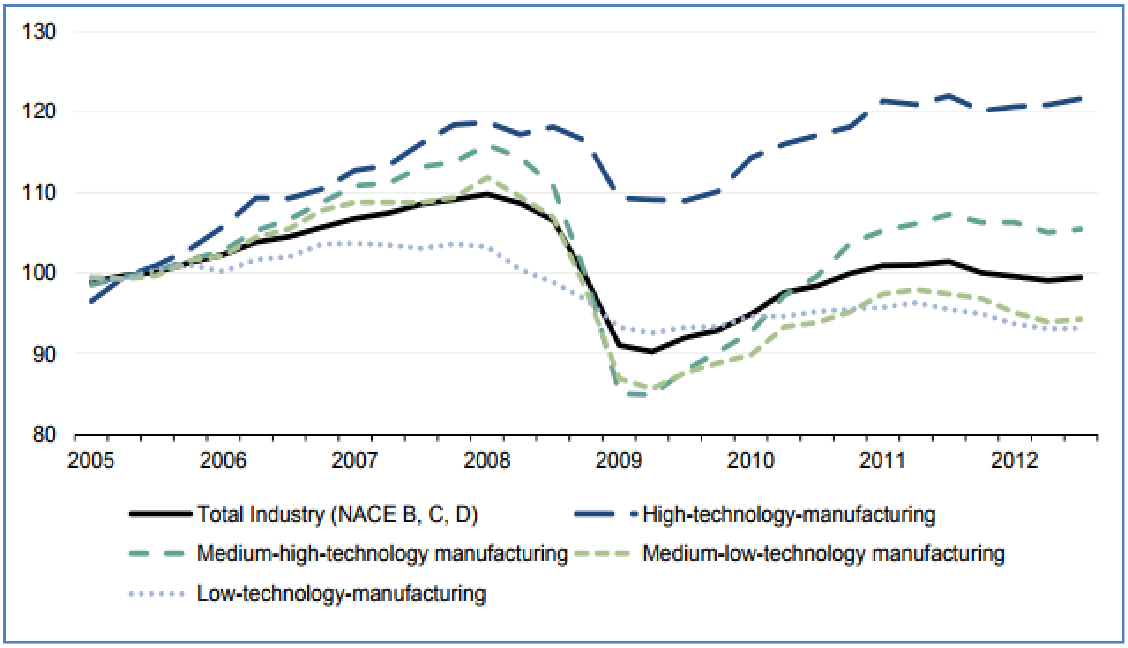


Figure 2.1: Index of production for total industry and main technology groups in manufacturing for the EU-27 countries, 2005–2012

Notes: The figure provides a breakdown of the production indexes regarding the different types of manufacturing sectors via the type of technology within the EU 27 member states from 2005 to 2012. A total industry index demonstrates the importance of high-tech manufacturing in comparison to the total industry but also to illustrate the decline of medium-low-technology and low-technology manufacturing. (Eurostat, 2013).

2.4 Innovation and Business

The importance of innovation is crucial to firms within the high-tech sector as without new and innovative products, the business will stagnate and another firm will seize market share. The growth of high-tech manufacturing industry is the leading light for the EU for overall industrial growth, and so it is critical that firms within this sector have the capabilities to innovate. The process of innovation can be costly from a financial, time and employee perspective and thus being able to account for these components is crucial for firms. Strong innovation-based businesses can generate revenue by licensing their new inventions to other firms, thus supplementing return for their R&D expenses (Mettler & Williams, 2012). Therefore, businesses can either soley use the innovation for products and services for themselves, or they can licence certain aspect to other businesses. Licensing occurs particularly for the riskier innovation that is less likely to generate a competitive advantage. As illustrated in Figure 2.2, Ireland possessed the highest percentage of innovative businesses at 36 percent between 2012 and 2014. This compares favourably with the EU average of 24 percent, illustrating how innovation is a major criterion for over one-third of businesses within Ireland. The implementation of enhanced innovation and R&D are critical objectives for the Europe 2020 strategy with a target of 3 percent gross domestic product (GDP) to be invested, due to their growth and sustainability characteristics (European Commission, 2010a).

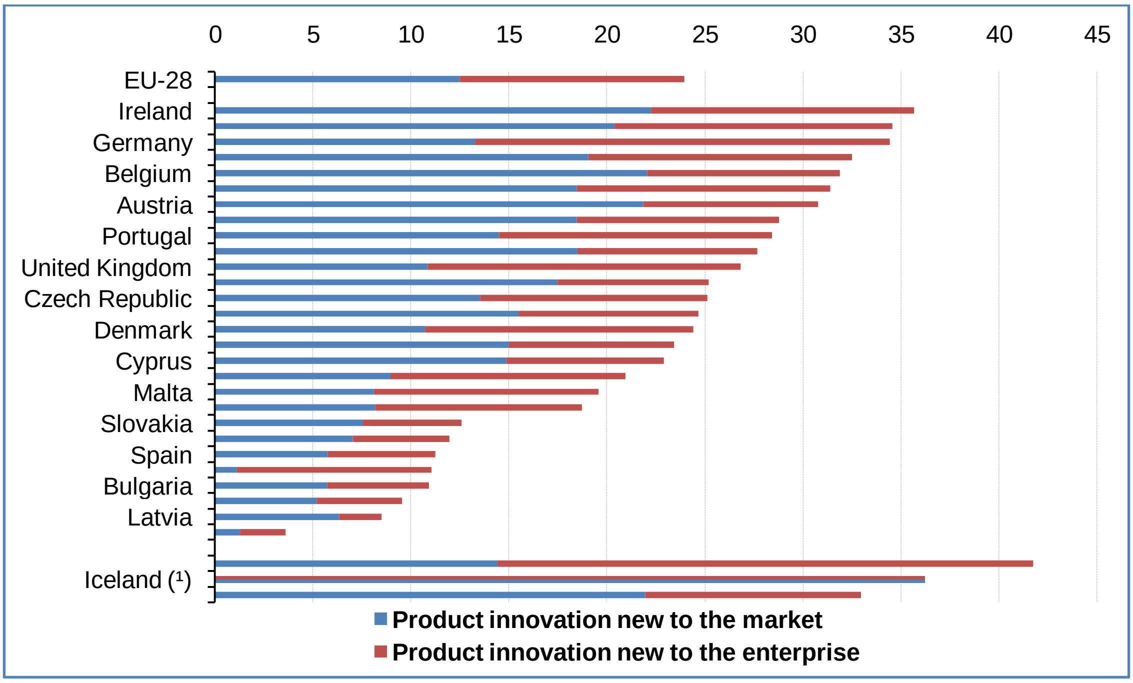


Figure 2.2: Share of enterprises that had product innovations, 2012–2014

Note: This figure shows the percentage of enterprises based in Europe which implemented product innovations from 2012 to 2014. The product innovation consists of two distinct categories: product innovation to the market and product innovation to the enterprise. The EU 28 member state average depicted as 24 percent of all enterprises implemented product innovation, with an even spread between both innovation types. (Eurostat, 2017d)

The figures provide a principal insight regarding the importance of innovation for businesses based in Ireland, perhaps due to the size of the country and corresponding markets. Indeed, for the firms to sell their products internationally, they may need to provide an innovative difference, or competitive advantage, not demonstrated by local businesses. The innovative approach will provide a stronger probability of success through differentiation and thus ensures that Ireland is a key player in the innovative landscape within the EU.

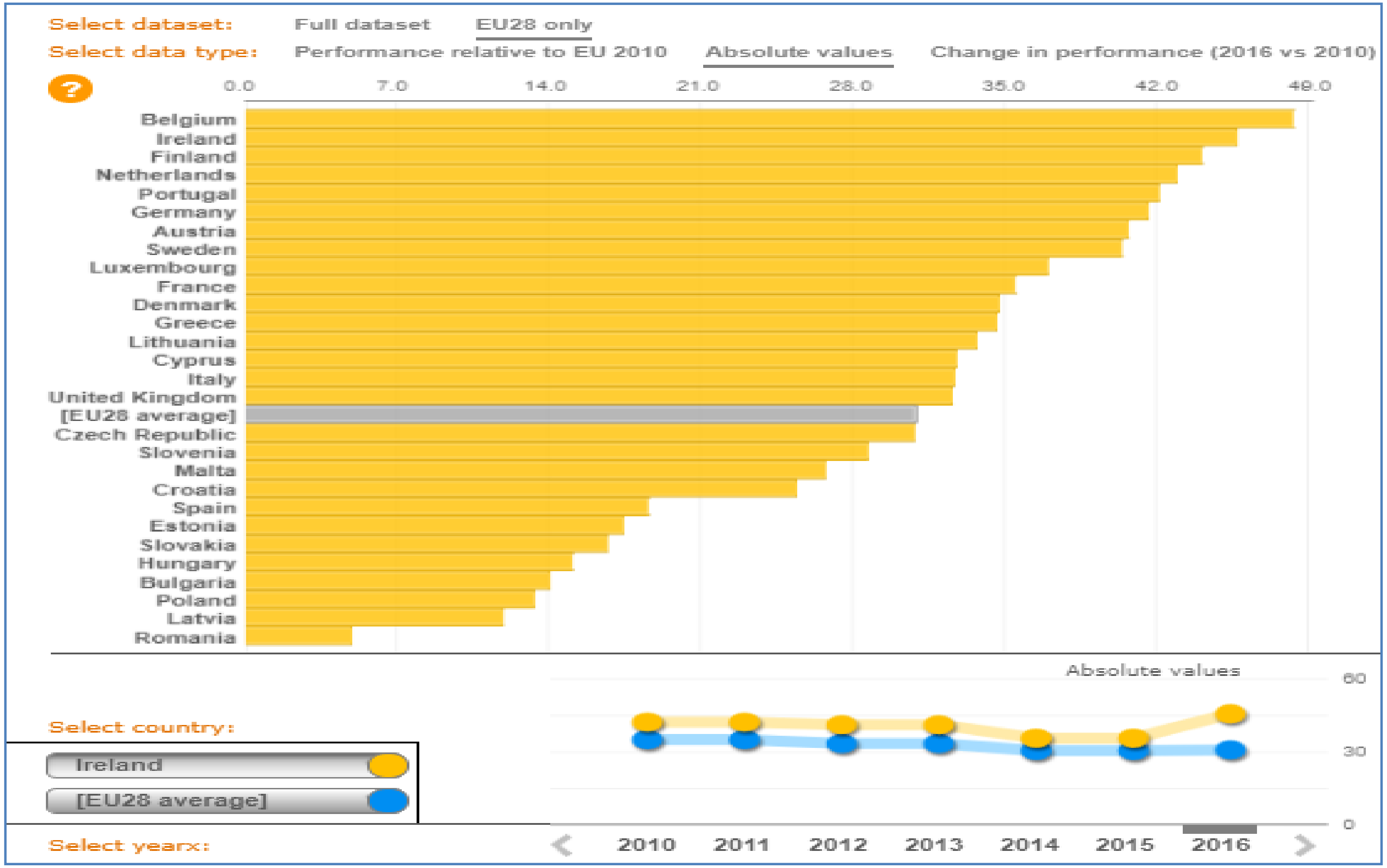


Figure 2.3: EU based SMEs with product or process innovations as a percentage of total SMEs

Notes: The figure demonstrates the level of product or process innovation amongst SMEs in countries based in the EU in 2016 using absolute values. The figure also provides a comparison of the change in innovation between Ireland and the EU 28 member state average, with Ireland improving greatly in 2016. The EU 28 average accounts for 31 percent, while the top country is Belgium with 48 percent and Ireland with 45 percent of SMEs implementing process of product innovations. (Eurostat, 2017e)

While Figure 2.2 displays an interesting overview of the importance of innovation to EU based businesses categorised into a country approach, it is through a combination of all four business sizes, as per Table 2.1. Previous findings have suggested that SMEs possess a critical influence on the economic future of the EU and that the high-tech sector has the strongest growth and influence on productivity. Subsequently, analysis of a combination of both is preliminarily displayed in Figure 2.3, which addresses the percentage of SMEs that have a product or process innovation. Interestingly, Ireland is a close second, with 45 percent, with Belgium first with 48 percent and this information supports the results in Figure 2.2, which reviews all business sizes. The most important results within this figure relate to the comparison between Ireland and the EU average at 33 percent, which shows that Ireland has a substantial additional amount of SMEs involved in innovation by 12 percent. This is almost identical to the difference between Ireland and the EU for SMEs as per Figure 2.3. This presents the importance of innovation and illustrates the relationship Ireland enjoys a hub of innovation for both SMEs and large businesses. High-tech SMEs have a critical value upon the growth and success of the European Union. The information presented in Table 2.2, Figure 2.2 and Figure 2.3 provide a strong foundation for utilising Ireland as a relevant case study to develop a robust understanding of high-tech SMEs.

2.5 High-Tech Firms

Table 2.5 and Table 2.6 both show the scale and magnitude of high-tech businesses within the EU, from the manufacturing and knowledge-intensive services perspective respectively. The crucial combined estimated number of enterprises within the high-tech manufacturing sector for the EU-28 is 45,741 firms, with Germany possessing the highest amount with 8,427. A total combined number of businesses within the knowledge-intensive services sector for the EU-28 is not provided, per Table 2.6. When comparing this sector to manufacturing within Germany double the number of firms are in operations at 92,477 firms, with a similar disparity in turnover at almost double due to an €89billion difference. The scale and size of values provide further insight into the importance of the high-tech sector towards country growth and economic improvement. Within the high-tech manufacturing sector, the average EU firm generates revenue of €11,169,096.79. This sum is a substantial amount given previous analysis relating to the large scale of SMEs within the EU and this sector. The value-added figure relates to the gross income generated from firm operations that also accounts for indirect taxes and subsidies. Both high-tech firm types are shown to generate substantial amounts with over €157billion produced by manufacturing and €481billion knowledge-intensive services.

Table 2.5: Economic statistics on high-tech manufacturing sectors in 2012

	High-tech manufacturing									
	Number of enterprises		Turnover (EUR million)		Production value (EUR million)		Value-added (EUR million)		Gross investment in tangible goods (EUR million)	
EU-28	45 471	e	507 879	e	448 566	e	157 619		16 237	
Belgium	611		12 487		14 694		6 058		830	
Bulgaria	428		:	c	:	c	257		93	
Czech Republic	3 441		13 218		12 537		1 701		316	
Denmark	669		13 918		13 734		6 323		507	
Germany	8 247		113 476		103 695		38 852		4 914	
Estonia	113		1 791		1 770		155		22	
Ireland	168		43 904		43 218		15 798		1 421	
Greece	448		1 443		1 316		574		53	
Spain	2 815		17 617		16 365		5 418		504	
France	3 227		69 999		56 420		20 156		2 047	
Croatia	713		902		792		331		85	
Italy	5 984		47 224		44 856		14 522		1 273	
Cyprus	:	c	:	c	:	c	:	c	:	c
Latvia	161		:	c	:	c	:	c	:	c
Lithuania	156		289		284		95		18	
Luxembourg	11		:	c	:	c	:	c	:	c
Hungary	1 604		16 338		14 552		2 989		462	
Malta	:	c	:	c	:	c	:	c	:	c
Netherlands	1 640		21 251		15 308		6 639		:	c
Austria	672		8 304		7 805		3 437		625	
Poland	3 033		12 374		11 092		2 229		266	
Portugal	448		2 921		2 501		684		105	
Romania	985		2 349		2 263		680		229	
Slovenia	329		2 287		2 168		865		147	
Slovakia	755		6 403		6 188		830		102	
Finland	602		28 709		13 877		1 325		169	
Sweden	1 816		25 065		22 864		8 941		461	
United Kingdom	6 385		42 395		39 540		18 234		1 261	
Norway	332		:	c	:	c	:	c	:	c
Switzerland	1 634		103 658		108 484		35 496		3 059	

Notes: The table shows a breakdown of economic statistics for high-tech manufacturing sectors in 2012 within the EU 28 member states, Norway and Switzerland and the EU average. The table provides details for each country's high-tech manufacturing sector regarding four distinct categories: number of enterprises, turnover, and production value, value-added and gross investment in tangible goods. The three letters and symbols are defined as the following : Not available e Estimate c Confidential. (Eurostat, 2017b)

Table 2.6: Economic statistics on high-tech knowledge-intensive services sectors in 2012

	High-tech knowledge-intensive services									
	Number of enterprises		Turnover (EUR million)		Production value (EUR million)		Value-added (EUR million)		Gross investment in tangible goods (EUR million)	
EU-28	:	c	:	c	:	c	481 947	e	:	c
Belgium	26 351		32 137		32 691		14 190		2 303	
Bulgaria	8 415		3 561		3 339		1 643		303	
Czech Republic	30 524		12 622		11 993		5 578		705	
Denmark	14 056		20 784		17 764		8 980		1 366	
Germany	92 477		202 161		162 957		96 626		10 121	
Estonia	3 255		1 418		1 326		620		144	
Ireland	:	c	:	c	:	c	:	c	:	c
Greece	12 304		8 363		6 771		3 465		1 122	
Spain	46 530		70 990		54 974		31 423		3 573	
France	115 845		162 141		163 188		69 705		9 223	
Croatia	4 932		3 198		3 007		1 523		211	
Italy	100 251		103 780		105 736		47 682		5 047	
Cyprus	773		1 076		1 039		547		152	
Latvia	4 249		1 436		1 373		606		124	
Lithuania	2 456		1 438		1 257		660		132	
Luxembourg	1 809		:	c	:	c	:	c	:	c
Hungary	33 449		9 647		7 061		3 773		670	
Malta	993		:	c	:	c	:	c	:	c
Netherlands	62 455		50 796		47 463		24 510		:	c
Austria	17 539		18 330		12 951		7 875		1 063	
Poland	60 976		24 019		22 275		11 127		1 701	
Portugal	14 226		10 982		10 487		4 706		1 072	
Romania	15 277		7 812		7 666		3 487		861	
Slovenia	7 061		2 854		2 597		1 185		294	
Slovakia	11 492		5 055		4 616		2 459		265	
Finland	8 736		:	c	:	c	:	c	:	c
Sweden	52 029		45 649		38 833		15 879		2 028	
United Kingdom	156 511		231 084		216 357		106 866		13 656	
Norway	13 301		23 392		22 272		10 925		1 297	
Switzerland	5 342		:	c	:	c	:	c	:	c

Notes: The table shows a breakdown of economic statistics for high-tech knowledge-intensive services in 2012 within the EU 28 member states, Norway and Switzerland and the EU average. The table provides details for each country's high-tech knowledge-intensive services in four distinct categories: number of enterprises, turnover, and production value, value-added and gross investment in tangible goods. The three letters and symbols are defined as the following; : Not available e Estimate c Confidential (Eurostat, 2017a)

As previously discussed, the majority of SMEs that are micro-sized due to their very low staff members and this can be of particular importance. It is expensive to work in this sector, given the R&D costs to cover innovation and other expenses, but the calculated value added per high-tech manufacturing firm is over €3.46billion. This can mean that a large proportion of revenue can be reinvested into the firm given the lack of individual wages. The breakdown relating to SMEs and large enterprises is not available for this area, but given previous analysis and discussion, the importance of high-tech SMEs is apparent.

2.6 Intangible Assets

Intangible assets are a consistent and crucial component of successful innovation, which can produce future growth opportunities for businesses. High-tech firms have a particularly strong positive correlation with intangible assets which often generate their value (Revest & Sapio, 2012). These future growth opportunities, if managed correctly, can produce a sustainable competitive advantage for firms, allowing them to grow and increase revenue. An interesting relationship exists between intangible assets and the acquisition of external capital, given that they are hard to correctly value and so possible lenders and investors may not be keen on these firms. Small technology sector firms struggle with ensuring they possess adequate capital, but since the financial crisis, the financing of such firms has degenerated (North et al., 2013). Therefore, it can result in businesses unable to generate enough capital to utilise the intangible assets correctly, and the firm will either not reach its potential or fold due to limited capital. With this in perspective, Figure 2.4 provides a snapshot of the difference from 1995 up until 2010 of the investment of intangible assets between the EU and the USA. For each of the six different investment areas for intangible assets, the USA has a larger percentage in each of them. Internal firm attributes such as intangible assets can result in the improving and growing strength of businesses (Barney, 1991). This can have a critical influence on the economic growth and performance of a country. Indeed, the difference is apparent; in that, 6.5 percent of GDP is invested within the EU countries, with 11 percent investment for the USA. However, the findings discussed in both Figure 2.2 and Figure 2.3 show a stronger investment in innovation. The EU has an average of 24 percent of all businesses that generated innovative products, while 29 percent of SMEs generated an innovative product or process from 2010 to 2016. Furthermore, an increase in high-tech business production levels has coincided with the beginning of this innovation timeline, as illustrated in Figure 2.1.

The comparison of these results with Figure 2.4 illustrates statistics that encourage an interesting discussion of how the EU member states have sought to capitalise on their previous lacklustre use of intangible assets and innovation. Subsequently, the EU and in particular countries such as Ireland have implemented innovation often from the high-tech sector into their economic strategy which will have a crucial influence upon the prosperity or stagnation of large economies throughout Europe.

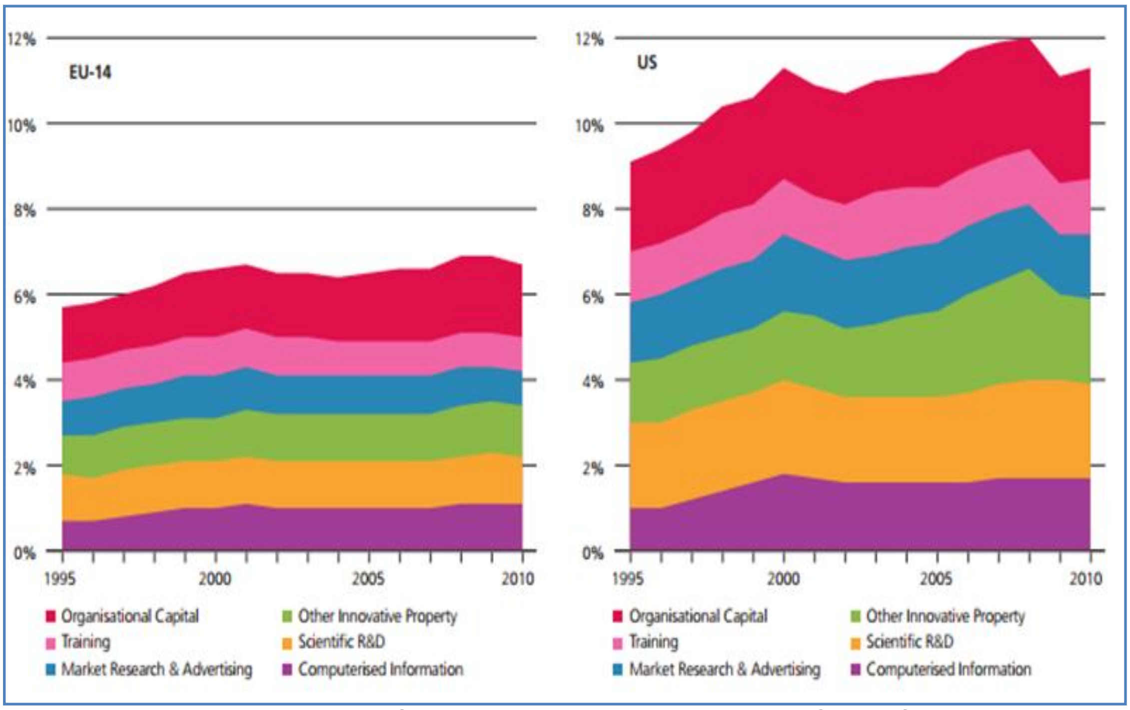


Figure 2.4: Investment intensity of intangible assets as a percentage of GDP for EU-14 countries and the USA between 1995–2010

Notes: The figure illustrates the breakdown use as investments of intangible assets as a percentage of GDP between the EU-14 countries and the USA from 1995 to 2010. The investments consist of six separate categories: organisational capital, training, market research and advertising, scientific R&D, computerised information and other innovation property. The figures provide evidence that the US has invested a higher proportion of its GDP into such categories, with a level of 11 percent in 2010 compared to 6.7 percent for the EU-14. (Van Ark, 2014)

2.7 SMEs and Access to Finance

SMEs throughout the world provide a large proportion of employment, yet they have limited external financing options particularly in comparison to larger businesses and are less likely to have bank debt or other loans (The World Bank, 2017). When asked about the major challenges facing European SMEs and entrepreneurs, the access to finance is the number one major issue, whereby 79 percent deemed it a barrier to growth (World Economic Forum, 2014). The finding is also supported throughout Europe, where access to finance is the biggest predicament they must face (European Commission, 2014). The financial crisis and resulting issues for European economies have caused three unique obstacles for SMEs; an inability to gain adequate finance, the high cost of finance and finally the limited risk profile banks are willing to take on (European Commission, 2014). Throughout most countries, access to all sources of external finance for SMEs is hard to obtain, and it has not improved since the financial crisis due to an increased need for collateral and often higher interest rates (OECD, 2013b). An inability to obtain finance is a problem that has affected millions of SMEs and the global economy and is a top priority under serious review to improve the situation.

There are two main reasons why a gap in funding exist for SMEs; the first relates to supply-side issues such as SME's information asymmetries and lack of a track record, which can severely hinder the funding available for investments (The World Bank, 2017). The second reason occurs less often but relates to demand issues, whereby the proposed use of the capital is not a worthwhile investment for the external party, and so the firm will not receive any funding (The World Bank, 2017). Indeed, there is a strong need for the improved financing of innovation, helping new firms grow and supporting start-ups (OECD, 2015b). The financial crisis throughout the EU has resulted in significant corrosion of the generation and amount of internal funds available to SMEs, resulting in a strong necessity to obtain external finance for survival and growth (ESMA Securities and Markets Stakeholder Group, 2012). Banks have been impacted by the financial crisis and so predominately favour providing capital to large, well-known, older businesses due to their limited risk from information asymmetries and also financial collapse when compared to SMEs (ESMA Securities and Markets Stakeholder Group, 2012). SMEs must have adequate access to capital in order for strong growth, to produce employment and to innovate, but are often hampered in obtaining debt due to their limited amount of collateral and credit history (OECD, 2017). This is an even greater issue for smaller and younger businesses with a large proportion of intangible assets, especially those involved in innovation (OECD, 2017).

Figure 2.5 illustrates that there has been an improvement in the access for finance since the financial crisis for SMEs in the EU, as banks have begun to recover and businesses seek external capital to grow. There is an increase in both the willingness of banks to provide loans and access to public financial support in 2016 when compared to 2008. VC funding has decreased significantly, but business angel financing has increased to help account for this significant drop in VC capital for SMEs. The percentage of loan rejections has also decreased by a considerable difference when taking into account the significant increase in 2014. The figure helps illustrate the current issues and options available to SMEs based in Europe when seeking to obtain capital.

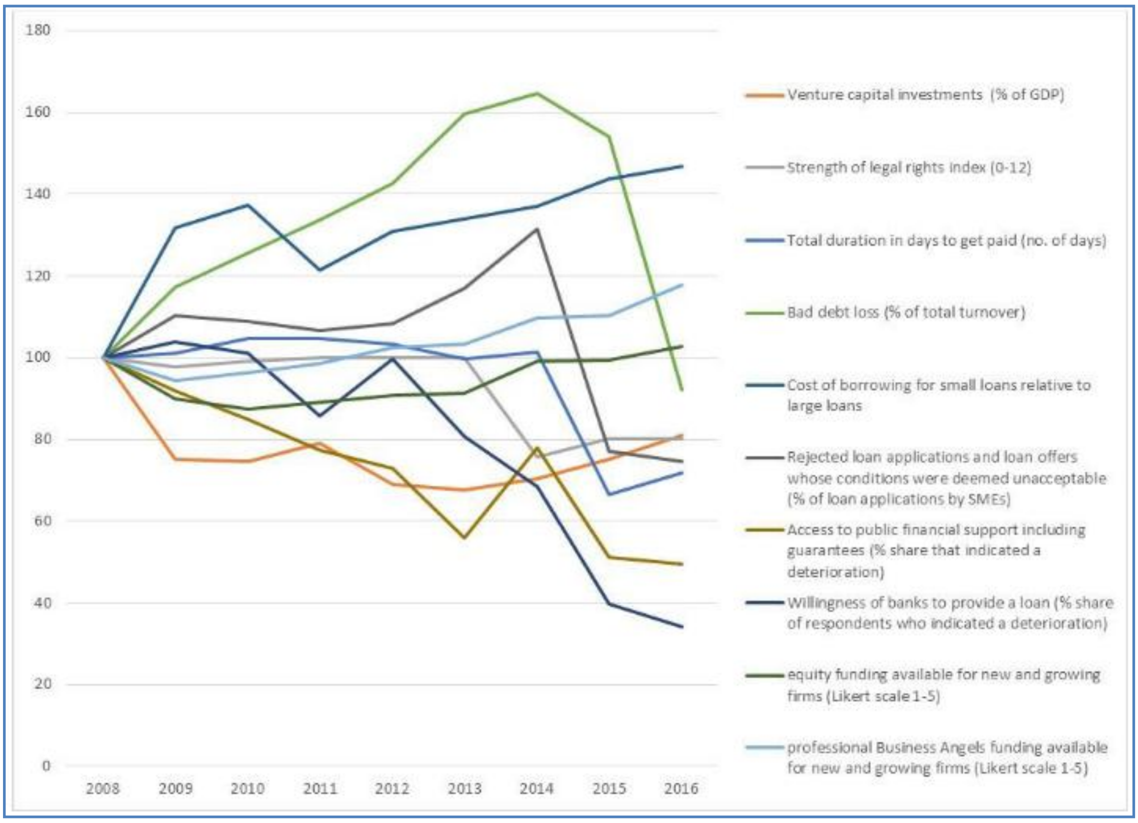


Figure 2.5: EU-28 progress in access to finance indicators for SMEs

Notes: This figure provides visual insight into the annual change in access to finance for SMEs in the 28 EU member states in comparison from 2008 to 2016, with 2008 as the base level of 100. The figures provide details on ten separate financial indicators, including venture capital investment as a percentage of GDP, the percentage of SME loan rejections, the availability of equity funding to younger, growing SMEs and also Business Angel funding for new, growing SMEs. A break in the time series occurred between 2014 and 2015 for both of the 'Bad debt loss' and 'Total duration in days to get paid' indicators. (European Commission, 2018a)

The provision of bank debt for SMEs reduced for a considerable amount of countries during 2016, but there was greater use of alternative types of finance (OECD, 2017). Bank debt is still the most used source of capital by SMEs, even though it may not suit them all, particularly young, innovative and high-growth firms who may need substantial capital in a shorter period of time than others but possess limited tangible assets (OECD, 2015a). The EC has sought to increase the use of different sources of finance, in order to decrease the debt usage in European firms, and aims to implement regulations in order to integrate the European Venture Capital Fund (EuVECA) abilities for investment into SMEs which are part of the SME Growth Markets (European Commission, 2018d). When entrepreneurs based in the G20 countries were asked about the access to finance for SMEs, two-thirds deemed it to be a serious impediment for young entrepreneurs (Ernst & Young, 2012). Governments throughout the developed world have noted that the difficulties in accessing finance for SMEs must be addressed and have begun policy reform and legislation changes, combined with new funding initiatives to help solve the problem (OECD, 2017). This is of particular note to remove the over-dependence of SMEs on bank loans when obtaining external credit and a variety of sources, particularly equity, have been investigated as to how best provide and encourage their use (OECD, 2017). Bank finance should be deemed an important option regarding the financial sources available to SMEs. However, a decrease in debt available to SMEs due to constraints on credit will make it imperative to have other options (OECD, 2015a).

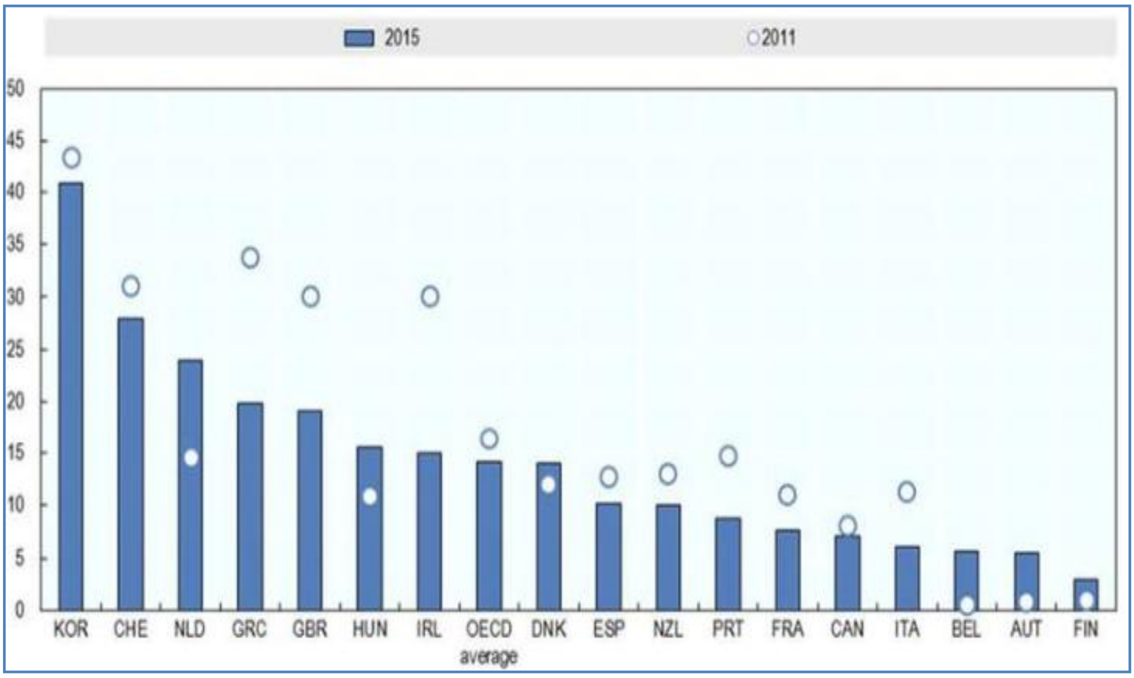


Figure 2.6: SME loan rejection rates in 2011 and 2015 within OECD countries

Notes: This figure provides details on loan rejections rates within individual countries and an OECD average for both 2011 and 2015. The largest rejection rate in 2011 was in South Korea with 43 percent, and they have the highest in 2015 with 41 percent of loan applications finding rejection. The OECD average rejection percentage had decreased from 17 percent in 2011 to 15 percent in 2015. (OECD, 2017)

Since the financial crisis, a range of financing constraints have been issued by banks throughout the world, resulting in limited access to bank funding for SMEs which provided further insight into their strong reliance for this finance type (OECD, 2015a). This would inhibit the second stage of the life cycle. Governments must now act to help early-stage businesses, as limited finance is available and external investors and lenders seek more mature, less risky investments (Ernst & Young, 2012). Many SMEs strongly depend on bank debt as their primary source of external finance to meet their business needs, but it is challenging to obtain for innovative, younger firms due to their greater perceived risk (OECD, 2015a). Initiatives such as the credit guarantee scheme have encouraged financial sources to flow to SMEs and start-ups, as more security is offered to debt providers to limit their risk (European Commission, 2018a). There is now a stronger need for SMEs throughout the world to readjust their capital structures and lower their dependence on debt than ever before, particularly due to extra debt utilised for survival during the financial crisis (OECD, 2015a). This is further emphasised by Figure 2.6, which illustrate the loan rejection rates in OECD countries, whereby an average of 15 percent of applications are not accepted. Ireland has a similar rejection rate at 16 percent in 2015, a dramatic decrease from the 2011 value of 30 percent. This illustrates the volatility of debt, as while the majority of countries illustrated have demonstrated a decrease in rejection, some countries such as the Netherlands and the UK have increased their rejection percentage.

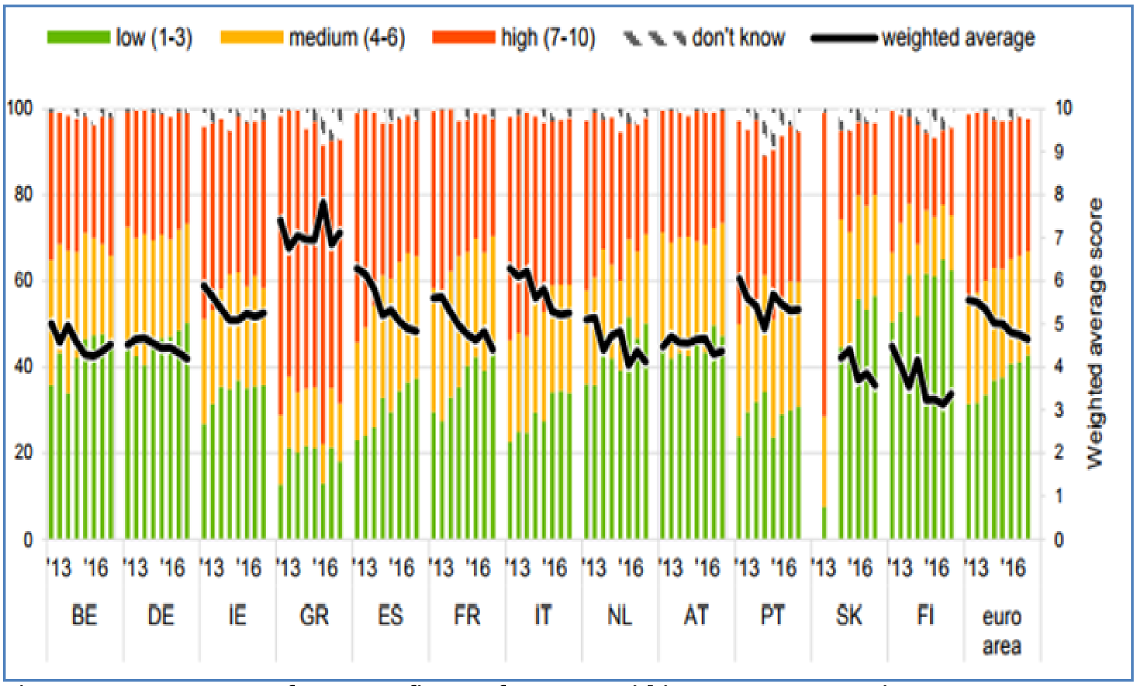


Figure 2.7: Importance of access to finance for SMEs within euro area countries

Notes: The figure shows the weighted average ranking of importance for access to finance for SMEs categorised into countries within the Eurozone. The figure provides this information from 2013 to 2016 with a scale of 0 to 10 with ranges consisting of low, medium, high and do not know. The euro area average's importance of access to finance decreased from 5.7 to 4.7 within the 2013 to 2016 timeframe and deemed of medium importance. (European Central Bank, 2016)

Figure 2.7 portrays an insight regarding the issue of obtaining external finance and the severity it has on influencing SMEs within the eurozone. SMEs within Greece believe that it is still a critical issue and it remains at roughly the same level as 2014, with a weighted score of seven for importance, deeming it high. The eurozone has had a small decline in its importance from 2013 to 2016, with it deemed a medium level issue, similar to Ireland, Spain and Italy. This result provides further support that Ireland is a country worth investigating innovative high-tech SMEs and their capital structure analysis.

2.7.1 Policy Developments to Improve Access to Finance

The European Securities and Markets Authority (ESMA) has deemed the financing of SMEs a major challenge which needs to be tackled by all EU member states (ESMA Securities and Markets Stakeholder Group, 2012). A report has been issued to discover methods to improve SME funding, such as the use of public markets or venture capital, and also the role of legislation which may hamper the attainment of external finance (ESMA Securities and Markets Stakeholder Group, 2012). Under the Small Business Act (SBA) its key objectives is to assist SMEs by implementing EU measures which aim to remove obstacles for growth and development, improve entrepreneurship and make the legislative aspects less cumbersome and inefficient (European Commission, 2018a). SMEs supply a limited amount of public information containing minimum details and so to counteract this information asymmetry, collateral is sought by investors and lenders (The World Bank, 2017). Innovative, young SMEs which possess a high proportion of intangible assets are deemed high-risk firms by lenders and investors, as valuing intangible assets is not well understood (OECD, 2017). Intangible assets decrease the probability of such SMEs gaining external finance in the current financial system, and this issue is magnified given that these firms need strong financing in proportion to their revenue (OECD, 2017). Thus, rarely are intangibles employed as collateral. This provides an insight into a critical issue innovative SMEs must deal with and often results in the findings by Oxford Economics, in Figure 2.8 where personal funds are extremely important during the first 5 years of business for SMEs. As illustrated, younger SMEs have a critically high dependence on internal finance such as personal funds, but as they get older this decreases, but remains high at 40 percent for those 10 years or older. Longer-term loans are also very important to SMEs, where it accounts for 30 percent of total finance for those firms that are less than 2 years old. This dependence on such debt increases to 40 percent when the firms reach 10 years or older. Leasing is an important instrument when seeking to grow, with a spike of 50 percent between the ages of 2 to 5 years.

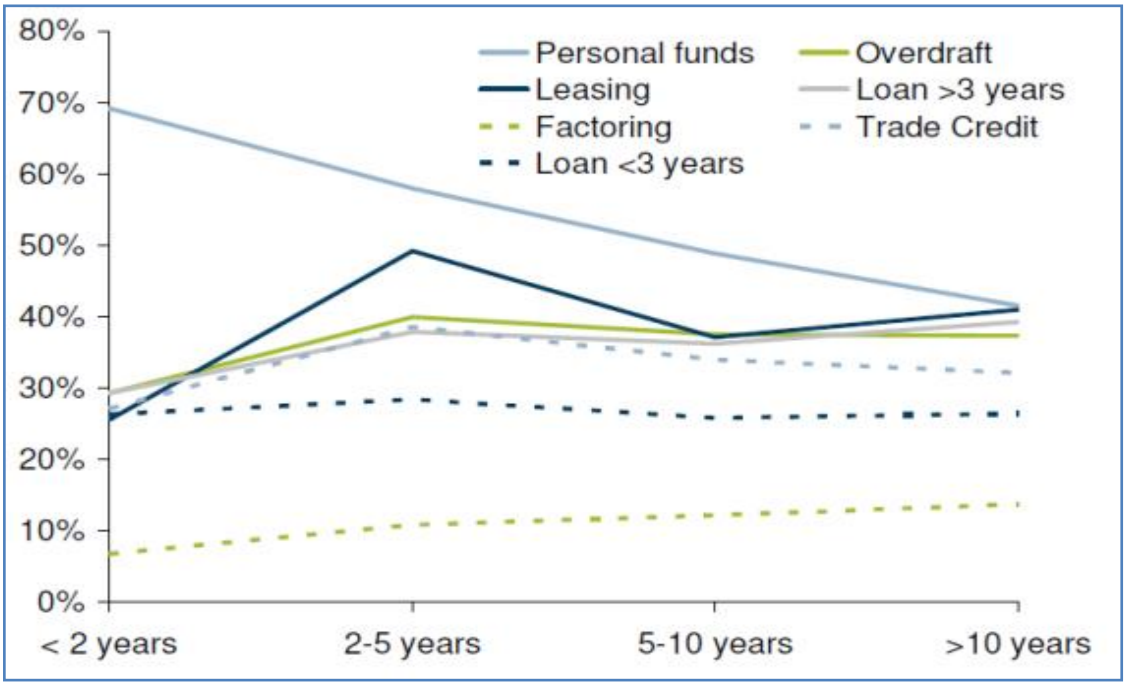


Figure 2.8: The percentage of different sources of finance used by SMEs as demonstrated by age
Notes: The figure illustrates the sources of finance used by SMEs as a percentage of total capital, throughout different age groups. The sources of finance provided in the figure consist of seven sources including personal funds, leasing, factoring, loans which have less than three years length, overdraft, loans with a greater lifespan than three years and finally trade credit. (Oxford Economics, 2011)

Further research has suggested that the impact and remaining influence of the recession resulted in innovative firms stemming back some of the most innovative aspects of their new products or services, as a way to limit risk from the market (World Economic Forum, 2014). While this may help the businesses gain capital easier than before, in the long term it will hamper both the business and economy to grow and will hamper the brightness of their future. Reasons such as this are why governments and legislators throughout the world are seeking to change policies to assist and encourage SMEs in gaining external capital. Indeed, the aftermath of the global financial crisis has resulted in recessions in many countries, and many governments have implemented new SME financial policies and strategies to help support their growth (OECD, 2018). A key aspect of the Capital Markets Union scheme is to increase the availability of finance to SMEs by undertaking a thorough review of the system and provide solutions as to how to assist these firms (European Commission, 2017b). By focusing on legislation already in place and making amendments and also non-legislative methods to assist SMEs access capital with a reduction in costs and time, is one such possibility under review (European Commission, 2017b).

Under the Access to Finance programme, 570 various policies have been put into practice since 2011 throughout the 28 member states to assist SMEs in obtaining a range of finance sources including new alternative finances (European Commission, 2018a). While grants, loans and guarantees cover some of the measures to assist such firms, none exist to irradiate tax discrepancies that SMEs within the EU may face (European Commission, 2018a). Figure 2.9 presents the most implemented measures by SMEs throughout the entire EU consisting of the development of research, development and innovation platforms and policies and also financing programmes to address to critical issue of a lack of capital (European Commission, 2018a). The third most implemented measure was an entrepreneurial mindset and methods to assist SMEs to grow and enter and develop in international markets (European Commission, 2018a). These findings illustrate how innovative SMEs are now beginning to have their issues accounted for and governments throughout the EU are acknowledging their importance to economic prosperity.

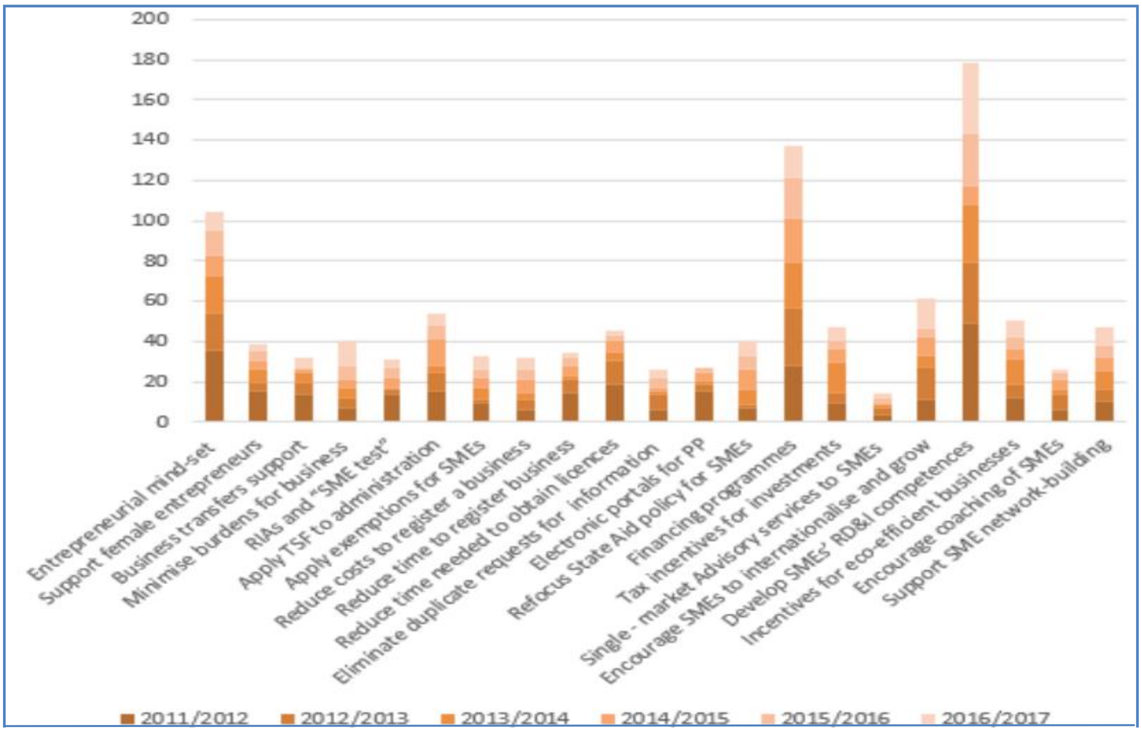


Figure 2.9: Most commonly implemented measures by the EU-28 countries, 2011-2017

Notes: The figure demonstrates the policies and measures implemented by the 28 EU member states between 2011 and 2017, encompassing 21 different areas of concern. The figure provides a breakdown for each year and combines tot eh total policies implemented into each specific area. The development of SMEs' RD&I competencies the largest topic with 178 policies and the second largest topic with 127 polices resonates with financing programmes. (European Commission, 2018a)

Previous research has demonstrated that firms which face financing issues possess a high amount of intangible assets overall (Brierley, 2001). Figure 2.10 illustrates that since 2013, a marked enhancement in SMEs ability to obtain bank loans and trade credit is apparent. In relation to the use of bank loans, a 20 percent increase for medium firms and overall 12 percent for SMEs has occurred. The findings of this can relate to the policies implemented as illustrated in Figure 2.9. This improvement is similar to that of micro firms, which have a significant impact on the findings, given that 90 percent of SMEs are micro. The improvement in loans for SMEs is a positive outcome as debt is preferred to equity under the pecking order theory (Myers & Majluf, 1984). This increase in debt should allow for an improvement in innovation amongst the countries involved and correlates positively with the findings in Figure 2.3. Investment capital is the fuel from which SMEs can continue along the path, and it has a critical role to ensure businesses obtain their goals, as without sufficient finance all SMEs will suffer (Mettler & Williams, 2012). Therefore, it is wrong to ignore the relevance of the increase in bank loans and trade credit over the past number of years, particularly about such firms' capital structure. This provides an understanding of the influence of a recovering economy when integrated with the introduction of new legislation and policies to help improve access to finance for European SMEs.

Figure 2.10: Bi-annual change of external financing for euro area business

Notes: The figure demonstrates five distinct measures of financing in the eurozone and the changes from 2013 to 2016 which encapsulates the three separate aspects of SMEs; micro, small and medium and large businesses. The five measures entail bank loans, trade credit, bank overdrafts, other loans, and leasing and hire-purchase. (European Central Bank, 2016)

2.8 SME Public Markets and Listing Status

Public markets for SME equity listings have come into existence over the past 40 years, but have gained limited traction due to a minute demand from SMEs seeking to list, often due to expenses and administrative issues (OECD, 2015a). Capital markets have been created specifically for SMEs to allow the firms to access public finance with less capital and administrative requirements compared to the main stock exchanges (The World Bank, 2017). A significant obstacle for SMEs undertaking the listing process regards the interpretation and implementation of legislative rules regarding issues such as market abuse and disclosure of information (European Commission, 2018d). When firms are listed, they must address a variety of expenses and meet administrative deadlines, which act as a major deterrent to SMEs encouraging them to remain private entities, particularly younger firms (ECSIP Consortium, 2013). The creation of new SME growth markets is still under ongoing development and review but seeks to introduce improved legislation that will create a public market to meet the needs of SMEs (ESMA Securities and Markets Stakeholder Group, 2017). This should encourage greater EU SME listings by acknowledging and fixing certain administrative and cost based structures within current market practices (ESMA Securities and Markets Stakeholder Group, 2017). The proposed development should benefit greatly in conjunction with the different market models that are available depending on firm characteristics and circumstances (ESMA Securities and Markets Stakeholder Group, 2017). However, it has not been a strong success as many

SMEs are apprehensive about listing due to the volatility of stock markets combined with the loss of control through the sale of equity and a limited amount of investors who want to invest in SMEs (The World Bank, 2017). SMEs are unwilling to enter public markets in the EU, as a significant decline in initial public offerings (IPOs) on EU multilateral trading facilities (MTFs) occurred due to the financial crisis and the listing nature of SMEs has not recovered. This results in an average annual IPO of 218 SMEs from 2009 to 2017, compared to 478 in 2006 and 2007 (European Commission, 2018d). A 55 percent drop is significant and illustrates the lack of urgency for such firms to publicly list, even though there are benefits such as those mentioned, available. In the USA, potential high-growth businesses have undertaken IPOs, while given certain exemptions from regulations and administrative workload and costs, which could provide an impetus for VC funding, as they can sell their shares to the market (Ernst & Young, 2012).

SMEs which are listed on the MTFs and stock exchanges tend to out-perform their private equivalents in both increased employment and growth, yet the issue of listing for such firms will be targeted by the European Commission (European Commission, 2018d). As of 2012, there were 23 million SMEs based in the EU and just 0.026 percent or 6,000 SMEs, were listed on MTFs or stock exchanges listings (ECSIP Consortium, 2013). This is compounded further when the number of firms on the Alternative Investment Market (AIM), part of the London Stock exchange for smaller firms, saw a decrease to 891 in 2012 compared to June 2007 when 1,337 firms were listed (ECSIP Consortium, 2013). These values demonstrate the extremely limited impact listed SMEs have when discussing SMEs in general and relates to previous information regarding the expenses and requirements of listed SMEs. Not only the amount of SMEs listed but also total value of the listings have also seen a massive decline, with an average of €2.5 billion raised annually by SMEs on European MTFs between 2009 to 2017 compared to €13.8 billion raised in 2006 and 2007 (European Commission, 2018d). Some listed SMEs within the EU have decided to become private and be taken off the public markets, while a fall in listed US firms by 22.2 percent occurred from 1991 to 2013 (ECSIP Consortium, 2013). An example of an SME market listing is EuroNext, and it has proved useful for SMEs seeking external finance. EnterNext is a stock exchange secondary market of Euronext and is predominately for SMEs who aim to obtain capital on public markets (EuroNext, 2018). It has a beneficial area for SMEs to gain assistance in growth, through a combination of access to investors, advisors, intermediaries and other stakeholders. The EnterNext markets currently list 700 SMEs, and EuroNext markets generated €740 million in 2014 with the listing of 31 firms (EuroNext, 2018). This demonstrates how there is a market for such listings, but it is imperative to ensure both the businesses and the investors are looked after efficiently.

A serious issue exists on firm listings since the financial crisis and governments and policymakers are now trying to advance the process otherwise SMEs listing will decline further. There exists a scope for improvement of the financial markets for SMEs as they are not working as effectively as they can (ECSIP Consortium, 2013). One of the objectives of the Markets in Financial Instruments Directive II (MiFID II) legislation is to open up pathways for SMEs to gain access to capital. One such method entails the development of markets where such firms can be traded, ensuring investors are willing to engage while supporting SMEs to list on a new class of MTFs, known as SME Growth Markets (European Securities and Markets Authority 2014). The MiFID II directive created the key criterion to allow SMEs to become publicly tradable due to a reduction in stringent parts of the listing process. New proposed amendments will seek to make it less expensive and timely to do so while improving the liquidity of the stocks available on the SME Growth Markets (European Commission, 2018d). Even tasks such as producing and publishing a prospectus can be a barrier for SMEs to publicly list as the exact requirements involved may require the hiring of expensive professional help (ECSIP Consortium, 2013).

Providing information to investors and lenders reduces the risk associated with SMEs and encourages investment and lending, but it can result in significant costs for the firms seeking capital (ESMA Securities and Markets Stakeholder Group, 2012). Governments will need to research SME listings further and relay relevant information into their approach. This will improve the process for a new paramount strategy and policies for SMEs to access finance through the provision of a robust range of alternative sources (The World Bank, 2017). Once firms are listed publicly, they will need to expand financially and exercise resources towards the implementation of information disclosures regularly (ESMA Securities and Markets Stakeholder Group, 2012). However, even SMEs which are listed on MTF stock exchanges can present insufficient information for equity research analysts (ECSIP Consortium, 2013). This is an area of improvement signalled by the EC, as with greater high-quality data, such SMEs will have a greater opportunity to source adequate external finance. The EC has begun to work on reducing the administrative issues and rules that EU SMEs currently must follow when seeking to list on public markets and gain capital. The new, updated guidelines and rulings for the SME Growth Markets will help SMEs gain public finance more efficiently while ensuring the market and investors are not damaged (European Commission, 2018b). It is critical that policymakers address legislation to enable SMEs to have a better chance at accessing capital with a better framework of regulations, such as decreasing risk and increasing transparency. However, it is a significant challenge to ensure all stakeholders benefit.

With a reduction in information asymmetries, capital providers can address the risk and provide lower costs of capital to SMEs compared with the high costs currently associated (OECD, 2015a). A vital component for public SMEs is to gain more efficient methods to generate equity capital, but this results in less reliance on bank debt and even a stronger known brand presence (European Commission, 2018d). Finally, although the introduction of MiFID II has provided an option for SMEs to access the SME Growth Markets through an improvement in the prospectus regulations, it does not help SMEs when wanting to evolve onto regulated public markets (ESMA Securities and Markets Stakeholder Group, 2017). This is an area not overly viewed as a current critical issue, but in the near future should be given attention. While Figure 2.11 illustrates the use of cash or equity as the primary source of capital for finance, given the previous information, the majority of the equity financing will be via private sale. However, the figure demonstrates how SMEs are willing to use equity finance provided the correct circumstances are in place. This will revolve around the implementation of new procedures and policies on listed exchanges that will help improve access to finance, while also encouraging the SME appetite for equity.

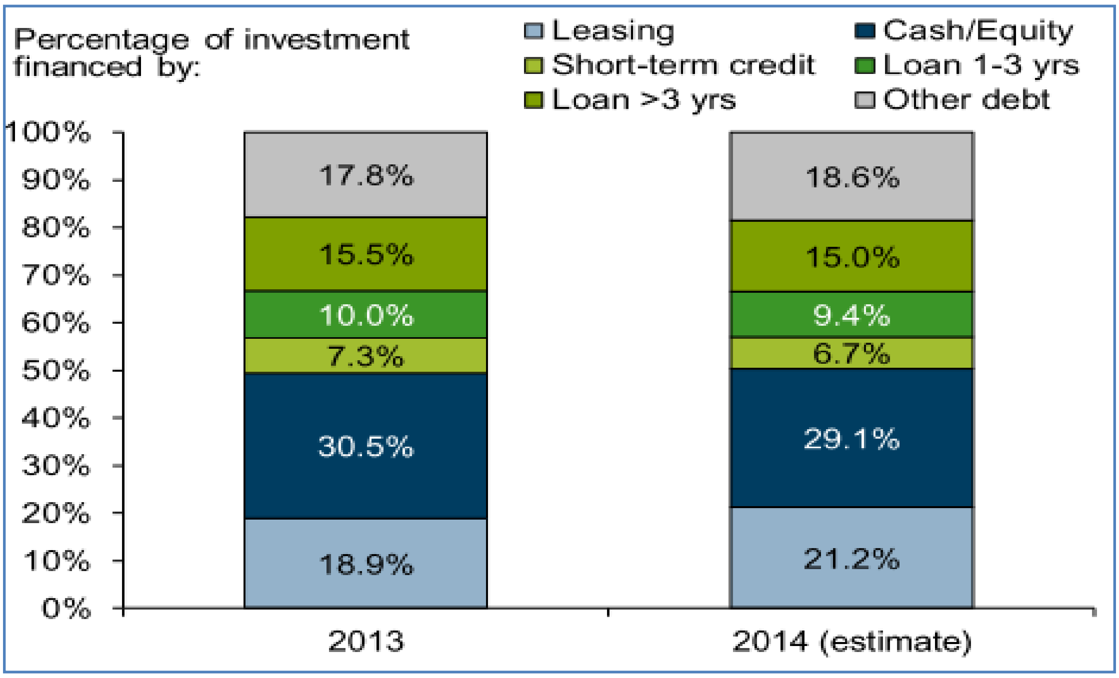


Figure 2.11: Percentage use of sources of finance for investments by SMEs in 2013 and 2014
Notes: This figure demonstrates the change in finance sources used by SMEs from 2013 to 2014. The sources are shown as a percentage of overall capital, and sources consist of leasing, short-term credit, loans greater than three years, cash/equity, loans between one to three years long and other debt. (Oxford Economics, 2015)

2.9 Alternative Finance

The aftermath of the global financial crisis has resulted in recessions in many countries, and since this many of these governments have implemented new SME financial policies and strategies to assist their growth (OECD, 2018). The policy of supporting SME finance has continued through the introduction of new financial instruments combined with a range of European Commission programmes and investigations into new financing policies and procedures (European Commission, 2016). Indeed, SME markets are quite illiquid, which reduces the likelihood of public equity investment, and it is an area under review by the EC (ESMA Securities and Markets Stakeholder Group, 2017). Many SMEs do not know about or understand the various alternative financial instruments available to them and this needs to be addressed in order to develop the market but also assist SMEs in obtaining finance throughout their lifecycle (OECD, 2015a).

The Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME) has introduced two specific measures to improve the access of finance for SMEs: The Loan Guarantee Facility (LGF) and The Equity Facility for Growth (EFG) (European Commission, 2018c). The LGF provides a guarantee to financial intermediaries such as banks to allow them to offer more debt finance to SMEs, thus lowering the risk for the debt providers. Subsequently, for each euro guaranteed within the LGF will result in the increased amount of 30 euro for SME financing and assist in supporting firms which would normally struggle to obtain such finance (European Commission, 2018c). The most implemented financial instrument throughout the OECD is the credit guarantee scheme, which assists SMEs in gaining finance, yet other policies and instruments are under constant review (OECD, 2018). Over 30 percent of credit guarantee schemes throughout the world have government involvement and are a very strong instrument in helping to finance SMEs (The World Bank, 2017). While they can be used to increase the amount of debt available and the improvement of contract clauses, it can result in unsuitable SMEs obtaining finance and an increase in financial distress and bankruptcy (The World Bank, 2017).

The introduction of the EFG sought to invest in funds that offer mezzanine and venture capital finance to SMEs seeking growth and expansion, especially those involved in international markets. The instrument will result in investment value of up to €4billion to 500 SMEs and also source additional finance through investment collaborations with private and public sources (European Commission, 2018c). The importance of such finance is gaining traction as the implementation of equity-based instruments has become more important to SMEs in recent years, particularly for fast growing innovative firms, where governments integrate new policies and mechanisms to support this (OECD, 2018).

The importance in ensuring an over-dependence on a specific finance type for SMEs does not occur, by maintaining the availability of a range of different capital, sources should not be underestimated (ESMA Securities and Markets Stakeholder Group, 2017). One type which the EU is contemplating consists of SME corporate bonds, known as 'mini-bonds', provided that they benefit all parties involved, which can be an issue for smaller firms issuing debt instruments (ESMA Securities and Markets Stakeholder Group, 2017). Alternative debt instruments have had limited to little success in the SME sector since capital market investors are involved and so legislators have sought to fix and implement new legislation to encourage SMEs to utilise mini-bond markets and small public trading markets (OECD, 2015a). The current financing set-up for SMEs does not support this ideology and must be addressed, with a limited amount of equity and strong use of debt (ESMA Securities and Markets Stakeholder Group, 2017). Furthermore, legislators have taken an interest in a hybrid of debt and equity instruments throughout the OECD, which they believe SMEs will be interested in when they are at a growth stage in need of capital but cannot access debt and do not want to relinquish some ownership and control (OECD, 2015a). However, they are currently not used by many SMEs since a solid market share and robust earnings are often required to obtain hybrid instruments (OECD, 2015a).

Table 2.7: Alternative Financing Techniques (AFTs) for SMEs categorised into four groups, characterised by levels of risk and return

Low Risk/ Return	Low Risk/ Return	Medium Risk/ Return	High Low Risk/ Return
Asset-Based Finance	**Alternative Debt**	**"Hybrid" Instruments**	**Equity Instruments**
• Factoring • Leasing • Purchase Order Finance • Warehouse Receipts	• Corporate Bonds • Securitised Debt	• Subordinated Loans/Bonds • Silent Participations • Participating Loans • Profit Participation Rights • Convertible Bonds • Bonds with Warrants • Mezzanine Finance	• Private Equity • Venture Capital • Business Angels • Specialised Platforms for Public Listing of SMEs • Equity Derivatives

Notes: The table provides alternative financing techniques available to SMEs that are categorised into risk and return levels. The first two categories consist of low risk and low return options entailing asset-based finance and alternative debt, which have four and two separate options of finance respectively. The third category is medium risk and return, which are hybrid instruments, entailing seven separate financing types such as convertible bonds and subordinated loans. The final category is high low risk and return, implementing five equity-based instruments such as private equity and venture capital. (OECD, 2013a).

Asset-based finance involves the valuation of a firm's assets such as inventory, machinery, land and accounts receivables in order to identify the amount of funding a firm can receive given their value instead of their credit rating (OECD, 2015a). As illustrated in Table 2.7 they are low risk and low return category of alternative financing, and this can assist SMEs in obtaining such finance since the risks are limited compared to private equity (PE) or venture capital (VC) finance. This can benefit SMEs who are young and have a limited record of accomplishment, provided their assets are valuable. It allows more flexibility than collateral-based lending, particularly in more advanced countries and has garnered popularity over the past few years (OECD, 2015a). Throughout the majority of countries in the OECD asset-based finance is used by SMEs for both trade and investment reasons, including those in emerging economies, while in Europe it has gained traction almost level with traditional bank lending (OECD, 2015a).

The EC has sought to introduce accelerator and development programmes for truly innovative SMEs who aim to develop and make a mark on international markets, known as The SME Instrument (European Commission, 2018e). Standard funding of up to €2.5 million is available for SMEs depending on their feasibility and their stage of development. This funding allows firms to enter the market or even create a market when they are at their strongest and able to make an impact. Up to 4,000 small firms will be able to obtain funding until 2020 (European Commission, 2018e). SMEs must realise that successfully marketing themselves to capital providers can be decisive and by improving their business plans and clarifying their objectives they can meet any due-diligence or transparency obligations (OECD, 2015a). It is a dual system, as SMEs must show they are good quality candidates for funding and can implement any requirements for external finance.

2.9.1 Private Equity and Venture Capital

Although debt is often the most sought-after type of external finance, it is hard for SMEs to access it before becoming profitable, thus at the beginning of their lifespan, they will obtain equity finance (ESMA Securities and Markets Stakeholder Group, 2012). If SMEs are open to using equity finance, they may prefer to limit the number of shareholders involved, thus instead of listing the firm publicly, the use of PE finance could better suit the firm (ECSIP Consortium, 2013). As of 2011 1,900 private equity and venture capital firms have invested in 25,000 SMEs in the EU through investment funds (ESMA Securities and Markets Stakeholder Group, 2012). Such institutions in Europe on average hold their investments for at least 4 years, which is a timeframe 800 percent longer than the average institutional investors in Europe hold quoted shares (ESMA Securities and Markets Stakeholder Group, 2012).

Within the G20, PE firms are beginning to finance small businesses that are based in strong growth markets where gaps in funding exist (Ernst & Young, 2012). This financing source is an option that was not strongly available in the past. Private equity funding has become more important over the past 30 years for SMEs, but since the financial crisis, PE firms have focused on funding more established SMEs to reduce their own investment risk (OECD, 2015a). The financial crisis has increased the lack of external funding for younger firms, due to a lack of bank funding and VC firms now also tend to reduce their risk and seek to invest in more established, older businesses (OECD, 2013b). Since the turn of the decade, venture capital and business angel finance have focused predominately on the high-tech sector, encompassing firms which are high-growth combined with strong innovation (OECD, 2015a).

25,000 SMEs in the EU have used both VC and PE funding, but two major obstacles prevent many other SMEs from accessing such finance, the first being the decreased amount of VC funds in Europe, resulting in increased competition and less capital (ESMA Securities and Markets Stakeholder Group, 2012). While the second obstacle consists of regulatory and legislative issues which prevent such funds from marketing their business to possible SME investors and entering the market (ESMA Securities and Markets Stakeholder Group, 2012). These two issues are critical to the success of VC and PE funding, which governments and policymakers must put right. Indeed, to emphasise the negative impact of both challenges, a substantial decrease of 56 percent in the supply of venture capital funding has occurred from 2007 to 2014 (World Economic Forum, 2014). It provides a strong insight into the decline of such funding and the need for Governmental policy adjustment and legislative support to ensure this type of capital remains an option for SMEs.

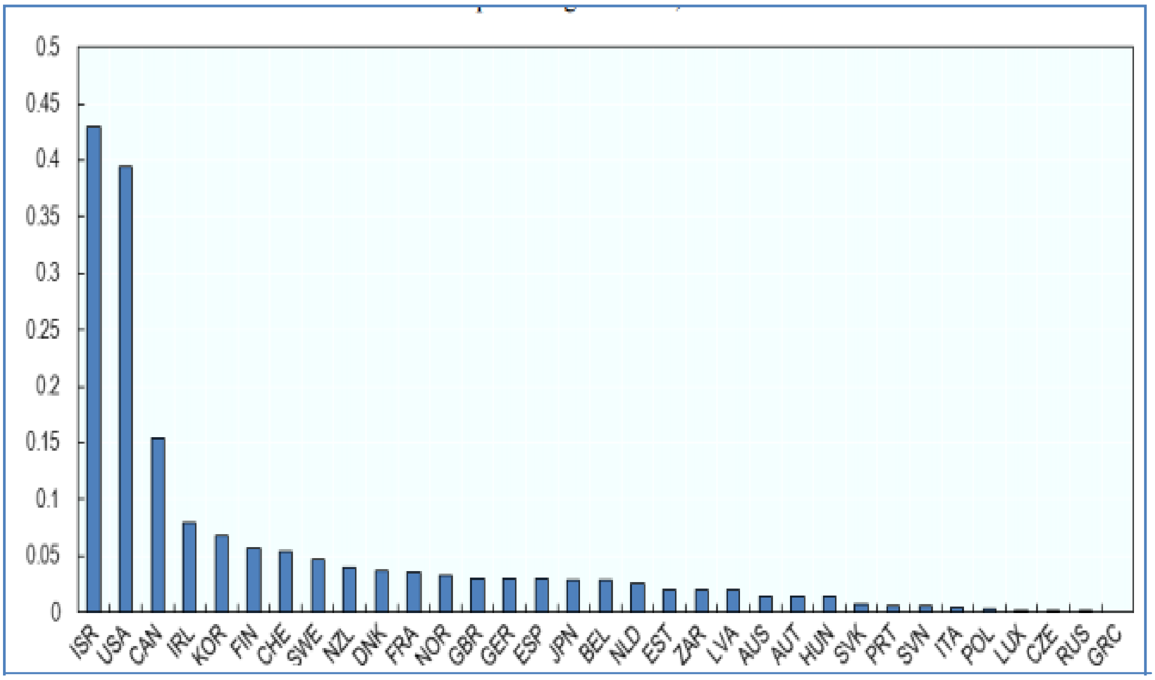


Figure 2.12: Venture capital investment for SMEs as a percentage of GDP throughout a range of OECD countries in 2016

Notes: The figure illustrates individual OECD countries venture capital investments as a proportion of GDP in 2016. The highest percentage investment is Israel with 0.43 percent, with Ireland in the top five countries with venture capital funding accounting for 0.075 percent of GDP. Countries such as Russia and Greece have venture capital funding of just 0.01 and 0 percent compared to GDP, respectively. (OECD, 2017)

As illustrated by Figure 2.12 the use of VC funding is miniature throughout the OECD, with an average of 0.05 percent of the GDP. This illustrates the available scope for future investment if the key issues are dealt with and SMEs view it as a plausible source of finance. A report undertaken by ESMA declared that SMEs are often negatively affected in their ability to obtain finance due to changes in regulations, such as the AIFMD1 which increased the burden for reporting and administrative work for firms using VC or PE sources (ESMA Securities and Markets Stakeholder Group, 2012). This increased the paperwork needed and transparency required by SMEs for the market. It is an area of interest for the European Commission to target to decrease the workload and costs and increase the number of SMEs using such financial sources (European Commission, 2017b). Funding at an early stage often consists of initial funding from family and friends and even business angels, then as innovative firms need more finance to develop and grow they will seek equity finance from VC and PE firms, with an eventual IPO as an exit strategy for those investors (ESMA Securities and Markets Stakeholder Group, 2012). Not only does a limited amount of IPOs hurt SMEs in gaining public finance but it also has a knock on effect to VC and PE firms who often use public markets as an exit strategy to sell their shareholdings of high growth SMEs to the market (European Commission, 2017b). The European Commission report provides an interesting insight, whereby VC firms may not invest in SMEs, given that the markets for SMEs are small and not strongly represented. Thus it has a negative impact on SME financing two-fold.

2.10 Ireland and SME Financing Issues

The Irish Department of Finance has published figures detailing the applications for different external finance sources for which SMEs have applied. It is critical that Irish SMEs can obtain adequate capital for further investment and growth in their business, to maintain a strong recovery from the recession (Economic and Social Research Institute, 2014). According to the report, the key source of finance for working capital is retained earnings, for 78 percent of the businesses. This is a substantial value but not unexpected given previous research relating to the dependence of internal finance for SMEs. While retained earnings may be the primary source for almost four out of every five such businesses in Ireland, they are also open to the use of debt, equity and other sources such as state funding when available. However, for public equity finance and SMEs, there has a been a substantial deficit in the opportunity and the implementation of public markets, as key criteria and pertaining issues have not been addressed (ECSIP Consortium, 2013). Smaller firms have a stronger rejection rate for loan applications, and it is an important topic for banks and businesses to deal with for future applications (Riding et al., 2012).

Figure 2.13 illustrates SME bank applications over the past 5 years, and it is apparent that a substantial decrease in debt from banks has emerged. The decline may be due to the SMEs being successful in their previous application and thus do not need to reapply, or it illustrates how, as the country moved out of recession, a strong dependence on internally generated revenue became substantial. Micro firms, in particular, have the lowest amount of businesses seeking debt, at just 15 percent, a significant 50 percent decrease in 5 years.

The relationship between debt and SMEs is still under investigation and the importance of capital structure can vary from each industry or sector, as previously illustrated given the perceived potential growth paths. Perhaps firms in Ireland would have a stronger preference for obtaining debt if the interest expenses were aligned with the Eurozone average. Irish SMEs must be able to gain access to external finance from a variety of sources and not become too dependent on one source, such as bank debt due to the associated threat of bankruptcy (Economic and Social Research Institute, 2014). Comparing the results with those in Figure 2.7**,** while just 20 percent of SMEs applied for debt finance, 50 percent of Irish SMEs stated that access to finance was a substantial issue that they have to address. R&D focused small businesses are more likely to get their loan applications rejected, that may account for such a finding (Freel, 2007). Therefore, while debt may not seem to be the current answer to this problem, equity and other sources may prove beneficial.

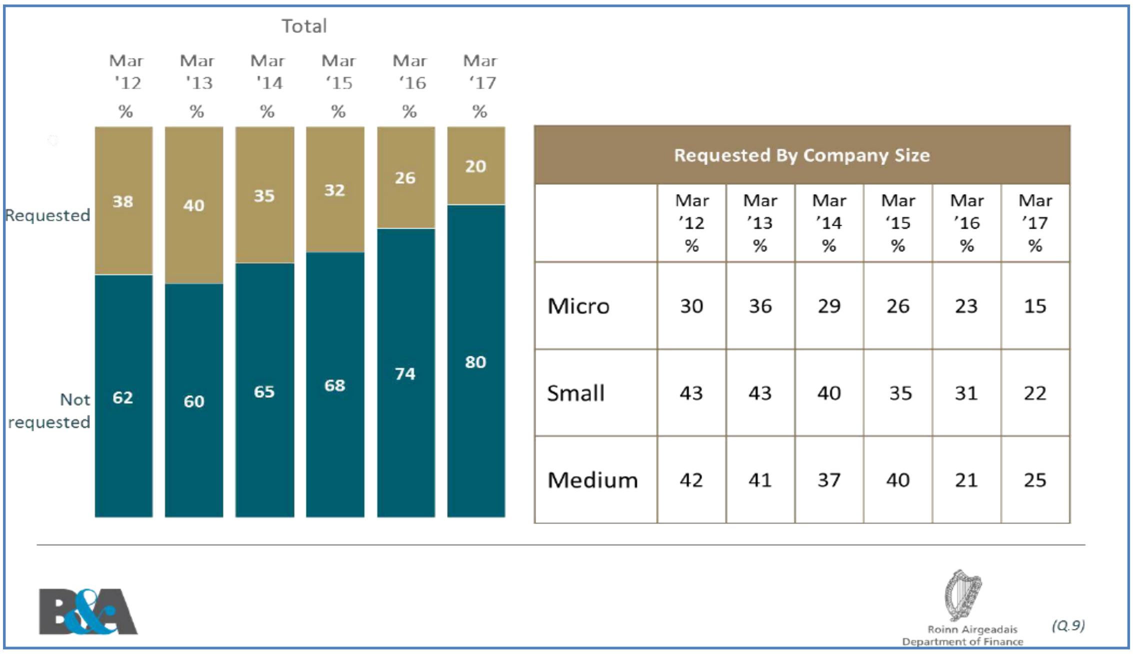


Figure 2.13: **Irish SMEs which have sought bank finance in the previous 6 months**

Notes: The information consists of an overview and a detailed breakdown of forms that requested bank finance. The first graph illustrates the percentage of Irish SMEs that have requested bank finance on an annual basis from March 2012 to March 2017. The second section of information illustrates the percentage of SMEs that requested bank finance characterised by their size: small, medium and large between the annual timeframe of March 2012 to March 2017. (Department of Finance, 2017).

Figure 2.14 establishes the significant difference between the amounts of credit outstanding, from €57billion in March 2010 decreased to €35billion in June 2016, as firms pay off their debts outstanding at a much higher rate than the offering of new debt. However, from November 2011 to December 2013, it decreased at a reduced rate, as many SMEs likely struggled to service their debt repayments in the aftermath of the financial crisis and amid a recession. An interesting point raised regards the demand and supply of debt, as the Central Bank of Ireland notes that during the second half of 2017, a smaller number of banks gained a stronger market share of SME lending (Central Bank of Ireland, 2018). This results in banks becoming more selective in their approach to providing capital, but they may also provide some firms with capital with more stringent and harsh conditions due to the limited competition.

The range of €0.5billion to €1.1billion being provided to SMEs each year during the same period indicates that the amount of debt offered to SMEs is much less than prior to the financial crisis. However, further analysis of the data indicates new SME lending has begun to increase with an overall upward trend from December 2013, with a 50 percent increase in new debt from August 2015 to June 2016 alone. This may be due to an increase in capital available for banks to provide, which was not a priority during the height of the recession. According to the Banking & Payments Federation Ireland (BPFI) SME Market Monitor report, by Q4 2017, SME lending in Ireland increased with an annual growth rate of 16.5 percent, the largest value improvement recorded at €1.55billion (EY-DKM, 2018). The total amount of SME credit outstanding by Q4 2017, stood at €26.2billion (EY-DKM, 2018), which supports the contiuned downward trend illustrated in Figure 2.14.

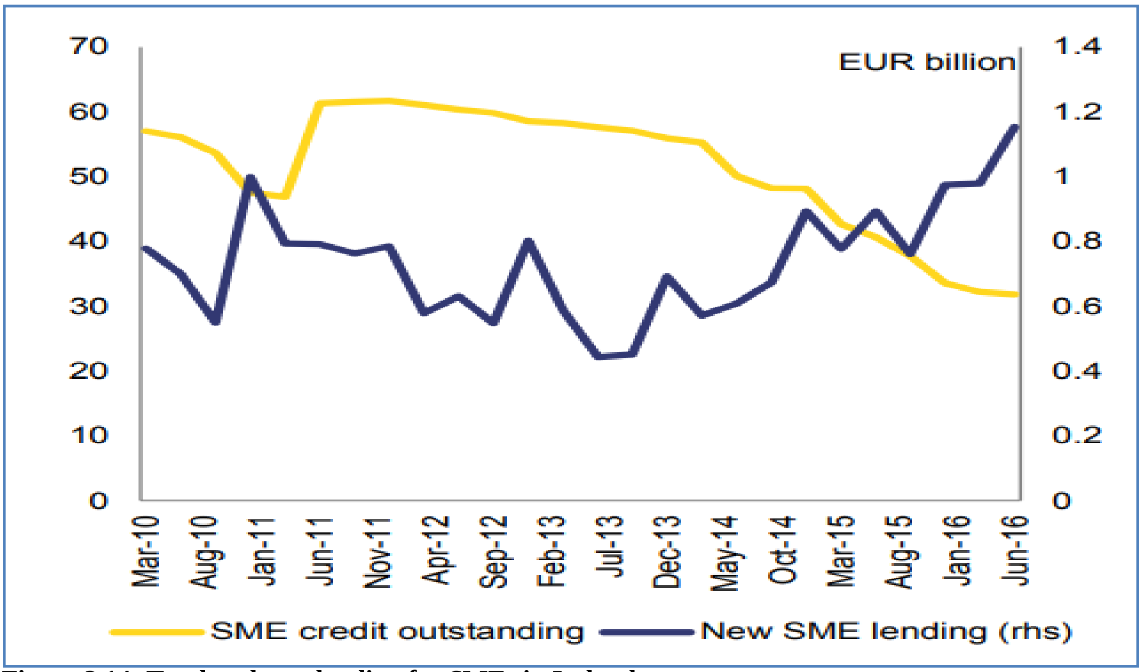


Figure 2.14: Total and new lending for SMEs in Ireland

Notes: This figure encapsulates two separate graphs to provide an illustration of the current SME lending situation in Ireland between March 2010 and June 2016. The SME credit outstanding in Ireland relates to the figures on the left-hand side, where the €57billion worth of SME credit was outstanding in March 2010 and decreased to €35billion by June 2016. The second graph within the figure illustrates the new SME loans provided in Ireland, which accounted for €0.8billion in March 2010 and increased to €1.2billion in June 2016. (European Commission, 2017c)

However, the findings in Figure 2.15, which consists of key financial sources such as venture capital and Government support, illustrate that this trend may not be correct. Only 6 percent of SMEs up to March 2017 had applied for non-bank debt. When this is combined with the results of Figure 2.13, the findings demonstrate how important retained earnings are for Irish SMEs and that the majority of such firms would prefer not to utilise external finance or limit it unless necessary. Micro firms have the highest enquiry level at 8 percent, which may suggest that given their size they are willing to take on loans from family and friends or other funding schemes. This would lead to the improved rate of application, compared to both small and medium-sized firms at 5 percent, who perhaps already utilised these resources. The importance of this is noteworthy since the majority of high-tech SMEs possess limited tangible assets and the expenses involved in R&D and innovation can be extremely expensive. SMEs that work in innovative sectors tend to fail when seeking external debt which is compounded further due to a lack of knowledge amongst banks and their unwillingness to take on an unknown risk (The World Bank, 2017).

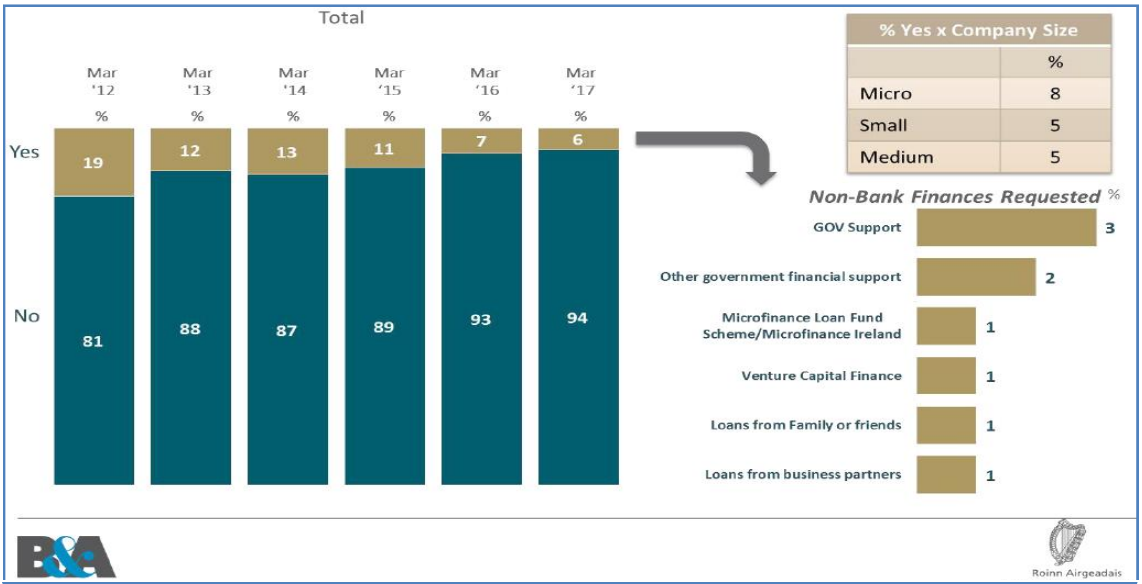


Figure 2.15: Details of SMEs that have enquired into non-bank finance in the previous 6 months
Notes: The information is provided into three separate entities. The first graph illustrates the percentage of Irish SMEs that have enquired into non- bank finance on an annual basis from March 2012 to March 2017. The second section of information illustrates the percentage of SMEs that requested non-bank finance characterised by their size: small, medium and large. The third section provides information regarding Irish SMEs relating to the percentages of six separate options of non-bank funding requested by them. (Department of Finance, 2017)

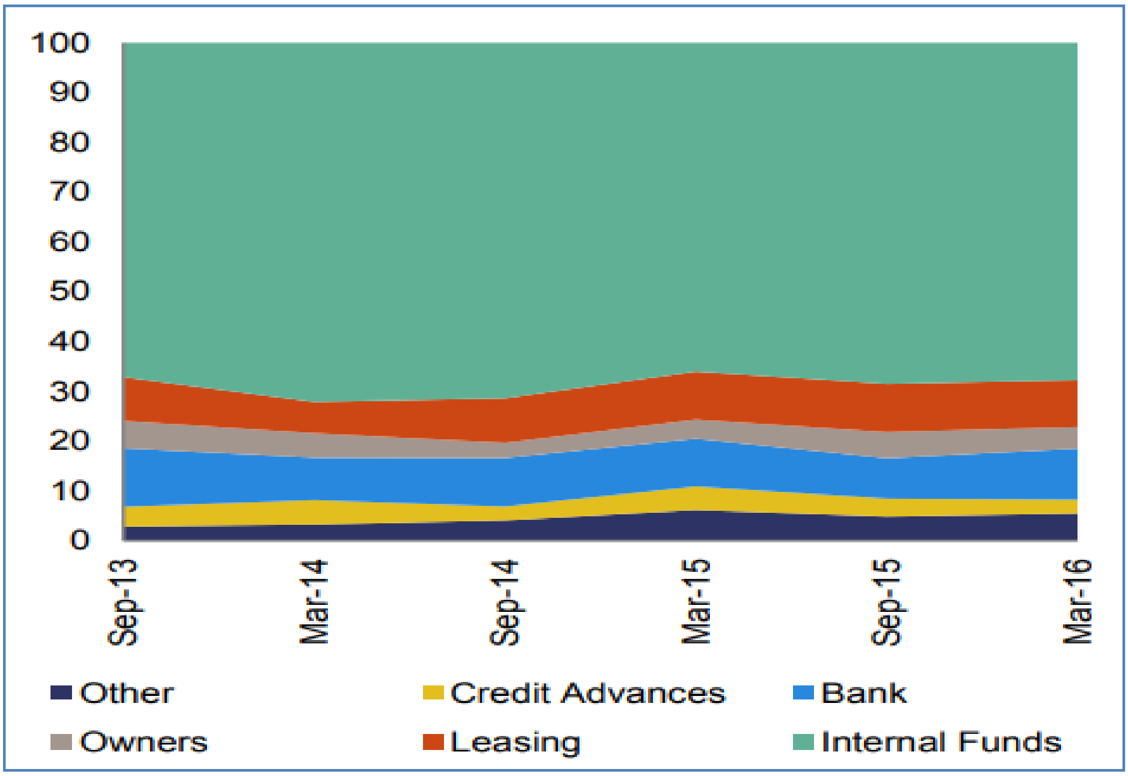


Figure 2.16: The financing sources used by Irish SMEs for fixed investments
Notes: The figure demonstrates the sources of finance used by Irish SMEs between September 2013 to March 2016 as a percentage of total capital. Six separate options are provided and consist of the owners, internal funds, bank funding, credit advances, leasing and other options. (European Commission, 2017c)

A positive observation reports that the Irish SME sector is now less monetarily susceptible with the latest figures compared to 2013, with 2.4 percent of SMEs defaulting between December 2016 and June 2017 (Central Bank of Ireland, 2018). Interestingly, as per September 2017, more Irish SMEs have decreased than increased their debt-to-assets ratio with a net decline of 12.6 percent (Central Bank of Ireland, 2018). Figure 2.16 illustrates how Internal funding, which often predominately incorporates retained earnings, is the major financial source of finance implemented by SMEs in Ireland, as from September 2013 to March 2016 it accounts for 65 to 70 percent of their total finance. Bank loans and leasing are the next most used options, accounting for a combined value of 20 percent on average throughout the time period. According to the 2016 SAFE Report, within the entire EU in 2016, 27 percent of all SMEs sought and applied for a bank loan and excluding 20 percent of firms whose application had still not been processed, 91 percent of the remaining SMEs were successful and willing to take on the loan (European Commission, 2016). While this is encouraging and will help SMEs that need an injection of capital, 39 percent of the successful external finance was valued at less than €100,000 (European Commission, 2016). The generation of internal finance is of major importance to European and particularly Irish SMEs. Subsequently, one strategy that allows access to larger foreign markets is through exporting.

2.11 The Value of Exporting

According to Eurostat, the European Union was the second largest exporter of goods in 2015, with €1.75trillion in the value of total goods. This was second only to China who exported a total estimated value of €2.02trillion of goods. The USA was the third highest exporter with €1.52trillion of goods exported in 2015 and was the largest country or Union with a higher import ratio than the export ratio, which also included both India and Mexico at much smaller values (Eurostat, 2017c). This statistic illustrates the importance of exporting within the EU as a key component within the business world. The portrayal of exporting should not be as a final step, but as an intrinsic part of a business' plan and many firms have taken this on with vigour, given the values mentioned. Indeed, the US alone imported $273billion worth of goods from the EU in 2015 and imported services valued at $169billion (United States Trade Representative, 2016). The values are monumental and to ensure such trade continues, the innovative, high-tech sector will have an important role to play given the previous statistics discussed. SMEs which possess an intangible, competitive advantage will quickly seek to do business in international markets (Oviatt & McDougall, 1994). Firms must obtain adequate support to improve and encourage economic growth. One such method is the provision of adequate finance particularly for the SMEs in this sector, given that 99 percent of firms are in this category. Firms which focus on selling in international markets are less likely to use large amounts of debt than those SMEs which focus solely on their domestic market (Central Bank of Ireland, 2018).

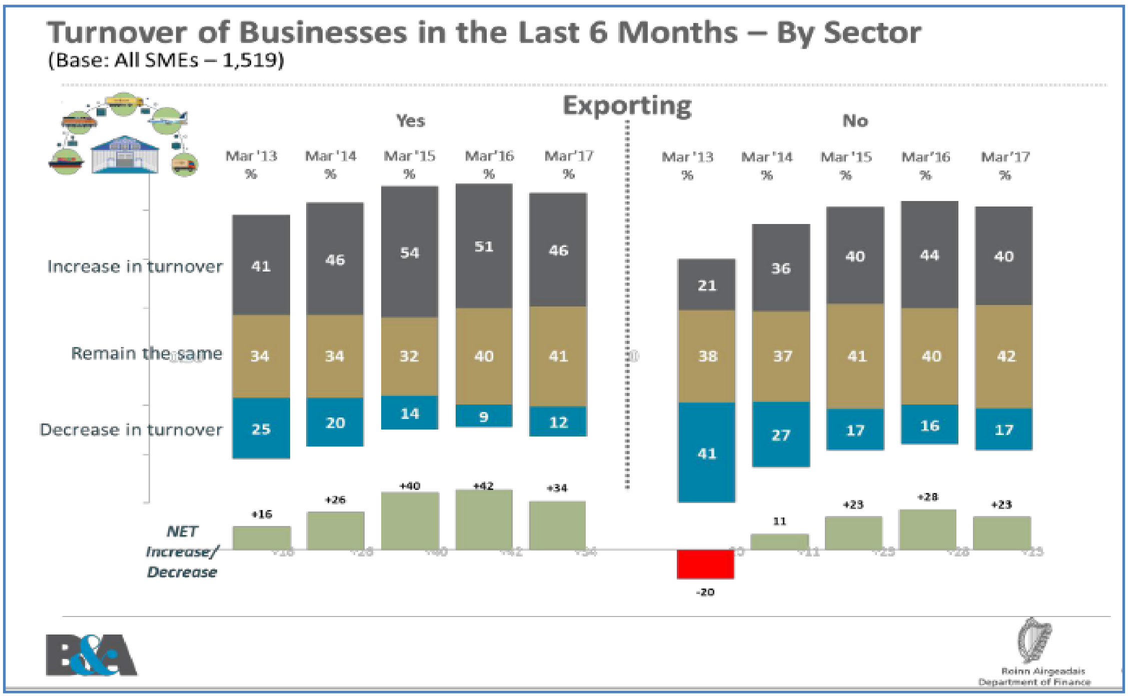


Figure 2.17: Exporting and non-exporting SMEs' turnover in the previous 6 months from March 2013–March 2017

Notes: The figure provides a breakdown of SMEs which export and those which do no export, regarding their turnover in the past 6 month. The options consist of; Increases in turnover, Remain the same and Decrease in turnover. The periods under analysis entails annual data from March 2013 to March 2017. The figure also demonstrates the separate net increase or decrease in revenue throughout this time for both firms which export and those that sell solely in their domestic market. (Department of Finance, 2017)

The importance of exporting should not be overlooked as it can increase the economic strength of countries throughout the world. Exporting is of critical importance to the economic growth of Ireland, yet firms wishing to export have trouble gaining capital to support this venture, and so this needs to be addressed (Economic and Social Research Institute, 2014). A change in policy and implementation of financing support instruments should be acted upon, particularly since exporting has been the primary source of recovery for SMEs within the EU-28 member states (European Commission, 2017a). Figure 2.17 presents an insight into the impact of exports on the generation of revenue and over the past 5 years there have been substantially impressive turnover increases compared to the decreases. It can be proposed that the positive improvements in turnover first occurred with exporting SMEs, particularly given the large differences between exporters and non-exporters turnover increase in 2013 and 2014. Figure 2.17 also illustrates that the decrease in turnover is less severe for exporters compared to non-exporters with 13 percent and 17 percent of the respective firms noting a decline in March 2017. Significantly, incorporating exports into the business model has a positive effect on both ends of the scale and so would encourage SMEs to undertake this challenging, but rewarding, opportunity. The financing preferences of SMEs can differ depending on the sector, yet exporting can influence how firms set up their capital structure. Young firms with growth expectations will seek different financial sources, while those who export favour the use of equity if available (Riding et al. 2012).

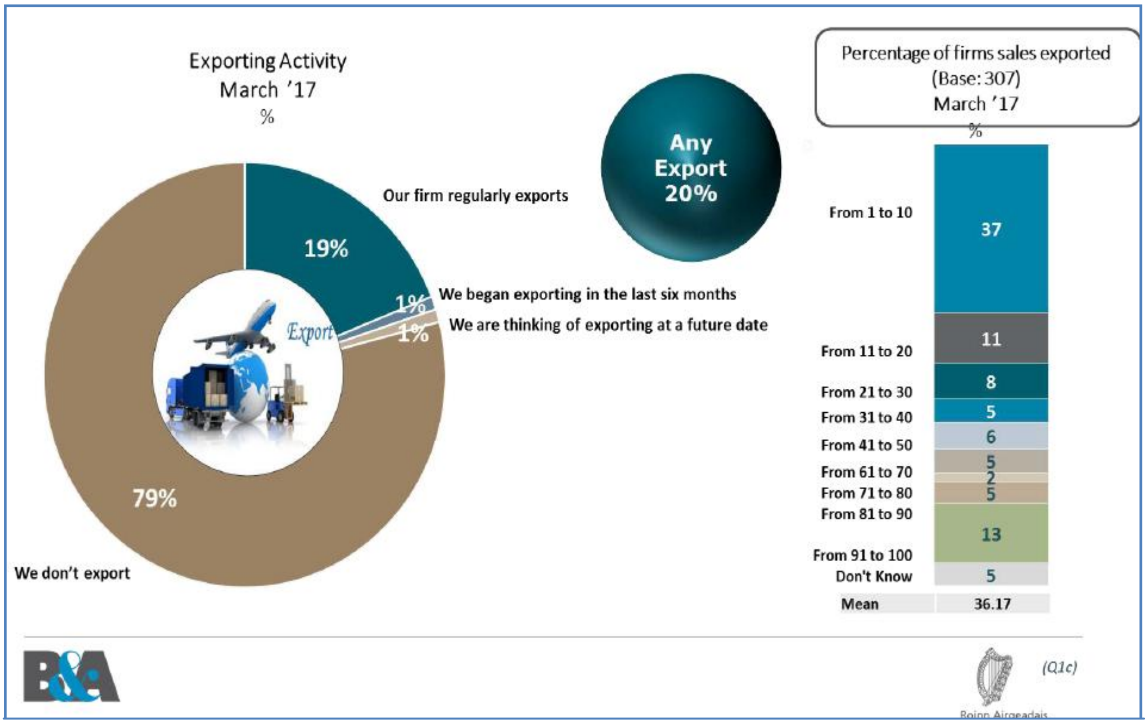


Figure 2.18: Exporting activity of SMEs and the percentage of sales exported

Notes: The figure illustrates two separate pieces of information. The first area relates to the percentage of SMEs in Ireland that export as of March 2017, with four distinct options available: We don't export, we are thinking of exporting at a future date, we began exporting in the last six months and our firm regularly exports. The second section illustrates the percentage of sales, which exports account for from the firms that declared they export. The mean value of exports is 36.17 percent of all sales, while the largest proportion relates to 37 percent of the firms declaring exports account for 1 to 10 percent of sales. (Department of Finance, 2017)

The method by which businesses are set up and grow has changed over the past 20 years. The introduction of the internet and e-commerce allows small businesses with limited employees to generate large values in sales. The correct implementation of the internet is crucial for all business success regardless of size, given that it provides a gateway towards globalisation, yet not all firms recognise this (Mettler & Williams, 2011). Indeed, SMEs are now able to sell in markets around the world and generate market share using modern technology, an eye for opportunity and improved exporting capabilities. Only 20 percent of the Irish SMEs questioned export. A staggering 80 percent of businesses declare it is not something they are contemplating to undertake in the future, as illustrated in Figure 2.18. The breakdown of the sectors is important, but overall the fact that such a limited amount of firms export, illustrates the amount of growth available to Irish SMEs. Interestingly, SMEs which utilise such technology have been found to have twice as many employees with growth and exports 100 percent greater than their peers (Pélissié Du Rausas et al., 2011). Often there are key reasons why firms would prefer not to export as such previous research has found that both internal and external barriers prevent SMEs exporting due to rules and regulations but also a lack of skills and inadequate financing

(Wilson, 2007). Venture capital and business angel funding programmes aim to invest in firms that will export in the future or are currently exporting, while 63 percent of public financing initiatives required the SME to export (Intertrade Ireland, 2013).

There are numerous possibilities for the future of these firms, but none so much as the high-tech sector, given the upturn in its influence upon economic growth and the importance of innovation. Combining these figures with the current standing that four in five Irish SMEs have the opportunity to begin exporting is of interest. It provides a strong indication that the Irish high-tech SME sector will have a substantial role to play in the fiscal future of the country. 44 percent of Canadian SMEs did not export in 2011, even though it was apparent that strong growth is positively correlated with exporting, with 26 percent stating they had no interest due to limited gains (Business Development Bank of Canada, 2011). During the recession in Ireland only 35 percent of micro firms, 50 percent of small and 60 percent of mediums firms exported to some degree, with the remaining business relying solely on the domestic market (Intertrade Ireland, 2013). This demonstrates the importance of exporting for SMEs with the use of international markets for growth and prosperity if adequately financed. While exporting may result in substantial initial costs this should not be a barrier. 98 percent of Irish SMEs that export stated that they have no issue in gaining new sources of finance relating to the improvement or continuation of their exporting. Subsequently, almost all SMEs exporting will be able to obtain extra capital to support an export strategy, and it provides another area of importance for high-tech SMEs to acknowledge and implement.

SMEs which do not develop will likely have to deal with a large number of difficulties in the future, as when SMEs do not grow, there is a strong, positive correlation with a high degree of failure (Freeman et al., 1983). One method by which SMEs can grow is via exporting if deemed a worthwhile investment, particularly given the results in Figure 2.17. SMEs which sell in international markets will gain the necessary developmental abilities for their entrepreneurs to reach their potential (Maranto-Vargas & Gómez-Tagle Rangel, 2007). This, in turn, will benefit the SMEs towards strong growth and correspondingly have a positive effect on the economy. Exporting SMEs tend to demand greater levels of capital than those who stay within their home market (Intertrade Ireland, 2013). Given the importance of high-tech SMEs, analysis of these firms will provide key findings of their capital structure on a topic where little research has been undertaken.

Chapter 3. Literature Review

3.1 Capital Structure Theories

3.1.1 Modigliani and Miller

The importance of capital structure has been under investigation for over 55 years, encompassing a range of topics, which has grown and diversified. Key research into capital structure theories will now be discussed. The research topic of capital structure originates from the analysis undertaken by Modigliani & Miller (1958) where the impact of the cost of capital is investigated. It encompasses debt and equity's influence on business value, but a large number of restrictions exist. Through static partial equilibrium analysis, results show that capital structure has no relationship with the cost of capital. Debt is viewed as a cheaper option than equity, but a large leverage ratio results in the threat of bankruptcy and the provision of a shareholder risk premium. This risk negates the cheap implementation of debt, meaning no benefit occurs. The cost of capital affects the financial performance and thus firm value, meaning that the capital structure cannot influence firm value. Subsequently, debt and equity are irrelevant to any business valuation and adjusting for a certain capital structure make-up has no influence. In 1963, Modigliani & Miller revisited their previous research and acknowledged that some of the strict assumptions in place were not practical and thus not included in this paper (Modigliani & Miller, 1963). The impact of taxes and interest are incorporated into their previous models when examining the impact of debt and equity on the cost of capital and also business value. It is found that interest payments are tax-deductible and so the use of debt provides a tax benefit. Equity, on the other hand, offers no such tax benefits with dividends payments and so Modigliani & Miller (1963) declare that firms should utilise a capital structure consisting of 99.9 percent debt to avail of the optimal tax shield. Given the financial implications of such a high leverage value, it is rarely implemented.

Investigating the importance of capital structure on business value, Wippern (1966) seeks to find the optimal financing structure. The investigation discovers that it may not exist, but further research may prove otherwise. Support is provided for the implementation of a range of financing sources towards the maximisation of shareholder value. When financial structure assumptions are included, such as a constant interest rate, a positive relationship between leverage and shareholder value is found. This finding agrees with Modigliani & Miller (1963) who support the implementation of maximum leverage. When this assumption is removed, the optimal capital structure consists of the point when the weighted average cost of capital equals the marginal cost of debt.

3.1.2 Trade-Off Theory

It is unreasonable to suggest that a firm should possess such a substantial leverage amount to finance its operations as described by Modigliani & Miller (1963). Due to the associated risk of high debt use, which can have detrimental effects compared to equity, another method of financing is imperative which can limit the risk of bankruptcy. The critical component revolves around what attributes are associated with sources of finance such as retained earnings, debt and equity. When a firm takes out a loan, it is a legal contract that states both the principal amount and the interest payments must be fulfilled. If a firm cannot repay its loan, the debt provider can use their right to liquidate the firm, which can stop the firm gaining its cash flows (Diamond, 1991). Failure to meet such criteria often results in firms going into arrears. Arrears often signals that firms are no longer financially viable and liquidators are tasked with recouping the loan amount for the banks. However, liquidation can have a large discrepancy in their value given the numerous influencing factors (Riis Flor, 2008). The threat of bankruptcy hangs over the use of debt, although it is often cheaper than the provision of equity up to a point (Block, Hirt, & Danielsen, 2014). The use of equity necessitates a firm selling a certain number of its ownership via shares, either privately or publicly. When a firm sells its' shares publicly for the first time, this is called an initial public offering (IPO), and anyone with the adequate resources can gain some ownership of the company in exchange for capital (Arnold, 2013). Firms are not legally obliged to provide ordinary shareholders with dividends although, when issued, they can be included within the covenant (Block et al., 2014). Shareholders want the firm to do well so that share prices can increase and thus value is created. This is often the sole method by which investors can generate a profit on their equity investment. Both debt and equity have positive and negative characteristics to consider when firms are seeking to finance investments and deciding upon a capital structure (Brearley, Myers, & Allen, 2013).

Subsequently, a trade-off between the benefits of cheaper debt and the drawback of a bankruptcy threat exists, and it is deemed a balance that firms should utilise. The trade-off theory was first noticeably discussed by Miller (1977) who declares that capital structure is independent of firm value when in equilibrium, as when firms try to exploit debt usage, the market responds to negate them. He states that the traditional method of analysing debt and capital structure does not incorporate personal taxes (Miller, 1977). Three taxes are found to have a critical impact on the value of the firm, and they consist of dividend income tax, interest income tax and the business tax rate. A business's value is construed through the comparison of each tax rate relative to the others. If one tax rate is below a certain level, the advantage of leverage can reduce significantly. Indeed the use of a significant amount of debt will result in higher costs and risk involved for equity owners. Subsequently, a balance must be met to optimise efficient use of financial sources. The importance of such a balance was further discussed by DeAngelo & Masulis (1980) in which they examine the impact of both personal and corporate taxes on the capital structure. The research delves into the trade-off between tax shields. They find that each firm has its own optimal capital structure. This provides support to a belief that not all firms are the same and thus should not be treated as so, as per Modigliani & Miller's work (Modigliani & Miller, 1963).

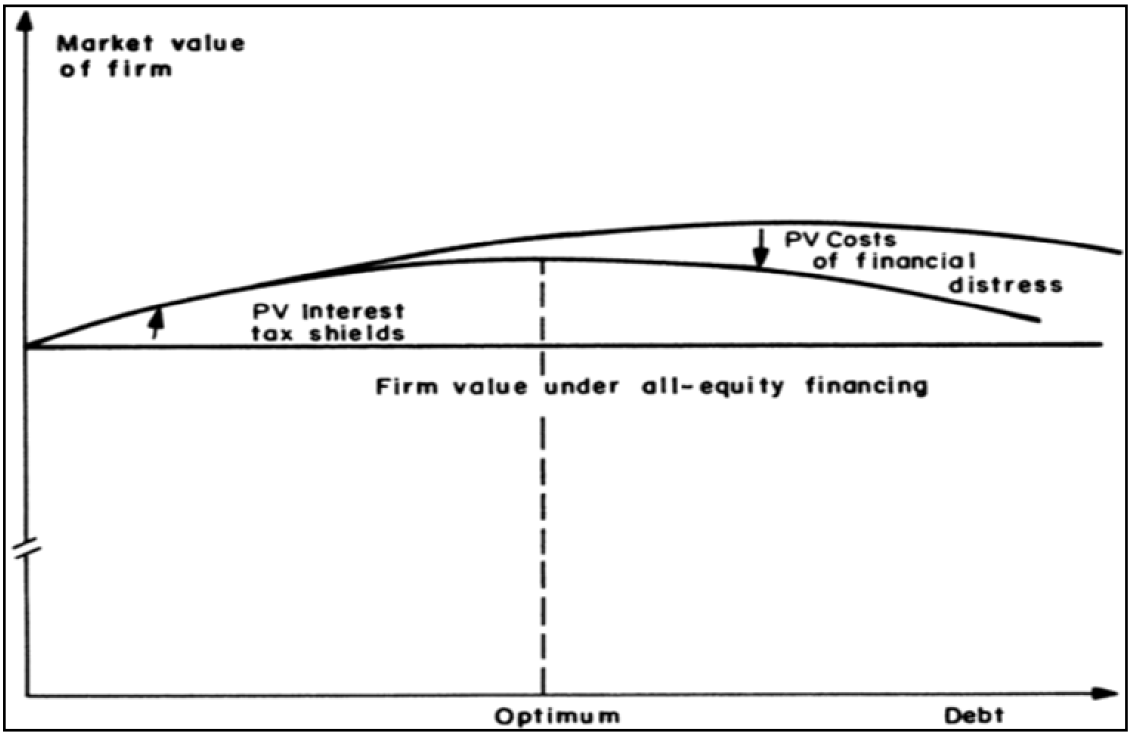


Figure 3.1: The static trade-off theory

Notes: This figure provides an illustrative breakdown of the trade-off theory, with the amount of debt on the X-axis and the market value of the firm on the Y-axis. An optimum level of debt exists when the PV interest tax shield is at the maximum amount, prior to being overtaken by the PV cost of financial distress that is associated with debt usage in the capital structure. (Myers, 1984)

The crucial finding of the trade-off theory research is that bankruptcy costs have a critical role to play due to the capitalisation of taxes by market price. Firms must find a trade-off point between the tax benefit of debt and the associated bankruptcy risk. It is important to maintain this balance if firms are to gain optimal benefit from the debt trade-off. The tax advantages of debt results in debt being construed as a tax shield. However, the impact of this tax shield can have various strengths depending on the industry involved given the scale of tax write-off expenses available to different industries. Thus, the tax shield varies depending upon the industry, due to the differing tax benefits available. Consequently, the industry can have a significant impact on the leverage level within firms. The importance of the industry is noteworthy, particularly for innovative firms, given the tax benefits associated with R&D, which some industries invest more in than others. The country in which a firm is based should also not be ignored. Most countries have different corporate tax rates, and so a firm in the USA will see a greater tax benefit with debt finance due to the tax rate at 35 percent in comparison to Ireland with 13 percent (Deloitte, 2017).

Figure 3.1 provides an insight into the financing situation of larger firms and illustrates how the trade-off theory can be utilised to gain an optimum debt ratio. Myers (1984) declares that the trade-off theory can have an important role to play in the financing of firms and that these firms can gain an optimal benefit by balancing debt. The trade-off theory gathers support from Graham & Harvey (2001) who demonstrate that it is undertaken by many firms. However, they reveal that no relationship exists between capital structure and asymmetric information, transactions costs and free cash flows, amongst others. The trade-off theory when implemented provides an insight into its importance for large firms (Fama & French 2002; Frank & Goyal 2004). Publicly listed and private firms can have different capital sources and uses, but large firms will attempt to obtain a targeted debt level, thus supporting the static trade-off theory (Brounen, de Jong, & Koedijk, 2006). This finding is of interest since listed firms are under more scrupulous pressure due to the public nature of their operations. However, public firms still utilise a similar debt management scale as private firms as the percentage levels, not monetary values, are only revealed. While the scale may differ greatly, the crucial element that revolves around the finding is that the trade-off theory is employed with a target level, regardless of the figure. Consequently, a firm may target a 20 percent debt level regardless even if that accounts for €50thousand or €2billion worth of debt within the firm. This is an engaging proposition, which firms will tend to use particularly the most profitable and so they need to generate new debt every year as their returns and assets grow. Large start-ups use more debt supporting the trade-off theory, thus illustrating that it is not solely for older firms (Coleman, Cotei, & Farhat, 2014).

The belief that debt can hinder or help firms is a topic under investigation, but Cotei & Farhat (2009) discover that the trade-off theory is maintained in the long term for businesses. The influence of the trade-off theory on SMEs is supported, as an investigation of such Spanish firms during 10 year period finds that more of these businesses aim for a debt target (Lopez-Gracia & Mestre-Barbera, 2015). The result allows an outlook into the mindsight of SME owners and managers, as it is good to have goals to obtain, via the trade-off theory, compared to M&M's theory that encourages the complete use of debt. This option is not practical because if one bad year occurs, the firm may fall into financial distress, further compounding into bankruptcy.

3.1.3 Signalling Theories

According to Baker et al. (2004), behavioural finance introduces pragmatic conjectures compared to traditional ideas of finance. Information has associated costs, and so managers are employed to work as agents of the current shareholders to collect and use the information to increase and protect their value (Campbell, 1979). It is important when examining the financing of firms and capital structure and how it influences the firms' value, goals, objectives and challenges. If a potential purchaser of a good cannot verify that the product is of adequate quality in proportion to the price asked, this can result in the breakdown of markets as the purchasers do not trust the sellers due to the presence of asymmetrical information (Akerlof, 1970). The issue of asymmetric information should not be underestimated as it mitigates the capacity for firms to obtain funding through the sale of new shares, but it can also affect the supply of such equity due to the impact on retained earnings (Baskin, 2010).

One way to diminish information asymmetries is through signalling (Spence, 1973). Signalling theory regards how certain changes within a business can provide a signal to outside investors or competitors and remove information asymmetries. A firm's capital structure can signal inside information to external stakeholders regarding the current and future positions of the business, thus removing some information asymmetries which can impact financing (Hall, Hutchinson, & Michaelas, 2000; Michaelas, Chittenden, & Poutziouris, 1999). The signalling theory follows a similar pattern to the pecking order theory due to the use of internally generated capital viewed by the market as a positive signal of solid future investments (Giudici & Paleari, 2000). However, signalling costs occur and consist of a variety of different expenses such as financial and time (Spence, 1973). It is important to note that any variation of signalling will likely not provide a precise full firm value but instead provide enlightening information where findings relating to the capital structure are applicable (Blazenko, 1987).

3.1.3.1 Leland and Pyle (1977)

A theory of signalling is produced by Leland & Pyle (1977) who find that signalling can also arise from firms owners' risk-aversion, given that the information they possess about the firm is stronger than outside investors. This signalling theory suggests that owners will utilise their own internal capital for high return investments, but use external equity sources when the return for investments are not as strong or weak, given the risk. Markets have an information difference between the purchasers and sellers, while in financial markets these informational asymmetries often exist between lenders and borrowers, where the owners of businesses hold more information about their firm then they provide to external parties (Leland & Pyle, 1977). A business that has information asymmetries with the market are expected to know the true value of the firm for the signalling equilibrium to hold, otherwise, owners can overestimate the value and increase the signalling costs (Ang, 1991). If only some information is provided to the lenders or investors, the markets will suffer. Thus, investments and businesses are often over-valued by the owners, resulting in debt providers implementing the market value as the average investment quality (Leland & Pyle, 1977). Such quality is low and will comprise a higher risk ensuing a larger cost of capital for compensation, which is often a deterrent for business to use such financial options (Leland & Pyle, 1977). When no information is provided to outside stakeholders, it can result in poor performance by the markets. When entrepreneurs invest in their businesses, it can be a signal of the quality, reducing information asymmetries and increasing the firm's value due to the additional investment by the entrepreneur (Leland & Pyle, 1977).

3.1.3.2 Ross (1977)

A manager-incentive signalling equilibrium is presented by Ross (1977) where it is proposed that managers will possess more significant and important information about a business than any outside party, as they must use this information to make decisions regarding the future of the firm. Managers are deemed to receive compensation through a known procedure of two parts: the compensation of the financial claims and the bonus relating to the firm's value according to the market's perception based on the financing source used (Ross, 1977b). Managers will act to obtain the largest compensation possible, and it covers the ability of the firm to repay debt through a limit of available debt (Ross, 1977b). The theory of Akerlof (1970) is built upon by Ross (1977) as a signalling model with application to the capital structure (Schmid Klein, O'Brien, & Peters, 2002). Ross (1977) suggests that the use of different financing sources can signal the future net present value (NPV) outcome of a project and thus relates to the value of the business.

In order to show the market and potential investors that the firm is of high-quality and a good investment, they can issue debt finance to a greater level than low-quality firms could carry, whereby the managers will face sanctions if the firm falls into bankruptcy (Ross, 1977b). Under the signalling theory, a firm's capital structure can provide information to external investors and lenders as different financial choices can signal strengths or weaknesses of the firm to the market (Korduneanu & Jovu, 2009). In essence, managers obtain the largest possible bonus if they utilise a capital structure that hedges the market signal's current value against the returns incentive outcome, as in equilibrium firms can be differentiated given their choice for financing (Ross, 1977b).

When random returns are included in the assumptions, managers will seek to limit their debt amount and risk of bankruptcy at a value stable with signalling, yet for high return firms if the financing amount is reduced, then the firm value will also decrease (Ross, 1977b). The importance of this theory suggests that managers possess key inside information regarding returns and so increasing firm debt results in greater risks such as bankruptcy, thus permeating a signal of a robust business. Firms that take on large values of leverage indicate they are more able to pay off the debt due to the future cash flows the firm will receive. The objectives of both signalling theories differ, whereby Akerlof (1970) seeks to maximise profits, while the maximisation of the manager's wage is critical to Ross (1977) which incorporates both the maximisation of firm value while taking into account the bankruptcy penalty (Schmid Klein et al., 2002). The incentive-signalling model is a capital structure theory that builds upon the assumptions of competition and perfect financial markets relevant in the literature concerning both the capital asset pricing model (CAPM) and the Modigliani-Miller irrelevancy theory (Ross, 1977b). Furthermore, when current shareholders have information that the business' investments will provide large profits in the future, they will often oppose the issue of new shares, to ensure the current owners are solely entitled to such returns (Norvaisiene, 2012).

3.1.3.3 Myers and Majluf (1984)

According to finance theory, in an efficient capital market, businesses were expected invest in projects which provide a positive net present value (NPV) regardless of the financing sources used (Myers & Majluf, 1984). However, managers possess more information about the firm regarding its assets value and future opportunities than outside investors, and so any actions undertaken by the business are viewed as signals by investors (Myers & Majluf, 1984). Subsequently, a conflict can arise regarding the benefits for old and new shareholders and on occasion the inside asymmetric information managers possess will result in the refusal to issue new shares, to maintain the welfare of old shareholders, which is paramount (Myers & Majluf, 1984). This can happen for old shareholders when the gain from the investments' NPV does not trump the cost of providing undervalued new shares (Myers & Majluf, 1984). Managers seek to maximise the full value of the current shares in order to benefit the old shareholders, while new investors are aware of this and will use this information when deciding on a share price they deem suitable for investment (Myers & Majluf, 1984). Investors can extrapolate a firm's activities, and so when a business does not offer new shares to finance its projects, this is a good news signal concerning the overall strength of the firm (Myers & Majluf, 1984). Consequently, the issuance of shares is often deemed to be a signal of bad news since the focus of the business should be keeping old shareholders content (Myers &

Majluf, 1984). An issue regarding the valuation of firms is assessed by Randleman (1980) who demonstrates that when firms are undervalued, they will use debt finance, but this research does not provide the reaction from the market regarding the financing selection.

The availability of financial slack which consists of both retained earnings or the ability to issue debt without the risk of default has a significant impact on whether a firm invests in all NPV projects with a positive outcome (Myers & Majluf, 1984). Previous studies have demonstrated the increased liquidity of a firm can signal a strong future performance to the market, thus reducing some inside information asymmetries (Myeong-Hyeon, 1998). If firms do not possess financial slack, they may have to pass on the investment or issue stock at short notice in order to invest in such positive NPV projects, but it is not an action recommended since the shares are likely undervalued (Myers & Majluf, 1984). When firms issue debt no change of share prices occurs; however, when equity is not issued the share price falls strongly in value (Dann & Mikkelson, 1984). The analysis by Myers and Majluf (1984) find that a preference for debt finance instead of equity exists if external finance is needed. If a firm has ample slack but seeks to issues new shares to finance an investment, this can be viewed as a negative signal for investors as the shares are likely overvalued (Myers & Majluf, 1984). Subsequently, ensuring the firm has enough slack to use for investments will reduce any conflicts regarding old and new shareholders as equity issues will not be needed and help limit the outcomes of information asymmetries which managers possess.

Firms have a preference for debt finance instead of equity since it is deemed to be a safer option to utilise than the riskier offering of shares (Myers & Majluf, 1984). Issues regarding the seminal signalling papers by Leland & Pyle (1977) and Ross (1977) do not investigate how firms can signal the net value of growth opportunities as the signalling costs often finish before the generation of their associated cash flow (Bhattacharya & Ritter, 1983). The sale of new shares at a lower price than their real value, when management possess knowledge not known to investors, can occur. The return from the investments could be outweighed by the dilution of ownership and decrease in overall firm value, and so the project may be abandoned in favour of maintaining current shareholdings (Myers & Majluf, 1984). An unwillingness to issue shares can be interpreted as a signal of positive news by investors, positively affecting the perceived price and influencing the issue and invest decision by firms (Myers & Majluf, 1984).

3.1.3.4 Signalling Firm Quality and Debt Finance

When a firm decides to utilise more debt and reduce their reliance on equity, this swap can be perceived as a signal of firm strength as it illustrates that management believes the firm can cope with the requirement associated with additional debt (Masulis, 1983). Debt is implemented as a signal of firm quality to the market, not only because it is used instead of equity. The findings suggest that only higher quality businesses are able to use a larger proportion of debt due to the marginal costs involved with the threat of bankruptcy (Foster & Young, 2013). If lower quality firms replicate the use of debt, there is a considerable probability that they will have bankruptcy issues, resulting in debt use viewed as a positive signal to all stakeholders. Businesses that have limited liability and which are highly leveraged may employ this as a signal of strength to the market, as competitors know that leverage increases the probability of bankruptcy, thus the firm will be perceived to possess a strong outlook on future cash flow (Brander & Lewis, 1986). When firms issue debt, such as bonds if the pricing of debt types is incorrect, this can have an impact on the firm value through signalling (Flannery, 1986).

However while the provision of debt is often perceived to be a sign of strength, in their highly cited research paper, Fama & French (1998) find that the use of debt is a signal of poor performance and lower value overall. This finding gains support since severe issues can occur if overconfident management exists regarding the firms' performance. Additional debt will be used to signal such confidence and reduce information asymmetries, but increases the likelihood of bankruptcy and the costs involved (Fairchild, 2005). Subsequently, following the signalling theory incorrectly can have catastrophic results for lower quality firms who believe they are higher quality. Some firms may have to provide collateral to negate this issue and demonstrate their quality. When seeking debt finance, the use of collateral as a signal to remove information asymmetries and to identify the risk level of borrowers can be critical (Bester, 1985; Ciarán Mac an Bhaird & Lucey, 2010).

Due to the impact of debt in decreasing the likelihood of a moral hazard, a negative relationship between leverage and the concentrated number of owners is proposed to exist according to signalling and agency theories (Deesomsak, Paudyal, & Pescetto, 2004). This theory suggests that when fewer owners are involved in a business, more debt will be used and it helps remove issues involved with new shareholders. If a manager maintains a large proportion of ownership by using debt finance, this ability to repay debt can signal a firms' higher quality to the market since large equity ownership is not as costly for high-quality businesses (Schmid Klein et al., 2002). On the other hand, if the business is expected to generate future loses, it will seek to gain new shareholders so that the losses are diluted for the current owner (Schmid Klein et al., 2002). This emphasises more support towards debt financing as a signal of higher quality firms with robust future investments and cash flow.

3.1.3.5 Debt Maturity Signals and Firm Value

Not only does the use of debt provide signals to the market, but also the properties of such debt are important, most noticeably the term length. It is propositioned that lower quality businesses would not be able to sustain long-term debt due to the uncertainties of their future cash flows (Stohs & Mauer, 1996). Incorrect pricing occurs particularly for long-term debt issues, subsequently, if the market cannot decipher the quality of firms, then higher quality businesses should issue short-term debt to account for their undervaluation (Flannery, 1986). Although this method increases the threat of bankruptcy due to needing to use multiple debt contracts over the long term, lenders will provide debt to firms in a healthy position, and so it signals to the market the firms have a positive future (Diamond, 1991). Due to asymmetric information, undertaking such a practice can signal the strong quality of the firm to the market compared to the issue of long-term debt (Blazenko, 1987; Hol & Wijst, 2008). The finding suggests that both firms with very strong and very weak bond ratings use short-term debt, and in order to ensure the correct positive signals are portrayed to the market, better quality firms can sustain and obtain the sum of multiple short-term debt policies (Stohs & Mauer, 1996). A larger leverage amount, particularly of short-term debt, produces a positive signal providing an insight that the firm could amend such financing conditions in the future. Businesses that possess positive internal information will seek to use short-term debt (Diamond, 1991). Previous analysis is supported whereby the maturity of debt and future earnings have an inverse relationship, with the use of short-term debt signalling larger expected earnings per share (Flannery, 1986).

Firms which have little information asymmetry with the market will use long-term debt to finance themselves, and it is further proposed that larger transaction costs and debt maturity can be a signal of firm quality(Flannery, 1986). However, debt with short-term maturity will be used more by firms with large insider information asymmetries (Michael J Barclay & Smith, 1995). When interest rates are expected to fall for long-term debt, 30 percent of the chief financial officers (CFOs) surveyed will issue short-term debt (Bancel & Mittoo, 2004). While 10 percent of the 86 CFOs would use short-term debt and the wait for the business rating to improve, thus debt maturity can be a signal of the management's future outlook (Bancel & Mittoo, 2004). The maturity term of debt has been investigated as a market signal, but Barclay & Smith (1995) determine that firms tend not to use maturity in such a manner.

3.1.3.6 Equity Signalling and Firm Value

If a firm decides to buy back shares, this signals a positive aspect for the business and the price improves, but if a firm seeks to utilise their inside information and issue new shares, this can be perceived as a negative signal for the firm and the share price will decrease (Myers, 1984). This offer of new equity can signal negative news due to additional costs than debt finance and so is not as easily undertaken in contrast to debt finance (Cosh, Cumming, & Hughes, 2009b). When firms are unable to obtain more debt due to being highly leveraged or unable to pay back debt, if they then sell new equity, it is deemed to be a poor signal by the market, resulting in a higher cost of equity (Greenwald, Stiglitz, & Weiss, 1984). Subsequently, firms do not wish to issue new equity to the market when they believe the price is not at an adequate, fair level (Graham & Harvey, 2001). When firms are undervalued, their managers can find it a good time to issue new stock even though the firm may possess sufficient internal finance (Viswanath, 1993). Subsequently, this demonstrates that all equity issues cannot be interpreted as a signal for price overvaluation when compared to the analysis by Myers & Majluf (1984). Businesses will issue equity when no other sources of capital are available and a limited number of firms issue stock to demonstrate their quality, demonstrating little support for signalling (Bancel & Mittoo, 2004).

3.1.3.7 Previous Experience, Ratings and Human Capital Signalling

A film's reputation, which consists of previous performance and experience, can be a valuable signal to the market when information asymmetry exists. This is of particular importance when the quality of the goods cannot be examined before purchasing, hence higher quality products may have a premium cost as compensation for reputation signalling (Shapiro, 1983). Even the number of hours an entrepreneur works can be viewed as a signal for investors as it can represent the determination for the business to succeed (Cassia & Minola, 2011). The closure of information gaps allows firms to gain insight into the firm as it diminishes information asymmetries and provides investors with a better understanding of the business and its' future outlook. Human capital that incorporates an advanced education level and experience in management can be used as a signal as it provides information regarding both the business and the entrepreneurs that can reduce the information asymmetries involved for start-up firms (Kim, Aldrich, & Keister, 2006). VC funds may use signals of human capital such as education level and start-up experience to decide whether entrepreneurs possess adequate qualities for investment (Hsu, 2007).

The capacity for a firm to manage its debt and ensure positive credit scores is critical as it not only signals the firm's ability to make repayments but also signals the competence and level of the management team (Coleman & Robb, 2012). If a firm struggles to repay its debt, then future lenders and investors will view the firm and management as higher risk and thus seek a larger return if they do business. Subsequently, credit ratings can also have an important impact on a firm's capital structure as they are often signals of quality and a positive change will signal good news to both investors and lenders and a change in the cost of capital (Kisgen, 2006).

3.1.3.8 Venture Capital Funding and Signalling

When positive signals relating to the shares on stock exchanges occur, the most experienced VC funds will improve their investments by a larger degree, thus demonstrating the importance of signalling and how firms react to good or bad news via signals (Gompers et al., 2008). As VC funds receive more information, they tend to make less accurate predictions regarding firm performance, since too much information overcomplicates the process with unnecessary extra data muddling the analysis (Zacharakis & Shepherd, 2001a). Not only a relationship with venture capital firms but also prior start-up experience and the higher education of the founder can increase the probability of gaining VC funding, thus illustrating their importance as signals (Hsu, 2007). Rosenbusch et al. (2013) investigate the quality of the VC firms whereby the best, first tier firms will choose to invest in a business with high growth opportunities and the capabilities of reaching high levels. This results in the best quality businesses obtaining stronger signals from the market, particularly in comparison to those who obtain funding from poorer quality VC firms (Rosenbusch et al., 2013). However, venture capital firms can possess more resource restrictions than other investor or lender types; they can overestimate the signals they receive from firms, particularly negative signals and thus reject firms that could prove good investments (Zacharakis & Shepherd, 2001a). The impact of VC funding and the associated value through signalling will diminish once the firm goes public through an IPO, but IPOs are not primarily undertaken to remove information asymmetries although they are a significant signal of high quality (Ritter & Welch, 2002).

3.1.3.9 Dividends Signals

One example within the signalling literature illustrates that the provision of dividends can be viewed as a signal of high-quality firms due to the expected future cash flows gathered from this information (Bhattacharya, 1979). When information asymmetries exist, the highest quality businesses are expected to be both highly leveraged and also pay out large dividends to their investors (Smith & Watts, 1992). It is also conveyed that dividends illustrate a positive signal of value and profitability when the control variable such as R&D and investments are used (Fama & French, 1998). When a firm issues dividends it provides an insight into the business and diminishes the level of information asymmetry within the market, while those firms that have limited cash and do not pay dividends will have higher costs of capital (Sharpe & Nguyen, 1995). Indeed, investors in publicly listed firms which reduce their dividend payout will interpret this as a signal of poor performance and an insight into lower future cash flows (Baskin, 2010; Kester & Robbins, 2011). Debt proves to be a positive signal of growth opportunities for larger businesses that pay dividends as it conveys a high-quality firm with a positive future to outside stakeholders (Fauzi, Basyith, & Idris, 2013; Ravid & Sarig, 1991). If firms provide both dividends and earnings information, the signals relating to earnings will have a significantly larger effect on the business' share price (McCluskey et al., 2006). This finding illustrates that there is a hierarchy of weighting regarding different types of information and earnings signals have a significant impact on the share price difference perceived by the market. Private businesses do not deal with issues of dividends and the perceived signals such changes can provide (Colombo et al., 2012).

3.1.4 The Pecking Order Theory

Describing the limited understanding of capital structure choices and why firms use different sources of finance while ignoring others, Myers (1984 p. 575) declares that "We know very little about capital structure. We do not know how firms choose the debt, equity or hybrid securities they issue." One theory that can help make sense of the financing decisions is the pecking order theory, discussed in detail by Myers & Majluf (1984) in their seminal paper. They depict that firms seek to utilise internal finance first and then have a preference for debt over equity when external sources are needed (Myers & Majluf, 1984). Unlike the trade-off theory, a target debt ratio does not exist, and firms are not seeking a defined proportion of debt (Myers, 1984), as the pecking order theory benefits from a simplified strategy to follow. The pecking order theory is best described through asymmetric information, whereby the firm's management will make decisions to benefit old the shareholders while assuming that they are passive and will not adjust their portfolios on every action (Myers & Majluf, 1984). Asymmetric information relates to management possessing greater information than investors and stakeholders in regards to firm valuations and investments (Schmid Klein et al., 2002).

The information deficit that exists between management and investors can have a significant impact on selecting the source of finance to implement for new investments, and the pecking order theory was built upon this knowledge (Myers & Majluf, 1984). This information asymmetry regards both the firm asset value and future opportunities meaning that any business actions are viewed as signals by investors (Myers & Majluf, 1984). Managers are expected to maximise the benefits for the "old", or current, shareholders when making decisions and the future investors are aware of this and interpret their activities accordingly (Myers & Majluf, 1984). This information asymmetry can result in issues regarding old and new shareholders and further demonstrates the finding by Riley (2001) who declares that it has a severe influence on the subject of capital structure. The private interests of managers are associated with the concerns of old shareholders compared to the welfare of new shareholders (Myers & Majluf, 1984). Subsequently, positive NPV investments may not be undertaken due to asymmetric information and the negative signals which equity issues provide to the market and subsequent price drop, which demonstrates how retaining and implementing internal finance can avoid this issue (Myers & Majluf, 1984). This disregard of investment can also occur when the inside information contains such considerable future growth that shares will not be issued in order to benefit the current "old" shareholders (Myers & Majluf, 1984). The capital structure that firms implement can occur to account for asymmetric information and reduce any negative outcomes (Blazenko, 1987). The declination of new share issues can be construed as a signal of positive news by investors (Myers & Majluf, 1984).

In comparison to the goal of maximising the profit of a firm (Friedman, 1970), the expected goal of a firm is to maximise shareholder wealth (Tudose, 2012). Profits can increase significantly one year, but end up as a loss the following year. Increasing shareholder value mirrors the increased value of a firm that encapsulates the present and future revenue and the present and future market share. Since the objective of the firm and management is to maximise current shareholder wealth (Hogan & Hutson, 2005; Kraus & Litzenberger, 1973), the financing of such projects with new equity can become an issue. Subsequently, the pecking order theory assumes that management will seek to maximise shareholder wealth. Thus the firm and its current shareholders are at the centre of key business decisions, where share issues are deemed to be damaging news (Myers & Majluf, 1984).

Financial slack, which predominately consists of internal finance and risk-free debt, provides the business with an opportunity for management to invest in all positive investments as they arise to leave without the necessity to use external finance (Myers & Majluf, 1984). By reducing or stopping dividend payments, the capital saved can be used towards slack and firms should restrict any payment of a dividend if they must utilise security to afford it (Myers & Majluf, 1984). Firms which do not recognise the strength and benefits of financial slack will have poorer performance, particularly those involved in innovation (O'Brien, 2003). If adequate internal finance is not available for investments, Myers & Majluf (1984) declare that to best support old shareholders, debt finance should be the preferred option instead of equity given that it has less associated risk and so planning to implement debt is preferred than an advanced commitment for equity finance. This pecking order theory is illustrated in Figure 3.2. When comparing the influence of asymmetric information of both firm value and risk, financing behaviour is believed to be influenced more by information gaps regarding the firm value (Myers & Majluf, 1984). Furthermore, when information asymmetry related to risk aversion, it has not been found to influence the decision of debt or equity use (Schmid Klein et al., 2002). Under the model used to depict the pecking order theory firms should always prefer the use of debt finance instead of equity for investments, once internal finance is no longer available, as safe debt does not result in a share value decrease, but equity use will lower the share price (Myers & Majluf, 1984).

Figure 3.2: The pecking order theory

Notes: Under the pecking order theory, a hierarchy of finance exists whereby firms should seek to utilise all sources of internal finance first, such as retained earnings and personal savings. Once this source is no longer available, businesses should prefer debt finance until they can no longer obtain more (Myers & Majluf, 1984) The final source firms should then seek to utilise is equity finance, which resonates with the sale of some ownership of the business. Under the pecking order theory, a target debt ratio does not exist.

3.1.4.1 Pecking Order Theory Support

Internal finance and retained earnings are not sufficient for investments resulting in businesses using a large amount of external finance. When investigating its relevance amongst SMEs, substantial support for the pecking order theory is found, but the positive relationship between sales growth and debt is not supported (Jordan, Lowe, & Taylor, 1998). Interestingly, debt can provide information in two separate ways; the first concerns the ability for a firm to make their loan repayments, which provides an insight into the firm's revenue and expenses management (Harris & Raviv, 1990). The second method whereby debt can remove asymmetric information is under the process of liquidation, managers must present closely held information to the debt providers (Harris & Raviv, 1990). The provision of both owner and firm characteristics to outside lenders and investors can help remove information asymmetries and improve the use of debt before equity (Coleman et al., 2014). While young, large firms tend to undertake the pecking order theory, equity appears to have a more meaningful impact on firms than debt. Small high-growth businesses tend to support the use of the pecking order theory (Frank & Goyal, 2003). Other findings provide some support for the pecking order theory, but it is not the sole capital structure to follow, and some firms may take aspects from the financing path. The impact of asymmetric information amongst other variables is not supported, while the influence of NPV is critical for firm valuation, particularly those that are large. Some support for the pecking order theory is found, as well as the trade-off theory (Graham & Harvey, 2001). Further research suggests that both the pecking order and trade-off theories provide an insight into the capital structure of SMEs. Indeed, SMEs have different financing tendencies compared to larger firms, with growth opportunities and internal resources influencing their capital structure (López-Gracia & Sogorb-Mira, 2008). The importance of both the pecking order and trade-off theories is apparent amongst businesses (Frank & Goyal, 2009). Furthermore, when the debt target capacity can change as per differing theories, the pecking order theory and trade-off theory are both mutually beneficial and co-exist (Leary & Roberts, 2010).

3.1.4.2 No Pecking Order Theory Support

Other findings, however, suggest the pecking order theory is not utilised by larger firms and that some businesses may merely fall into its use as opposed to following it. Businesses with sufficient retained earnings will not utilise external sources, but when access to capital markets for financing is available, the pecking order theory is not as strictly followed (Helwege & Liang, 1996). This finding illustrates how the implementation of capital structure theories can change depending on the firm's characteristics and economic influences at play. Furthermore, when a strict version influencing debt and equity usage is under analysis less than 20 percent of businesses follow the pecking order theory (Leary & Roberts, 2010). Information asymmetries exist for start-ups and increase the problems in obtaining debt and this can be an issue for following the pecking order theory. The pecking order theory should not be followed as businesses may benefit from the use of equity when they are undervalued, even if retained earnings are a viable option (Viswanath, 1993).

3.1.5 Market Timing Theory

Previous research into earnings and asymmetric information illustrates how new investors tend to be taken advantage of by managers (M. Baker & Wurgler, 2002). This occurs when the market values of debt and equity change by a significant degree and managers time such events in order to best serve the firms' financing and capital structure targets (Taggart, 1977). The market timing theory is summarized as a simplistic approach where managers review debt and equity markets and select the finance type which is most beneficial to the firm at that given time if any (Frank & Goyal, 2009). Two versions of market timing exist, and both revolve around the rationality of investors and managers regarding new shares being offered when the market receives good news, resulting in a reduction in information asymmetries and share price increase (Baker & Wurgler, 2002; Luigi & Sorin, 2009). The version of market timing presented by Baker & Wurgler (2002) theorises that managers and investors are irrational and the market can misprice firms over time. This research is the first to investigate the impact of marketing timing on capital structure. Previous market values of equity can produce the current capital structure since firms with high market-to-book values will issue new equity, while those with low market-to-book values will purchase shares due to market timing and this builds over time (Baker & Wurgler, 2002). Consequently, a negative correlation exists between leverage and market valuations, with a build up over time producing the firms' capital structure. This version states that managers trust that they can time the market, not beat it, to capitalise on when to instigate share repurchases and share issuances (Luigi & Sorin, 2009). The market does not need to be inefficient for the second type of market timing to exist (Baker & Wurgler, 2002).

The theory builds upon previous findings, such as when strong market performance improves share prices in comparison to previous historical prices, firms will seek to capitalise by issuing new shares to investors (Marsh, 1982). However, when businesses react to market conditions in this way, it was also found to occur in conjunction with a targeted debt level (Marsh, 1982). The market timing theory suggests that the main reason new, large equity issues occur is due to opportunistic managers who strike when the market overvalues them with a higher market-to-book value often due to significant growth opportunities (Alti, 2006; Klein, O'Brien, & Peters, 2002). The valuation process consisted of book-to-market ratios meaning that firms with leverage tended to generate new finance when this value was high, but firms with little debt and low leverage would obtain this financial source when the firm value was low (Elliott et al., 2008). When shares become overvalued, the theory of market timing suggests that firms will issue equity to the market (Graham & Harvey, 2001). Subsequently, the capital structure of firms was reactionary to the market valuation change over time, thus supporting a market timing theory, compared to other theories such as the pecking order or the trade-off theory whereby the firm is proactive in making capital structure choices. The issuance of equity can limit a firm's maximum value as they often provide information prior to the ideal time meaning that high-quality businesses may decide against issuing equity to limit such transparency costs related to information asymmetries (Almazan, Suarez, & Titman, 2009). Furthermore, the ability for high market-to-book valued public firms to pay the costs of debt finance can have an impact on their capital structure as they will use equity finance when the market highly values them (Lemmon & Zender, 2010). If managers time the issue of equity correctly, it can both improve the situation of current shareholders with the new shareholders taking the hit, while it can also reduce the cost of equity (Elliott et al., 2008). One of the most engaging components of the market timing theory demonstrates that an optimal capital structure does not occur (Luigi & Sorin, 2009). Instead, the long-term capital structure is affected by previous market valuation changes and attempts by managers to time them (M. Baker & Wurgler, 2002).

3.1.5.1 Market Timing Findings and Support

When comparing the findings of both Leland & Pyle (1977) and Ross (1977) regarding the relevance of signalling and asymmetric information, it is found that a considerable majority of firms chose their debt finance without any regard for the market signals it could portray (Graham & Harvey, 2001). Klein et al. (2002) declare that from 1991 to 2002, little findings support the relevance of signalling for capital structure or information asymmetry theories, resulting in an enlarged disparity between theory and evidence. Indeed the discrepancy "suggests the need for a more capable asymmetric information theory of financing decisions" and so the relevance of market timing is a theory which may be significant (Klein, O'Brien, & Peters, 2002 pg.343). Baker & Wurgler (2002) demonstrate that market timing exists in four separate types of studies. The first two pieces of analysis discover that: when the cost of equity is low, businesses will provide new shares and when the cost of equity is high, they will buy back shares, while firms will also issue new equity instead of debt when the market overvalues their share price. The final two studies suggest that when investors believe the markets and firms are performing strongly and positive about future earnings, firms should sell shares and also that market timing has been stated as a real strategy by managers (Baker & Wurgler, 2002). A critical piece of research undertaken by Graham & Harvey (2001) who surveyed 392 CFOs finds that two-thirds have an openness to capitalise on market timing given the valuation of shares. Gaining from share valuations is not an unusual trait and firms will have time inherent opportunities to sell shares that can also lower information asymmetries (Bayless & Chaplinsky, 1996). These results provide substantial support that market timing is a capital structure theory implemented on an on-going basis and one in which firms seek to use when possible. Firms have previously been found to implement the market timing theory with robust performance and improved growth before a stock issue, but once issued the performance will heavily subside with low stock returns (Loughran & Ritter, 1997). Interestingly, given the drop off in performance throughout the period analysed, the value of the shares did not account for the likely fall in performance after the share issue (Loughran & Ritter, 1997). The findings suggest that information asymmetry exists between the investors and managers and that by timing the sale correctly, time management can maximise the value for the current shareholders. However, investigating the exact influence of market timing on the capital structure of firms is more complex than examining the existence of market timing (Alti, 2006).

When distinguishing the differences between market timing effects and asymmetric information it is found that when growth options are controlled, the incorrect pricing of shares is still imperative to financing decisions supporting market timing (Elliott et al., 2008). Market timing is evident by large firms that adjust their capital structure during periods of historically low interest rates, as managers issue more corporate debt finance than equity to fund their investments (Barry et al., 2008). Changes in the value of share prices due to stock return have a significant impact on the debt-to-equity ratios of publicly listed US firms (Welch, 2004). Huang & Ritter (2009) find support for the market timing theory since firms will issue new stock finance when the price is high, and the cost of equity for the firm is low, which subsequently decreases the debt ratio. Although the impact on the capital structure can last some years, these firms do not interfere with the price change effects by issuing new debt or equity, further illustrating the impact of stock returns and share price changes (Welch, 2004). When reviewing the market timing theory (Frank & Goyal (2009) declare that it correctly predicts issues regarding valuations, but not those regarding the trade-off theory. Following the announcements to critical data and earnings, equity issues occur in clusters, with a positive correlation between the gap in time periods and the enormity of the announcement confirming the market timing theory (Klein, O'Brien, & Peters, 2002).

3.1.5.2 Market Timing Mixed Support

Theories of finance which rely upon a managerial optimisation process, such as market timing, must take into account the costs and benefits of decisions throughout different periods, meaning the best financing options will change (Frank & Goyal, 2009). The pecking order theory and market timing theory are both similar since they do not provide an optimum debt ratio for a firm to obtain (Huang & Ritter, 2009). Findings suggest that the market timing theory is more of an opportunistic capital structure theory driven by share value changes rather than a theory which businesses will implement long term. Indeed, firms will seek to rebalance their capital structure towards an optimal leverage ratio in the long term, within two to four years of issuing equity at an overvalued time supporting the trade-off theory, (Huang & Ritter, 2009; Kayhan & Titman, 2007; Leary &

Roberts, 2005). This is illustrated by Alti (2006) where a target debt level, via a modified version of the trade-off theory, is found to exist in combination with a short-term market timing effect which influences the debt level in the short term when firms are listed on a strongly performing market. Subsequently, some support for Baker & Wurgler (2002) is demonstrated often in the short-term, but it is not a capital structure theory for firms to solely follow in the long term.

3.1.5.3 Market Timing Opposition

The pecking order, market timing and static trade-off theories provide a considerable understanding of the capital structure and its determinants (Denis, 2012). However, modern research has illustrated problems associated with each, meaning none can be declared the capital structure to implement (Denis, 2012). When deciding upon their capital structure choices, French and German firms have less concern regarding the price of their shares, thus opposing the market timing theory (Brounen et al., 2006). The findings by Alti (2006) note that for strong IPO bull markets, businesses that decide to list will provide a substantial amount of equity to the market, thus resulting in a decrease of debt ratios. However, once these firms become publicly listed, they will issue more debt in order to account for a large amount of equity sold, in order to raise their debt-to-equity ratios (Alti, 2006). This compares against the market timing theory, where firms sourced capital depending on market values and continued this trend, without any financial leverage target (Baker & Wurgler, 2002).

The market timing theory may not truly be implemented since firms that issue shares at a high value, would be expected to gather the return into their cash account, however, this is found not to occur and negates a key part of the hypothesis relating to the supply effect (Denis, 2012). Subsequently, the validity of this theory is under question as it expects to sell shares at a high value to capitalise on the timing and this finding does not support such an outcome. Another finding which demonstrates further issues with market timing is proposed by DeAngelo et al. (2010) whereby firms who have overvalued share prices do not issue equity, as managers may be aware of constantly selling overpriced shares to intelligent investors and thus may limit this practice. It is found that replacing ex-post earnings instead of analyst forecast earnings, produces similar results as the market timing theory, and this fixes the twin understanding of market timing (Elliott, Koëter-Kant, & Warr, 2008). Market timing can also be interpreted as existing by financing decisions relating to the market-to-book values of firms as often such firms will seek to limit the threat of bankruptcy by using equity instead of debt to fund investments(Hennessy & Whited, 2016). The firms follow the trade-off model without any market-timing adjustments and once they begin to generate a profit, the debt issuance will reduce due to issues regarding tax and shareholder returns (Hennessy & Whited, 2016). The results provide similar findings to that of Baker & Wurgler (2002) but without the combined equity issuances at ideal times, thus finding fault with the market timing theory (Hennessy & Whited, 2016).

3.2 Determinants of Capital Structure

A range of variables influences the implementation of financial sources that can inhibit or increase the total capital structure components. Whether certain capital structure theories are supported is a crucial aspect of how firms view and utilise their financing options. Firm characteristics will provide an insight into the capital structure make-up and what variables determine the finance method used. Research into this topic finds that asset tangibility, non-debt tax shield and profitability considerably influence the capital structure choice. However fixed assets, size, and growth in total assets are not imperative to financial options (Cortez & Susanto, 2012). Analysis has provided an insight into the entities that influence the use of debt, equity, or internal finance, and whether it is more than the cost of capital or availability. Harris & Raviv (1991) analyse this topic in detail and find that the size of the business, non-debt tax shields, opportunities for investment and fixed assets have a positive relationship with the use of debt.

On the other hand, key determinants, which decrease the debt value, consist of profitability, bankruptcy probability, volatility, product uniqueness and advertising expenses. Prior to this, the key determinants which influence capital structure decision entailed: firm size, growth, asset structure, profitability, the uniqueness of the product, volatility of earnings, industry type and non-debt tax shields (Titman & Wessels, 1988). The majority of these variables have remained key factors in the analysis of capital structure as discussed in the following findings. Initially, firm earnings, volatility, non-debt tax shields and financial distress costs were found to have a critical impact on the constitution of capital structure (Bradley, Jarrell, & Kim, 1984). Rajan & Zingales (1995) analysing both firm size and profitability, illustrate that debt has a harmful influence on profitability, and this impact magnifies as businesses grow. This is an interesting finding, as firms that become more profitable should find it financially easier to cover their liabilities. However, the costs and risks of debt may be too high even with tax advantages and very profitable firms may decrease their leverage.

Growth opportunities, liquidity and profitability, are key determinants of capital structure and have a negative impact on the use of debt, while the firm size has a partially positive influence on debt usage (Ozkan, 2001). Furthermore, tangibility, liquidity, firm size, growth opportunity, non-debt tax shield, earnings volatility, profitability and share price impact the level of debt usage in differing scales (Deesomsak et al., 2004). These findings provide a strong understanding that capital structure is not simply down to the availability of financing options and their respective costs, but significantly more details are enshrined in the decision. Asset structure, age, size profitability, growth and the industry are established key determinants that can affect the capital structure of SMEs (Hall et al., 2000). Examining SMEs' capital structure illustrates how many of the determinants are similar to large firms, although the impact may differ. The collateral prerequisite, firm size, intangible activity, age and the structure of ownership are key influences on the SMEs' capital structure (Ciarán Mac an Bhaird & Lucey, 2010).

The more recent analysis has suggested that different variables can have an important impact influence in selecting a suitable capital structure. Asset structure, firm size, growth opportunities, asset tangibility, profitability, inflation, the impact of tax shields, non-tax debt shields, tax rate and bankruptcy-related costs have been found to have an effect to varying degrees on the capital structure (Bayrakdaroglu, Ege, & Yazici, 2013; Chen, 2004; Kayo & Kimura, 2011). Reviewing previous research, it is synthesised that profitability, tangibility, growth opportunities, firm size and the industry are all critical characteristics of a business that influence it's capital structure (Chaudary & Guidi, 2012). By analysing the key determinants of capital structure, three specific types have been found to exist: the time, the specific firm characteristics and finally the country or industry (Kayo & Kimura, 2011). The most interesting concept about this analysis is that only firm characteristics can change depending on the company's actions unless they are drastic and move country or industry. Preceding research has discovered that the industry can have a significant role in the capital structure makeup (Goyal, Lehn, & Racic, 2002). Other findings illustrate that firm types and time have the largest effect on the capital structure, while the country and industry characteristics have a lesser influence. Indeed the industry has a limited impact on the book leverage value when analysing an incomplete model (Kayo & Kimura 2011). Furthermore, when researching capital structure on listed firms based in New Zealand; company size, industry, growth and profitability were all found to influence the financing decision (Fauzi et al., 2013). The industry is an interesting variable given that depending on the differences between the industries and firm types, it may or may not have an impact on the capital structure.

3.2.1 Profitability

If a company follows the pecking order theory, it is much easier for it to manage its' financial position as a financing hierarchy is promoted (Margaritis & Psillaki, 2010). Cotei & Farhat (2009) declare that equity is a final option and only used when no other financing opportunities exist. This is supported by Nawaz et al. (2011) who state that firms should aim for a high debt/equity ratio as it demonstrates an increase in financial performance. It is also revealed that companies should have a primary preference to finance new investments from retained earnings rather than issuing debt (Myers & Majluf, 1984). Equity can introduce share price and dividend complications for companies, which is not an issue if internal sources are used. Investors see investments without security issues as a signal for positivity coming from the company, whereas it is deemed bad news if the company must seek other sources (de Jong, Verbeek, & Verwijmerenet, 2010).

3.2.1.1 Negative Relationship with Debt

A large range of previous analysis has discovered that financial performance and debt have a negative relationship, with profitable firms retaining a small leverage level (Titman & Wessels, 1988; Harris & Raviv, 1991; Smith & Watts, 1992; Margaritis & Psillaki, 2010). This concept has garnered support whereby the debt ratio and gearing of businesses are negatively correlated with their profits (Fama & French, 2002; Frank & Goyal, 2003). Shareholders play an important role in a company, and so Carroll (1991) states that a company’s performance should encourage the maximisation of earnings per share thus generating wealth for the owners. Leary & Roberts (2010) confirm that less than 20 percent of firms adhere to the pecking order’s prediction for debt and equity patterns as profit maximisation has become even more important. Previous research points to a negative relationship with the use of debt and profitability, as often the most profitable businesses have been found to possess low levels of debt (Rajan & Zingales, 1995; Titman & Wessels, 1988). Profitability is a key component of the pecking order theory given that profitable firms will generate higher revenue and have a larger amount of retained earnings to utilise (Titman & Wessels, 1988). Under this structure, the higher the profitability, the less the debt used. There would be no necessity for debt financing given the continued presence of internal finance accounting for all business expenses and investments. While researching the determinants of capital structure, leverage displays a negative relationship with profitability (Booth et al., 2001). This result is supported by recent research that exemplifies how profitability is negatively related to the leverage ratio (Cole, 2013; Tsuji, 2013).

The negative relationship between debt and profitability is further expanded in research that is more recent. Analysis of SMEs within the same country throughout a five years finds that a reduction in both short term and long term debt is supported amongst profitable firms (Sogorb-Mira 2005). Debt levels are strongly associated with the volatility of a company's potential earnings, thus profitable firms tend to possess low leverage (Drobetz & Fix, 2005). This result seems to be significantly associated with debt. Further analysis concludes that firms which comprise low gearing as part of their capital structure have high profitability and this is entwined with another finding whereby the higher the leverage, the greater the likelihood of bankruptcy occurring (Bodie, Kane, & Marcus, 2008; Kayhan & Titman, 2007). Not only can debt impact the profitability for firms, but can also result in the downfall of a business, often at a quick pace. The issue of debt is legal since it is to be paid back in full consisting of both the principal and interest payments. This is taken into account in the analysis by de Jong, Verbeek, & Verwijmeren (2010) who find that debt leaves firms with large fiscal deficits. It is apparent to see why profitable firms will keep away from debt, since it is viewed as a financial resource not needed, due to the risks associated with it.

3.2.1.2 Positive Relationship with Debt

The relationship between capital structure and profitability may point to a strictly negative relationship, but previous analysis has suggested that a positive correlation can also exist. Debt finance can be viewed as the lesser of two unwanted options and so to finance new investments with strong positive NPVs, additional financing through external sources may be necessary. Cotei & Farhat (2009) support the use of debt, where they declare that equity is the last resort for a firm's capital structure. While it may seem that an inverse correlation exists between the use of debt and the generation of profits as the sole verdict, this is not the case in all research. As previously discussed, Modigliani & Miller (1963) find that a positive relationship between profitability and debt exists and that firms should use as much debt as possible allowing it to act as a tax shield. While this maximum debt theory is subjected to substantial criticism from a practical management viewpoint, given the threat of bankruptcy and risk, recent research has surfaced which supports the use of debt amongst profitable firms.

The results of such research may not be implemented, but it is supported by modern research as under favourable market conditions, debt can lead to higher net profits (Norvaisiene, 2012). It is intriguing to note that differences in the type of debt can have a varied impact on profits. The inclusion of short-term debt as a source of capital for firms has been found to have a positive correlation with financial performance as it improves profitability (Abor 2005; Salawu & Awolowo 2009). In the past few years, a trend has co-existed with the negative relationship previously analysed. Nawaz, Ali, & Naseem, (2011) discover that a high debt-to-equity ratio increases the firms' financial performance for large and listed firms. Çekrezi & Kukeli (2013) research a sample of non-listed small firms and find that short-term, long-term and total debt ratios have a positive correlation to the firms' return on equity (ROE). Thus providing evidence that debt can have a differing result on SMEs as well as large firms and illustrating the vast scope of research yet to be undertaken in this area. In essence, the financing options that profitable firms undertake is a topic not fully understood and given the contrasting findings that exist; more research should be undertaken.

3.2.2 Firm Size

Firm size has a key influence on capital structure (Rajan & Zingales, 1995; Titman & Wessels, 1988). Small firms have limited access to external sources of capital, such as debt, and so will make altered financing decisions due to their dissimilar issues when compared to large businesses (Ang, 1991) This belief that SMEs are more likely to have financing difficulties is supported (Engel & Stiebale, 2013). A contentious issue concerning determinants and capital structure involves the aspect of company size, as some authors believe it to be very important while others state it has no significance. A larger amount of uncertainty illustrates this lack of understanding and the risk involved with new firms compared to those which are older and established (Rosenbusch et al., 2013). This is to be expected as trepidation exists with start-up firms concerning whether their product or service will be successful. Support for the pecking order theory by larger firms is noted by Titman & Wessels (1988) where these firms will use long-term debt, while smaller businesses tend to use short-term debt but at a lower scale. This emphasises how larger firms are more likely to generate profits as extra financial burdens do not hamper growth.

Furthermore, younger firms possess a preference for long-term debt or private equity compared to medium term debt or venture capital funding (Gregory et al., 2005). Larger businesses in the mature stage of their life cycle will tend to have a positive correlation with the use of debt, and this provides support to the trade-off theory (Frank & Goyal, 2003). Once SMEs begin to grow, the ownership and management of these firms begin to divide, and this can result in a multifaceted situation when ensuring the business performs effectively (Schulz et al., 2001).

Small businesses tend to have lower debt levels due to the threat of financial difficulties associated with debt and how they may have a higher chance of being liquidated given their smaller size (Ozkan, 1996). In support of this, smaller firms will tend to produce fewer profits than larger firms, meaning the tax shield benefits of debt are less important for SMEs, meaning this attribute is not taken into account (Pettit & Singer, 1985). The total leverage amount is positively correlated with the size of the business and thus larger firms will utilise larger debt amounts (Harris & Raviv, 1991; Rajan & Zingales, 1995). Smaller firms lack economies of scale and often have higher interest rates which are a deterrent for debt use and under this finding, larger businesses are more open to utilising debt (Cassar, 2004). Contrary to this, when total assets are implemented to measure firm size, a negative correlation exists with leverage amongst private US businesses (Cole, 2013). The long-term debt ratio also decreases amongst listed firms in China as they grow (Chen, 2004).

Further research suggests that larger SMEs alter their capital structure by using different options of finance (Newman, Gunessee, & Hilton, 2012). These findings provide insight into the workings of firms, both large and small. When available, debt finance may be the cheaper option, but internal sources are often preferred, and smaller firms use less debt. Given the scale of expenses involved with new investments and projects, internal finance may not be enough to sustain a large firm in meeting optimal performance. Subsequently, for large businesses the pecking order theory is a more reliable theory to follow, as they tend to have a preference for debt instead of equity when internal finance is no longer viable (Helwege & Liang, 1996). The type of debt can also have a crucial role in the comprehension regarding the relationship of size and debt usage, as a one-year loan is significantly different to a twenty-year loan in terms of commitment and financial costs. Larger businesses favour a higher proportion of short-term debt compared to smaller businesses, and they obtain a lower valued amount of long-term debt. Therefore a relationship between larger firms and the total debt ratio is not found due to these results (Chung, 1993). A reason for this is suggested that due to low interest rates, large firms tend to have a positive relationship with short-term debt use (Fauzi, Basyith, & Idris, 2013). While a positive correlation exists amongst size and the debt ratio, the overall spectrum of this topic has more analysis to undertake. Subsequently, although larger firms may have better access to debt finance, once they reach a certain size, debt is less heavily utilised. The analysis of size as a determinant of capital structure portrays opposing results, which illustrates its importance for further investigation.

3.2.3 Firm Age

The age of the firm has an important role in determining the capital structure undertaken. While age effects all businesses only a select number of researchers have examined the impact of firm size, age and capital structure (Hogan, Hutson, & Drnevich, 2017). Results have suggested that the inability to obtain adequate financing exists for younger SMEs which are beginning to undertake research (Demirel & Parris, 2015). The issue of a funding gap has existed over a large time span and not been adequately fixed. Under the pecking order, theory firms should use financial slack, which contains retained earnings, as the primary source of finance and in relation to older firms, profits can be generated over a longer period and then retained (Myers & Majluf, 1984). This can result in debt having a lower likelihood of being utilised in the capital structure of older businesses. As firms grow older, banks are more willing to provide debt, while leverage also has a positive relationship with firm size(Petersen & Rajan, 1994).

Older businesses often find it easier to retain their earnings than younger ones, which can result in a negative relationship between debt and age under the pecking order theory(Berger & Udell, 1998; López-Gracia & Sogorb-Mira, 2008). In essence, over time firms can generate revenue that they can maintain, while younger firms often produce less revenue and so may need to use debt finance to fund all projects and investments. Contrary to these findings, a positive relationship between debt and age amongst firms is also prevalent. The age of the firm is positively related to the leverage ratio, which can occur due to a lower amount of information asymmetry in existence and a stronger track record in business (Haas & Peeters, 2006). An interesting point produced by Faulkender (2005) resonates with the belief that younger firms have less of a track record and are not as well known as their older and more experienced competitors. As firms become older, the market learn about their business and gather information meaning it can become easier to obtain external capital. This point is highly applicable for relatively new high-tech firms as information asymmetries are considerably associated with younger firms (P. Gompers & Lerner, 1999). In essence, firms that are new and a have limited presence in the market are less well known to investors and lenders. This often results in a greater risk existing in the provision of capital for such firms and to account for this risk; capital is less likely to be provided to younger businesses. Firms that have a record of accomplishment and demonstrate their survival for some years, often find it less complicated to gain external capital. Firms at the initial stage of development often have the most difficulties in obtaining finance, as proposed by Berger & Udell (1998) in the financial growth cycle framework whereby the capital structure of small firms can change due to firm age and size. This paradigm takes it key concept from the financial life-cycle model which is discussed by Weston & Brigham (1978) whereby different financial sources and issues arise throughout a firm's development. At the initial stage of an SME's lifecycle, internal finance is of critical importance to ensure that TBSFs remain financially viable (Ullah & Talyor, 2005).

Large information asymmetries tend to exist for SMEs, but their greatest impact is on high-tech SMEs, given their relationship with intangible assets and future growth opportunities (Berger & Udell, 1998). Support for a business cycle having a significant impact on the use of debt due to their growth and age is supported by (Akhtar, 2012). This research controls for the firm fixed effects and results in more prominent findings regarding leverage disparity due to changing business life cycles (Akhtar, 2012). Indeed, the research also finds that as firms age, some are content to remain non-listed and do not want to grow to the final stage of an IPO. An interesting aspect to note is that venture capital firms are willing to accept higher risk if the returns are substantial through the provision of capital to such firms (Berger & Udell, 1998). Subsequently, if the firms are unwilling to reach the IPO stage, it can negatively affect the likelihood of obtaining venture capital finance at any stage. If incorrect planning and non-implementation of a business plan occur during earlier stages, it can have a substantial negative impact. Such an issue can result in the closure of the firm due to a lack of adequate finance as young firms are more likely to have financial issues than older ones (Cressy, 2006).

Financial constraints are more apparent to be a burden for small high-tech firms, particularly for younger businesses (Westhead & Storey, 1997). The attainment of external finance is more difficult for young, innovative start-up, due to the risk involved in R&D and subsequent information asymmetries (Hall, 2002). Young high-tech firms are found to rely on personal financing (Bollingtoft et al. 2003). This of particular note for such firms operating during their initial year, with a large amount of owner finance employed (Coleman & Robb, 2011). Such a finding is rejected in another research paper, whereby new technology-based firms depend on external debt (Cassia & Minola, 2011). However, younger and unprofitable firms have been found to seek equity finance through venture capitalists (Minola & Giorgino, 2011). Age is an interesting insight into the capital structure of firms, particularly relevant to the high-tech and technology sectors given the prevalence of information asymmetries, lack of tangible assets and limited experience in the market.

3.2.4 Intangible Assets

Intangible assets are not easily valued and are often composed of the percentage of expenses on R&D and patents among others (Frank & Goyal, 2009; Michaelas et al., 1999). If successfully integrated it will often result in the creation of their specific market section and the future growth potential is hard to quantify (Clarysse, Heirman, & Degroof, 2003).

This can help explain the difficulty in accurate valuations. Funders do not want to be undervalued but possible investment candidates or lenders do not want to lose money, and this can lead to an impasse. Previous findings illustrate that banks will seek some collateral when providing loans to limit the risk involved (Berger & Udell, 1998; Cressy, 2002). An issue with intangible assets is that they provide limited value for collateral or none at all, which rings true with high-tech firms (Berger & Udell, 1998). This resonates with research which demonstrates how tangible assets can be used as collateral and so they have a positive correlation with long-term debt amongst firms (Fan, Titman, & Twite, 2012). Subsequently, TBSFs gain the majority of their value from intangible assets and growth opportunities which are difficult to value correctly or transfer, compared to tangible assets such as vehicles or land (Revest & Sapio, 2012). High-tech firms can be at a severe disadvantage in gaining external finance compared to other business sectors due to their limited tangible assets for use as collateral or valuations (Brierley, 2001).

A greater likelihood exists for intangible assets to lose their value in financial difficulties and these firms will use less debt than firms with substantial tangible assets (Myers 1984). When further analysing this, the use of less debt in the capital structure can be a hallmark of high worth businesses. This exists for large high-growth high-tech corporations such as Microsoft who employ equity over debt finance, despite possessing strong profits, due to their large quantity of intangible assets (Brearley et al., 2013). Intangible assets can become successful competitive advantages for firms, which can produce future sustainable returns (Hitt et al., 2001). This is the crucial reason behind their importance to many businesses, yet often they are not viewed similarly by possible investors or lenders, as tangible assets. Subsequently, intangible assets tend to be difficult to price given their volatile nature and how their value can quickly evaporate (Revest & Sapio, 2012). This can occur if competitors monetise or patent similar intangible assets or get to the market first and generate market share that would be hard to catch. Colombo & Grilli (2007) find that external debt can be a problem to attain for firms with a high percentage of intangibles due to a lack of tangible assets, such as machinery or land. Given this issue with the banks, businesses with a greater amount of intangible assets use less debt (Rajan & Zingales, 1995).

Businesses that spend a significant proportion of their expenses on R&D not only incorporate intangible assets, but this can also result in the importance of innovation to the businesses' strategy. When defining innovation in a practical context Arvanitis & Stucki (2013) declare that there are five distinct measures which can examine innovative processes in firms. Innovation can be shown to exist when: an extensively adjusted product comes on the market, new products are introduced, altered or original products are introduced, patent applications occur, and finally, if R&D is undertaken (Spyros Arvanitis & Stucki, 2013). This definition provides a wide range of variables, which leads to a greater understanding of what innovation is from a business perspective.

The intensity of R&D can be viewed as a proxy for intangible assets, but firms with larger intangible amounts have significant difficulty in obtaining debt (O'Brien, 2003). Highly innovative firms that possess higher leverage values but undertake considerable innovation will not perform well, as innovation and research can take a long time period to mature. Debt payments, however, are paid at specificed times such as as every month, until it has been completely repaid. In essence, debt can hamper innovation meaning that intangible assets will have a negative correlation with debt. Furthermore, intangible assets can produce extra information asymmetry between the owners and would be investors as the value can be ambiguous and the next steps of the business will not be fully provided. This reinforces prior findings in which problems gaining external finance are due to information asymmetries (Clarysse et al., 2003). Intangible assets tend to have a negative relationship with debt and leverage (Gompers & Lerner, 1999). This is sustained by Brown et al. (2009) who find that young high-tech businesses will utilise retained earnings as well as equity finance, but not debt, due to asymmetric information. Intangible assets can provide a competitive advantage which can result in high-tech firms having strong financial success and long-lasting business performance, if handled correctly (Hitt et al., 2001). This a critical reason why many high-tech SMEs will struggle with adequately financing themselves, but if done correctly, a sustained competitive advantage may be produced. Intangible assets may contain knowledge-based competitive advantages which produce significant firm value via future growth opportunities (Barney, 1991).

3.2.5 Growth Opportunities

Myers (1977) previously discussed how high-growth firms might not use equity financing for new investments if they have previously issued debt. These businesses may not follow up on the investment, as the wealth generated will be provided to the creditors. Subsequently, the threat of bankruptcy is more apparent due to the risks involved with growth opportunities, resulting in equity being used for finance (Myers, 1977). Growth opportunities promote the firms' objectives to become entrants in new markets, gain and improve market share in current markets, or the engagement in the promotion of their diversified products (Engel & Stiebale, 2013). In addition to this, Engel & Stiebale (2013) find that when firms are expanding, they will often meet financing difficulties while in possession of growth opportunities. Myers (2001) supports the belief that growth opportunities combined with assets and cash flow all play a crucial role in the value of a business. Accordingly, the implementation of an adequate financing strategy is crucial for firms to meet their potential and ensure that financial options do not inhibit growth.

3.2.5.1 Negative Relationship with Debt

Businesses that possess growth opportunities will often take on greater risks, and this results in issues in gaining debt finance due to the threat of bankruptcy. It can be further compounded by the intangible nature of growth opportunities, meaning they will have to use equity as an external source, thus lowering the leverage (Myers, 1977). SMEs' ability to cultivate growth opportunities to their maximum potential can be restrained by the impact of information asymmetry and the fear of losing control of the business (Bertoni, Ferrer, & Pollon, 2010). It is proposed that although growth opportunities are assets that provide value to businesses, in essence, they do not produce revenue in their current state. Furthermore, they are often strictly attached to that particular business and cannot be used as collateral due to their intangible characteristics (Titman & Wessels, 1988). The proxy for growth opportunities utilised by Michaelas et al. (1999) implements the proportion of a firm's intangible assets compared to totals assets. The negative relationship between debt and growth opportunities amongst firms has support from previous findings (Rajan & Zingales, 1995; Booth et al., 2001). The unobserved growth opportunities can be represented by the R&D expenses, and thus a negative association exists between growth opportunities and market leverage. R&D expenses are used to signal unobserved growth opportunities and firms with higher debt levels will tend to have zero of these expenses (Fama & French, 2002). In their paper which encapsulates industry, country, firm type and time analysis, Kayo & Kimura (2011) reinforce prior findings which provide analysis regarding the growth opportunities' negative impact on the debt ratio. This negative relationship between companies with high-growth and leverage has been found throughout the years.

3.2.5.2 Positive Relationship with Debt

As per previous research, similar findings exist for SMEs and growth which have a negative effect on debt ratios (López-Gracia & Sogorb-Mira, 2008). However, debt is not always found to have a negative correlation with growth opportunities, as small firms who are associated with innovating were discovered to possess larger debt levels (Acs & Isberg, 1996). Further evidence of this positive relationship is developed when Sogorb-Mira (2005) disseminates that growth opportunities attract particularly long-term assets, consequently the debt maturity is similar. More recent research also points to a possible positive relationship and not the negative one that has been disseminated. A positive relationship between leverage and growth opportunities are found by Bayrakdaroglu, Ege, & Yazic (2013). R&D can be a marker for innovation, although it can create information asymmetries according to the pecking order theory, where internal finance should be the primary finance option. Small firms with significant growth rates often need additional financing sources than internal finance to satisfy their capital need, resulting in the existence of a positive relationship for both past growth and future growth with the gearing level (Michaelas, Chittenden, & Poutziouris, 1999). This provides support to the pecking order theory. Due to the inability of high-growth firms to satisfy their financing by internal measures, they have been found to utilise short-term debt to account for any gaps, thus further maintaining the pecking order theory. High-growth business companies continuously utilise lower debt in their capital structure (Bradley, Jarrell, & Kim, 1984; Smith & Watts, 1992; Barclay et al., 2006), while other results have proposed that growth opportunities are financed with debt (Huang & Ritter, 2009). Therefore, given the differing results, it is a topic not fully understood and is open for further examination to analyse the relationship.

3.2.6 Patents

An interesting aspect of patents is that they are only issued when novel technology can be displayed by firms who can illustrate that they legally own the technology involved (Levitas & McFaydan, 2009). Subsequently, patents may be viewed as a signal that firms can take an innovative idea and generate a useful technology (Levitas & McFaydan, 2009). Businesses which are predominately based on world-leading technology and innovation which export will have a strong application for patents (Salomon & Jin, 2010). Patents can have a significant benefit for SMEs involved in R&D as the signals it can provide will instigate venture capital firms to invest and also gain customers, knowing that their work has legal protection (Holgersson, 2013). Therefore, patents can be of particular importance for high-tech SMEs given the nature of their sector and the level of intangible assets.

When firms invest in protecting their intellectual property through patents, this is viewed as a signal of high quality and significant market value of innovative products, providing a positive scenario for venture capital investments (Hsu & Ziedonis, 2013). However, the use of patents amongst SMEs may put these firms at a disadvantage given the significant costs involved in protecting their intellectual property (IP) (Blackburn, 2003). Patents are deemed to be a signal of quality whereby firms will have improvements to trade (Hsu & Ziedonis, 2013). This is backed by research which demonstrates how exports have a strong, positive correlation with patent applications (MacGarvie, 2006). Businesses, which gain more patents for their work when they export, will be provided with extra chances to innovate. Patents can be utilised to not only protect intellectual properties but also as a signal to obtain remuneration and assistance in the future (Long, 2002). Subsequently, the value of the firm often increases due to the signals from patents (Levitas & McFaydan, 2009).

Patents can help remove risks associated with firm ambiguity and allows SMEs to obtain external finance, in particular, venture capital funding and also government grants (Demirel & Parris, 2015). Signals are often provided by patents that increase the firm's knowledge of the market which results in a lower cost of capital and fewer liquidity needs for the firm (Levitas & McFaydan, 2009). There is lower use of debt finance by businesses involved in R&D that utilise rights such as patents to signal their growth opportunities (Coleman, Cotei, & Farhat, 2014). Patents and patent applications can signal the ability of start-ups to secure profits from innovative means to external investors (Audretsch, Bönte, & Mahagaonkar, 2012). Furthermore, such firms can increase their likelihood to gain equity finance if they can signal the feasibility of the project through prototypes combined with patents (Audretsch, Bönte, & Mahagaonkar, 2012). This finding is supported by Gompers & Lerner (2001) who reaffirm patents may not be as valuable by themselves when seeking external funding and only possess sufficient value when merged with other assets.

3.2.7 Human Capital

When analysing new ventures, it was found that better experience at this level allows the firms to gain adequate finance and improved valuations from venture capitalists (Hsu, 2004). SMEs are often found to possess limited resources such as capital and knowledge and are more susceptible to damaging changes in the market (Buckley, 1989). Shepherd & Zacharakis (1999) review the previous literature and conclude that venture capital firms have a greater appetite to invest in businesses that can demonstrate more skilled and capable founder. However, venture capital firms may not have strong evaluation skills and tend to reject a large proportion of investments, as they greatly miscalculate any dire signs from such firms (Zacharakis & Shepherd, 2001b). Within start-ups, an over demand for loans can occur due to an increase in human capital, but this does not mean that a greater supply will occur (Grilli, 2005). The amount of capital involved can thus be generated from retained earnings if the debt is hard to access. Entrepreneurial recycling can occur in which entrepreneurs who sold a firm previously, now use the experience and wealth towards new ventures or investments (Mason & Harrison, 2006). The experience of the founder can have a positive relationship with an IPO as a key objective for a firm (DeTienne & Cardon, 2012).

The experience of working on previous start-ups can substantially influence the objectives of the firm (Westhead et al., 2003; Westhead, Wright, & Ucbasaran, 2001). When seeking to improve their skill set, SMEs are depicted as facing a litany of challenges such as a lack of training opportunities, the inadequate access to finance and the current culture (Lange et al., 2000). The importance of start-up experience should not be underestimated and can have a significant impact on the firms in question due to acquired knowledge (Bandura, 1986; Davidsson, Low, & Wright, 2001). The founders of NTBFs are often not natural leaders with business backgrounds but instead technically gifted. High-tech firms can create new jobs, and also change technology in daily use, therefore having a significant influence on the future (Bartelsman, Haltiwanger, & Scarpetta, 2004). The actual business idea behind many NTBFs can be very technical and often hard to understand which produces another layer of information asymmetry (Hogan & Hutson, 2005). This can put these firms at a disadvantage when seeking capital, and until banks and investors understand the NTBF industries and their business plans better, this is likely to remain the same. However, growth can be determined by the founder's technical work experience, particularly when it relates to entrepreneurial knowledge (Colombo & Grilli, 2005). Indeed, human capital is critical when analysing the important issues of goals and financing (Chandler & Hanks, 1998; Watson, Hogarth-Scott, & Wilson, 1998). Experience would synthesise into knowing when to sell the firm or knowing when to hold out in the long term. Venture capitalists and angel financers can have considerable difficulty evaluating these firms, which also limits the available capital (Brierley, 2001). Subsequently, new jobs, goal completion and technical change can only become a reality if NTBFs are allocated adequate capital from key stakeholders in the financial markets (Aoki & Dosi, 1992).

3.3 High-Tech SMEs and Capital Structure

3.3.1 Signalling Theories and SMEs

The theory of finance was produced with no distinctions regarding size and discussions focused on larger firms (Ang, 1991). Furthermore, theinteresting point is that capital structure theories exist based on businesses, but do not take into account the differences and issues that exist for small firms compared to larger businesses (Michaelas, Chittenden, & Poutziouris, 1999). The issue of larger asymmetric information is often pinpointed as the key reason that SMEs are unable to gain adequate financing due to their problem with providing reliable signals, which are of critical importance (Berger & Udell, 1998; Carpentier & Suret, 2006; Engel & Stiebale, 2013). If inadequate funding exists, a higher proportion of smaller rather than larger business will seek to obtain debt finance, due to the issue of information asymmetries associated with equity financing and undervaluation (Graham & Harvey, 2001). When investigating the capital structure of start-ups and new firms it is declared that their track record will provide significant signals with their future outlooks to investors and lenders, specifically banks, but new firms which survive will likely grow through the use of their retained earnings (Brito & Mello, 1995; Cassar, 2004). A firm's survival rate can signal whether a firm could successfully take on debt finance as banks learn more about them and their level of risk. Sales growth has been used as a proxy for agency problems related to debt for non-listed firms throughout the literature due to the unavailability of the book-to-market firm values, as past growth can signal future growth (Hol & Wijst, 2008).

Private firms do not have to issue information to stakeholders like publicly listed firms and so the information asymmetries of such businesses, mainly SMEs, can limit the ability to gain external finance as their signals are more unreliable (Ang, 1992). The agency costs effects are rejected for all financing decisions by non-listed firms (Hol & Wijst, 2008), which supports previous findings by Scherr & Hulburt (2001) who find that for small and also unlisted firms the agency effect is not supported. Concern about the models used in the signalling theory as discussed by Ross (1977) is that they do not account for small firms and their financing abilities, as often the manager owns some proportion of the business. Therefore, the issues of management compensation about firm value and risk aversion are of significant importance (Ross, 1977). This is supported by Graham & Harvey (2001) who state that private smaller firms are affected more by information asymmetries, will not use debt as a signalling mechanism and do not issue new shares to portray market signals. Due to the large information discrepancies, small, high-growth businesses frequently must accept any external source of capital offered, meaning that when firms issue equity, it should be less of a negative signal compared to other businesses (Lemmon & Zender, 2010).

3.3.2 Technology Firms, High-Growth Firms and Signalling Theories

Both Ross (1977) and Leland & Pyle (1977) claim that an increase in equity results in a decrease in firm value and so by default an increase in leverage can improve the value through signalling. Under the signalling theory, high-growth firms encapsulate higher quality businesses and should seek to use debt finance as information asymmetries are strong; thus equity may be undervalued. However, the literature does not illustrate an agreed upon definition of quality through the use of variables (Smith & Watts, 1992).

This is an interesting approach but may not correlate with high-tech SMEs given the nature of the firms and their difficulty in obtaining capital sources. There is a high dependency on internal funding by European TBSFS for new projects, due to information asymmetries with the market as firms prefer to keep their information private regarding innovation and research (Bhattacharya & Ritter, 1983; Revest & Sapio, 2012). Small, high-growth businesses must deal with information asymmetry issues, but these firms will have a greater probability to produce considerable cash flows (Lemmon & Zender, 2010). The majority of investments produced by innovative small businesses involve assets that are not suitable as collateral, given their intangible knowledge, meaning they struggle to signal their lower risk (Demirel & Parris, 2015).

TBSFs often have information asymmetries between the managers and the market since R&D projects and their output are hard to monitor, the firms are only in existence a short time, and the task is often too technical for financial stakeholders to comprehend (Revest & Sapio, 2012). This is supported by Coleman & Robb (2012) who illustrate that for new technology firms, due to a large amount of information asymmetry, investors will view other information in making their decision. Such information consists of previous work experience, credit ratings, education and prior experience with start-ups as key signals of quality regarding the founder and the firm (Coleman & Robb, 2012; Robb & Coleman, 2010). Signals such as credit rating, patents, trademarks, copyrights, endorsements and VC funding often illustrate high quality to investors for NTBFs and thus improve the ability to obtain complementary external assets and gain traction with customers (Grilli & Murtinu, 2014; Robb & Coleman, 2010)

A consequence of NTBFs gaining funding from venture capitalists is that it produces a positive signal about the possibility of working on joint ventures with other businesses and using their resources (Colombo, Grilli, & Piva, 2006). When VCs finance TBSFs it is a signal of high-quality and can diminish insider information (Revest & Sapio, 2012). When firms gain VC funding their employees gain valuable knowledge and experience while the firm integrates corporate governance policies for monitoring as part of the contract (Revest & Sapio, 2012). The use of incubators can signal the firm quality to outside stakeholders (Colombo & Grilli, 2006). When NTBFs obtain sufficient capital, this will provide positive signals to future employees regarding future success allowing firms to gain capable employees while reducing issues associated with new businesses (Brinckmann, Salomo, & Gemuenden, 2011). When surveying high-tech firms, 70 percent of their founders would issue equity because they believe it signals a strong positive future outlook (Hogan & Hutson, 2008). 50 percent of the firms believe debt does not actually provide a positive signal and just 21 percent believe debt is a positive signal (Hogan & Hutson, 2008). For technology firms listed on public stock markets after an IPO, if they issue additional equity, this can signal negative news to investors meaning they will use internal finance more often (Carpenter & Petersen, 2002). Contrary to this, while firms involved in R&D possess larger amounts of information asymmetry, Alam & Walton (1995) finds that they will have a greater probability of obtaining external finance. The issue of R&D information asymmetry is significant.

3.3.3 Market Timing Theory for SMEs and Industry Types

While the theory of market timing has been discussed previously, it is first demonstrated by Baker & Wurgler (2002) that it has a significant impact on the financing choices and overall capital structure on publicly listed firms (Luigi & Sorin, 2009). The research does not make any discovery regarding private firms, of which SMEs are an extremely large component. This point is supported by Brounen, de Jong, & Koedijk (2006) whereby market timing is found to be a strategy incorporated by public firms in order to obtain the maximum value regarding when to issue new shares but does not suggest any finding for private businesses.

Under the market-timing theory proposed by Baker & Wurgler (2002), it is suggested that firms issue equity when overvalued and repurchase shares or issue debt when undervalued. However, an issue with this finding is its generality does not account for smaller firms that may have difficulty gaining finance and larger firms who may have ample finance (Akhtar, 2012). Therefore, this insight provides further barriers in relating this to private SMEs as a capital structure theory to implement. Although small, high-growth firms are predicted to time the issuance of shares easier, they are found to be quite rigid on their ability to select such in comparison to older businesses due to their growth rates (Lemmon & Zender, 2010). A misvaluation can occur on a greater scale with IPOs, and this is an ideal topic with which to analyse market timing (Alti, 2006). This process is not an option for private firms unless undertaking an IPO and thus illustrates the different relevance capital structure theories can have on private and listed firms. The external finance sources raised by younger and smaller businesses have a lower impact on capital structure changes (Frank & Goyal, 2003).

While the relevance of market timing appears to exist more for publicly listed firms, the importance of the theory in different industries is still under discussion. The capital structure for R&D intensive listed firms is suggested to be highly susceptible to market changes since these businesses possess large amounts of asymmetric information and so misvaluations are more apparent (Blazenko, 1987). However, in the more recent analysis, the industry is found to have no relevance to market timing theory unless there is a correlation between the share price valuations within a specific industry (Frank & Goyal, 2009).

3.3.4 Modified High-Tech Pecking Order Theory

Younger firms, smaller firms and those with large R&D activity often do not apply for bank debt. Further analysis finds that technology-based firms utilise a different financing pattern to firms in other sectors; larger capital amounts are raised, particularly for strong growth firms. Younger and unprofitable technology-based firms often seek to obtain venture capital financing (Minola & Giorgino, 2011). This is reinforced by further analysis where TBSFs have a higher usage of equity finance and lower amount of owner capital and debt finance (Coleman & Robb, 2012). When investigating Irish software SMEs, these firms tended to utilise equity instead of debt finance (Hogan & Hutson 2005). Fama & French (2002) discover a negative relationship exists between leverage and high-growth firms during the first year of business as profitability is negatively correlated with gearing levels. Indeed, high-tech firms use internal sources first and then eventually move onto external finance. In support of this, high-tech start-ups employ a modified version of the pecking order theory with equity as the second finance source, rather than debt (Minola, Cassia, & Criaco, 2013). A key reason is to disassociate them from the threat of bankruptcy and instead use equity even given the issues involving information asymmetry as previously discussed (Minola, Cassia, & Criaco, 2013). When high-tech SMEs use venture capital, they judge debt as the last choice of finance given the uncertainty amongst debt providers (Serrasqueiro, Nunes, & da Rocha Armada, 2014). There is support for the modified pecking order theory as NTBFs obtain six times less debt than equity, suggesting an issue of credit rationing exists (Colombo & Grilli 2007). These findings illustrate a variant of the pecking order theory for high-tech SMEs whereby; internal finance is favoured first rather than equity and finally, debt is sought as a last resort.

Support for the modified high-tech pecking order theory exists since NTBFs implement equity finance over debt due to the limited availability of debt financing (Cosh, Cumming, & Hughes, 2009). NTBFs prefer internal sources of finance, and then equity and then finally debt as the concluding source, but only a limited amount of such firms take on any debt. This is due to the information asymmetries existing with banks and to a lesser degree with VC firms that purchase equity (Hogan & Hutson, 2005). Further support of this modified pecking order theory resonates with the issue of technological uncertainty, market uncertainty and information asymmetry (Serrasqueiro et al., 2014). Subsequently, equity financing is a significant source of capital for technology-based firms, particularly those with older entrepreneurs that have previous experience in founding firms (Minola et al., 2013). NTBFs with previous VC investment have a better likelihood of gaining external capital than those without (Vanacker, Heughebaert, & Manigart, 2014). Analysis of strong growth firms and those which possess patents have declared that they use more equity than debt (Coleman, Cotei, & Farhat, 2014). The investigations can thus theorise how the capital structure of high-tech SMEs differ from other sectors and that while they may follow the pecking order theory, it must be adjusted to suit their circumstances.

3.3.5 The Financing of Innovation

While many businesses can be innovative, there is no guarantee that this innovation will lead to improved profits. Indeed, innovation and growth can have an unusual relationship; innovation is not the sole path to success, but it has critical significance on some fast-growth firms, yet for the majority of businesses, the role of innovation is not significant (Coad, 2009). It is best summarised by Lee, Sameen, & Cowling (2015) who elucidate that in practice most innovative investments provide only a small return, while just a few produce truly significant yields. Often the innovative firms generate the largest market share in their respective industries and become the major force (Gompers & Lerner, 2001). Whether firms can achieve sustainable profitability by introducing a new idea straight away or if they follow, a more gradual innovative plan is a key strategic issue. This staggered, second option is supported by Barwise & Meehan (2011) whereby a measured plan of introducing innovation involves companies deviating away from the norm over a longer time period.

The implementation of innovation primarily adheres to adequately providing for resources such as expenses, staff and time. Only when these are catered for can businesses create products and generate revenue (Brophy & Shulman, 1993). Innovation is often related to R&D which places large financial burdens on high-tech SMEs due to substantial fixed costs and a lack of available finance, which can halt innovation for smaller businesses (Hoffman et al., 1998; Symeonidis, 1996). Given the nature and importance of innovation, it is often found that internal sources of finance are not adequate and so they must seek external capital to reach their full potential in the commercial market and meet their goals and objectives (Beck & Demirguc-Kunt, 2006; Schneider & Veugelers, 2010). One of the main reason why information asymmetry exists for innovative businesses is that firms that concentrate on R&D are unlikely to divulge many details on their innovative ideas and projects (Bhattacharya & Ritter, 1983). This leads to a decreased likelihood that firms will receive capital from external sources.

Due to limited financial resources, pioneering businesses must forge ahead with a sole objective of producing an innovative product. However, a substantial risk is apparent given their size and unlikelihood to sell less innovative products which could reduce this risk (Giudici & Paleari, 2000). Innovation awareness is important as the businesses that often receive less finance are innovative, while the country they are based in can have an impact on SMEs (Freel 2007; Mason & Pierrakis 2013).

3.3.5.1 Venture Capital Finance

Venture capital is a preferred option over debt, particularly when entrepreneurs have limited productivity and the venture capitalists will provide a positive input to them (de Bettignies & Brander, 2007). VC firms play a substantial role in the financing of early-stage innovative firms, with a positive relationship developing, and further capital being invested as more information becomes available (Hellmann & Puri, 2002). It is imperative to ensure a focus remains on the strength of the economy, especially for external financing sources. Paik & Woo (2014) illustrate how a slump in the economy can instigate venture capital firms to prioritise investing in both older stage businesses within the industrial and agriculture sectors and also early-stage financial firms. However, a strong economy provides a greater supply of capital and thus, venture capital firms favour investing in early-stage firms. In essence, venture capital firms will seek to minimise their risk in times of economic turmoil when there is less opportunity for return. Findings in previous studies suggest that closing the information deficit between start-up firms and venture capitalists is imperative for these firms to gain such funding (Paik & Woo, 2014).

3.3.5.2 Public Finance and Government Grants

Another source of external financing which TBSFs can apply for is through government grants and loans, which often have more favourable rates and conditions than private lenders or investors. Public finance can fix funding gaps, provide capital to high-tech SMEs such as NTBFs and remove the dependence on internal finance, providing such businesses with growth opportunities (Colombo, Croce, & Guerini, 2012; Czarnitzki, 2006). Public finance can have a crucial effect regarding the performance of high-tech firms in their early years, but mainly for firms that have a high probability of becoming successful (Lach, 2002). In relation to grants, the majority succesfuk firms are often less innovative, safer businesses. The most innovative businesses, therefore, waste scarce resources, such as time and workforce, unsuccessfully searching for and applying for such capital (Schneider & Veugelers, 2010).

Governments throughout the world have different policies regarding grants, and so a firm's location is important in their ability to obtain government finance (Colombo, Croce,

& Guerini, 2012). The financial market is not perfect and sometimes certain sectors or industries are not provided with adequate capital to grow. Subsequently, public finance is viewed as a necessary stopgap to support these high-tech firms. A key reason why this is necessary is the Horizon 2020 report which notes that in regions such as Europe, the high-tech sector is lacking a sufficient amount of high-growth innovative businesses (European Commission, 2011). NTBFs can play a significant role in economic improvement and the creation of significant modern jobs to economies emphasising their importance for both the present and the future since they can possess new technologies which people can use for many years to come (Audretsch, 1995; Storey & Tether, 1998). Highly innovative firms can produce the largest level of success, but the risk involved and substantial capital requirements can result in government grants not fully supporting these businesses unless specifically adjusted and informed about their capital needs (Mason & Brown, 2013; Wallsten, 2000). This, in turn, adds an extra layer of intrigue to the funding conundrum that many innovative businesses must address.

3.3.5.3 Information Asymmetry

Two key problems which most start-ups deal with relates to their vulnerability due to information asymmetry and the issue of collateral (Binks & Ennew, 1996). NTBFs can have significant problems gaining adequate finance, due to the lack of physical, tangible assets that can be used as security; (Robb & Coleman, 2010). Information asymmetry can occur when the founders of the business have greater information than outside stakeholders. Subsequently, problems become apparent when these firms begin seeking external capital, demonstrating that the issue of information asymmetries can be crucial in understanding financing gaps (Stiglitz & Weiss 1981). A variety of informational asymmetries can affect the financing of start-ups and entrepreneurial businesses (Hall & Lerner, 2010). Many investors would be wary of investing in start-ups due to a limited track record and lack of credentials from which they can assess the business, thus increasing the perceived level of risk (Hall, 2002). Initial asymmetric information creates a moral hazard selection problem for banks where they charge high rates initially and reduce rates in later periods after the borrower types are revealed (Petersen & Rajan, 1994). These firms embody new future technologies, and so their overall business model is riskier than most firms are unlikely to provide critical information for fear would-be competitors copy their ideas and get to the market first. Such financing difficulties exist for NTBFs and are often exacerbated by the information asymmetry issues associated with technology businesses (Carpenter & Petersen, 2002). Due to the greater level of risk for investors and lenders to provide, capital to firms of which little is known, thus, they are averse to such a selection. Support exists for this finding via a stronger rejection rate in smaller firms which are seeking loans and thus this issue may need to be addressed by firms for successful applications (Riding et al., 2012). Many factors are key to gaining adequate capital such as competitive advantage, significant projected growth figures and also an owners ability to pay back any loans (Coleman & Robb, 2012). These three components combined offer outside investors a sense of whether the business is valued properly and help remove some of the information asymmetry associated with investing in high-tech firms (Coleman & Robb, 2012).

3.3.6 The Financing of High-Tech SMEs

There is a high demand for capital during the initial stages for high-tech businesses (Giudici & Paleari, 2000). However, for high-tech firms, particularly smaller firms, obtaining external capital through both debt and equity paths remains an obstacle which is intensified by those heavily involved in R&D (North, Baldock, & Ullah, 2013). Further support for this declares that start-up technology firms have unique and unusual features which hamper the availability of financing opportunities (Hogan & Hutson, 2005). High-tech firms like other businesses also have a lifecycle but it is not the same as in other sectors, particularly regarding the aspect of capital (Berger & Udell, 1998). An issue which is also important for young high-tech firms, when discussing the cost of capital, is the transaction costs for both debt and equity, which are higher for smaller firms (Titman & Wessels, 1988). For many firms, it can have a decisive role in the capital sources used by them as extra costs could build up and eventually prove detrimental to the business. It is typically the case that research which focused on high-tech firms favour other forms of financing rather than bank debt, while firms looking to grow are open to utilising venture capital (Minola & Giorgino, 2011).

Marketing and R&D are key components of any successful high-tech business and must be financed adequately (Giudici & Paleari, 2000). If a high-tech business does not possess enough capital to support either of these functions, they are unlikely to succeed. The issue of whether firms in the high-tech sector can source debt finance comparable to other industries is also a contentious subject and is found to be a problem due to a lack of tangible assets (Colombo & Grilli, 2007). Banks are not able to provide sufficient finance to innovative high-tech SMEs, particularly those that are young (Gompers & Lerner, 2001). This can relate to the issue of collateral, whereby banks will often seek collateral before they agree to provide finance (Thorne, 1989). A requirement of external capital is an issue which is faced by many start-ups and can result in a lack of adequate finance available for them (Angelini & Generale, 2008). Rosenbusch et al. (2013) support the belief in which they declare younger businesses can be insecure and less confident leading them to be a larger risk for investors. This may be the case, but there is also the chance for large growth in shorter periods for start-ups. Financial barriers to entry are a huge obstacle for SMEs within the high-tech sector and often results in a time delay between initial R&D and bringing the product to market (Geroski, 1995). Caves (1998) shows that smaller businesses grow quicker than bigger and older firms do, yet these firms have a better chance at survival than smaller ones. High-tech SMEs, in particular, NTBFs utilise a high amount of owner financing although those with strong credit ratings can raise debt easier (Coleman & Robb, 2011). Additionally, high-growth companies have been found to possess considerable profitability rates if they became successful without the use of any external sources of capital (Sexton & Marion, 2000). The combination of these findings exemplifies that further research is required for high-tech capital structures. Subsequently, when compared to SMEs within varied industries, the capital structure of NTBFs is quite different.

3.3.6.1 High-Tech Firm Finance and Growth Opportunities

The capital structure of high-tech firms are found to have a small amount of debt in comparison to firms within other industries, a key reason for this is due to the impact of growth opportunities (Castro, Tascón, & Amor-Tapia, 2015). The principle of agency theory, whereby management looks after themselves primarily and not shareholders, with limited growth opportunities and more mature industries will possess a high debt level (Romano, Tanewski, & Smyrnios, 2000). Contrary to this, it is suggested that high-tech firms can draw upon both debt and equity finance during their start-up year and throughout their lifespan due to their future growth potential (Audretsch & Lehmann, 2004; Coleman & Robb, 2012). All firms have the potential to maximise their returns from growth opportunies when they are based in developed countries with adequate financial markets (Denis, 2004). As opposed to SMEs in other sectors, high-tech SMEs do not lower their debt ratio when in possession of strong growth opportunities or increase it when tax rates are high. This surmounts to a suggestion that high-tech SMEs do not have an interest in obtaining a target debt ratio compared to other SMEs (Serrasqueiro, Nunes, & da Rocha Armada, 2014). Furthermore, they discover that better growth opportunities are positively associated with high-tech SMEs utilising debt. Growth opportunities for NTBFs are of most benefit when combined with strong management skills and a large financial repertoire to reach peak potential, but, this is a rare occurrence (Colombo & Grilli, 2005).

3.3.6.2 NTBFs and Financing Issues

According to Rickne & Jacobsson (1999) NTBFs create a competitive advantage due to the knowledge of their employees involved in engineering, science or medicine, which can then be created into products or services and sold. Some noteworthy analysis undertaken illustrates how firms may not obtain their preferred capital size at the initial stage due to financing constraints (Cabral & Mata, 2003). The ability and likelihood to obtain differing financial sources are critical to NTBFs within the UK (Minola, Minshall, & Giorgino, 2008) Other research has focused on the importance of debt during the initial stages of the high-tech SME's lifespan (Coleman & Robb, 2012; Minola & Giorgino, 2011). There has been little research undertaken on the relationship between NTBFs and their capital structure choices (Coleman & Robb, 2012). This limited research suggests a strongly held belief that such businesses can have a positive impact on society and the economy, but the issue of fund allocation remains due to the failure of governments to act accordingly (Schneider & Veugelers, 2010).

The threat of bankruptcy from debt and the limited tangible assets they possess hinders their equity and debt position (Revest & Sapio, 2012). Therefore ensuring they possess enough finance can be a challenge for management. Changes in the economy are more likely to affect smaller firms. Regarding NTBFs, negative changes in the markets can have detrimental effects, primarily due to information asymmetries and their lack of collateral (Denis, 2004). There is also the understanding that these industries which NTBFs are focused on are all uniformly subject to particular attributes such as the impact of new technology, huge competitive rivalry, future uncertainty and the stream of new entrepreneurs (Preece, Miles, & Baetz, 1999). In essence, most NTBFs cannot afford to slow down, as there is always something bigger or better on the horizon to which they must be able to react. This is different from more established industries; for example, banking, which took some time to introduce banking apps for smartphones. To ensure they are not left behind in these high-tech industries, NTBFs can react rapidly and initiate changes both from a business and an organisational perspective (Laamanen & Autio, 1996). To further expand on this lack of discordant literature, Minola et al. (2013) reveal how NTBFs often have greater accessibility and preference for the use of equity instead of debt finance.

3.3.6.3 TBSFs

A key issue regarding TBSFs is that the majority of their value is not derived from tangible assets, such as machinery or factories, but instead from growth opportunities and intangible assets which are not easy to move to different companies or even sell at all (Revest & Sapio, 2012). This can prove to be difficult when seeking external finance (Brierley, 2001). As discussed, intangible assets are notoriously difficult to price, and when a high-tech business is forced to stop operations, their value evaporates at an alarming rate (Revest & Sapio, 2012). TBSFs often face the largest problems in gaining access to sources of external finance due to information asymmetries such as calculating a correct valuation of their intangible assets and both the strength and likelihood of future growth (Clarysse et al., 2003). Businesses which have a higher amount of tangible assets will borrow more under the trade-off theory, while those with a greater amount of intangible assets will use less debt (Rajan & Zingales, 1995). Subsequently, a negative relationship between the use of debt finance and the likely high growth opportunities of a business may well exist (M.J. Barclay et al., 2006). Intangible assets, while not useful when seeking external finance, prove to be indispensable for the success of a high-tech firm due to their rarity and can prove to be a distinct competitive advantage for such firms who utilise them accordingly (Hitt et al., 2001)

3.3.6.4 Impact of the Recession

Since the dot-com crash, there has been noted trading closures such as the European Association of Securities Dealers Automated Quotation (EASDAQ), due to limited support for investing in these high-tech firms in key European economies (Revest & Sapio, 2012). The majority of high-tech firms now seek a listing on the National Association of Securities Dealers Automated Quotation (NASDAQ), which is the forefront for technology company listings. A key issue with IPOs is the possibility that over time larger firms will generate larger expenses. However, the firm may still utilise retained earnings for the majority of its financing needs (Carpenter & Petersen, 2002). A problem in gaining adequate finance has existed before the global financial crisis for small businesses in the technology sector, but the gap has worsened since the crisis (North et al., 2013)(North et al., 2013)(North et al., 2013). When external capital options were available, the legal obligations were often too intolerable and thus not accepted. This results in the negative impact on the future growth of TBSFs, illustrating the significance of available financial sources for early-stage businesses. Young technology firms frequently find it more costly to utilise external capital than internal (Akerlof, 1970). This is expected as investors and banks were severely affected by the financial crisis, meaning they are now seeking the highest returns with the lowest available risk if any risk at all. It is neither marketing nor competition but the lack of finance which can have detrimental effects on innovative SMEs in fulfilling their long-term objectives (Canepa & Stoneman, 2008). Furthermore, it was disseminated that innovative firms which came into existence during an economic recession enjoy an advantage in performance (Eesley, Hsu, & Roberts, 2012). Subsequently, if such firms could survive economic hardship then when both the local and global economies begin to show strength and recovery, these firms should be able to capitalise on such previously inaccessible favourable conditions.

3.4 Exporting

3.4.1 Exports and Performance

When discussing export performance for a firm there is no single universal definition in the literature, yet exports tend to be reviewed on a short-term basis by firms (Lages & Lages, 2004). It is found that performance is of vital importance to firms, but it can vary due to the different targets, goals and objectives which firms have when implementing an international strategy (Lu & Beamish, 2006). However, limited evidence exists to confirm that a firm's performance is impacted by exporting (Salomon & Jin, 2008). This issue has allowed different tranches to take hold of the research, sometimes to the detriment of the topic. In their research, Brouthers et al. (2009) utilise both profitability and sales as key metrics for export performance. They note that Styles (1998) provides an insightful piece regarding the difficulties SMEs can have in categorising exports as part of the businesses' overall financial performance. In previous literature examining technology start-ups, both profitability and firm growth were discovered to represent two crucial reasons why firms expand internationally (McDougall & Oviatt, 1996; Oviatt & McDougall, 1994). Exporting is viewed as a sign that a business is in a good economic position and therefore many investors view this favourably, often in emerging markets (Ganesh-Kumar, Sen, & Vaidya, 2001).

Due to the fluctuations in exchange rates, currency issues can have a substantial role in a firm's exporting strategy (Campa, 2004). Exporting to countries that use a different currency can negatively affect SMEs, given their inability to purchase derivatives to hedge the risk efficiently. SMEs must ensure that any export plan and strategy does not ignore the impact of exchange rate changes and firms must limit this risk where possible (Lu & Beamish, 2006). When exchange rates fluctuate, this can impact exporters, with appreciation meaning exports decreases since there is a fall in their challenge and marketability, but contrary to this domestic assets rise in value for possible new exporters (Chaney, 2016). An interesting point states that exporters will often gain more stability in their revenue since different markets are not positively correlated fully with each other (Campa & Shaver, 2002). The knowledge gained from exporting amongst different sectors is also unknown, but exporting can provide industry expertise to firms not available in domestic markets (Salomon & Jin, 2010). Furthermore, fiscally beneficial outcomes arise from exporting, and it provides a strategy for SMEs to sell their products in foreign markets (Fina & Rugman, 1996). An interesting finding regarding SMEs consists of the rationale that exporting has a declining impact on profitability, yet the growth of an SME is positively influenced by exporting (Lu & Beamish, 2006). Often both profitability and growth would follow the same path, yet it is not evident in the results.

3.4.2 SMEs and Exports

Exporting is an easier, more flexible and quicker method to gain foreign market share than setting up a subsidiary within each target country (Lu & Beamish, 2006). SMEs can expand into new geographic markets via subsidiaries although this tends to result in firms navigating the same challenges as start-ups. Such obstacles are cultivating stakeholder relationships and the successful recruitment and training of staff, which are both key credentials (Barringer & Greening, 1998). Previous literature has disseminated that firms which export are often strongly positively correlated with size (Bonaccorsi, 1992). Both productivity and size have a positive influence on exporting, resulting in larger firms that generate more products gain a greater probability to export (Bernard & Wagner, 2001). Furthermore, positive growth in different countries was found to be a crucial strategy for the SME's progression, instead of remaining in the domestic market (Barringer & Greening, 1998).

Young firms which integrate new communication technology into their businesses provide themselves with an opportunity to export more than any in previous decades (Evangelista, 2005). The advent of the internet and accessibility of e-commerce to even the smallest firms, open borders and the removal of trade embargoes and quotas have provided the necessary situation for small firms to now grow globally. This stance has been supported by Wright, Westhead, & Ucbasaran (2007) who declare that small companies which have a limited supply of resources are now operating on an international basis depending on their capabilities and diversities. Before the introduction of e-commerce, SMEs possessed the largest probability of making a significant gain in foreign markets (Reynolds, 1997). This finding relates to the previous analysis in which the key reason firms export is to increase their economies by both scale and scope (Kogut, 1985). Subsequently, the dawn of the internet has significantly increased the performance of firms internationally as it allows SMEs to have direct access to customers in different markets. Oviatt & McDougall (1994) declare that some firms will seek to export from inception. However, not all firms follow this path, as they may wish to utilise their resources in a more controlled manner (Westhead et al., 2001a).

Due to their more fluid structure and smaller size, SMEs have an advantage when looking to adapt to global markets, as their quick adaptation can result in improved firm growth internationally and greater profits and subsequent retained earnings (Autio, Sapienza, & Almeida, 2000). Lu & Beamish (2001) analysed the relationship of both exporting and foreign direct investment (FDI) for SMEs, which found that when an SME's strategy used both fronts it tends to be less profitable than a strategy of strong FDI, but limited exporting. However, when firms first begin to utilise FDI it can have a negative impact on profits but as FDI grows, the performance of these SMEs increases accordingly (Lu & Beamish 2001). This paper analyses them congruently but does not examine exports as the sole strategy, consequently, the impact on profits is a tad ambiguous in regards to this. Commercialising knowledge is a critical component of a business seeking to sell on international markets to allow them to grow and gain market share (Autio et al., 2000). Therefore, from this perspective, it would seem unwise to follow such a strategy of investing both time and money into FDI, specifically since SMEs now more than ever have greater access to global markets. Exporting is now a vital cog in the acceleration of internationalisation for SMEs due to the data and the capabilities to interact with all stakeholders (Mathews & Healy, 2008). In essence, it has revolutionised the process of a firm expanding internationally and thus SMEs can utilise the capacity to interact globally from the first step.

3.4.3 Exports, Innovation and High-Tech SMEs

Bernard & Bradford Jensen (1999) find that firms will seek to export when they have increased production, have a new product or service and are successful. It is entrenched that exporting increases the overall market size allowing for a greater survival probability. This viewpoint is built upon by Alvarez & Robertson (2004) who declare that innovating activities, which encompasses R&D amongst others, are positively related to exporting. Firms at the forefront of technology have demonstrated greater benefits from exporting. This is due to their implementation of innovative ideas and products gained from foreign markets (Salomon & Jin, 2010). Indeed an increase in innovation is positively related to knowledge and information access based on these markets (Penner-Hahn & Shaver, 2005). A strong positive correlation exists for UK firms between exporting, undertaking R&D, and innovation utilisation, meaning that firms tend to commence all 3 due to this relationship (Harris & Moffat, 2011). High-tech SMEs have shown signs regarding the proposed necessity of exporting to accomplish international growth, however, it is not the sole method for small businesses (Jones, 2001).

The question of endogeneity is addressed since exporting may improve the firm performance and innovation, but also high performing firms may decide to export meaning the great performance may not be a result of exporting (Golovko & Valentini 2011). When examining the influence of endogeneity between learning through exporting and future performance for high-tech SMEs it is hard to quantify specifically and no results are present (Love & Ganotakis 2013). Further research into this topic finds that SMEs exporting is strongly correlated with product innovation (Cassiman & Golovko, 2011; Van Beveren & Vandenbussche, 2010). Due to the costs associated with R&D, home markets alone may not provide substantial revenue to proceed with the investment and thus exporting is a necessity to gain the optimal benefits. However, high-tech SMEs' innovation may benefit from exporting but it does not impact their scale of innovation (James H. Love & Ganotakis, 2013), while an increase in innovation does not occur when a firm exports (Baldwin & Gu, 2004; Harris & Moffat, 2011).

Research prior to the 1990s has often revolved around larger firms when discussing the performance of businesses when they internationalise, yet smaller and larger firms differ greatly and have been shown to possess exceptionally diverse qualities (Shuman & Seeger 1986). Subsequently, these findings regarding larger firms would not be expected to have a strong reciprocation with smaller businesses. Indeed, smaller businesses need to be more risk-averse when entering selected foreign markets due to their limited resources (Erramilli & D'Souza, 1993). Burgel et al. (2000) examine almost 600 German and British high-tech start-ups and find that businesses that solely possess domestic sales have lower sales growth. High-tech firms which had a comparatively large percentage of foreign sales tend to enjoy elevated growth (Feeser & Willard 1990). These findings emphasise the belief that high-tech firms view international sales as a critical component of the sales strategy from the beginning, not a future goal. It is suggested that innovation without access to foreign markets results in limited substantial changes to improve performance (Love, Roper, & Hewitt-Dundas, 2010). Salomon & Jin (2008) provide some support to previous results that exporting is positively linked with innovation. Contrary to a successful strategy and business plan, innovative high-tech SMEs tend to export due to opportunities which have arisen but are not dependent on exports to succeed (Love & Ganotakis, 2013).

3.4.3.1 Exporting and Human Capital

Three central barriers for NTBFs when exporting were found to resonate around human resource issues, organizational capabilities and finally institutional problems (Cahen, Lahiri, & Borini, 2016). Thus, only one is outside of the firm's control. This reinforces previous literature whereby marketing staff are integral for revenue and profit generation for innovative investments. Along with innovation, a sustainable competitive advantage can be produced by SMEs which strategise international market sales through the improvement of staff technical abilities, that advances firms in international markets (Maranto-Vargas & Gómez-Tagle Rangel, 2007). Without such staff to produce an innovative product or service, available options would be similar resulting in a lower likelihood for marketing staff to reach such heights. More support is provided since an important component of any young small firm is the owner who can have a crucial role in both domestic and international expansion due to the experience and resources they possess (Brush, Edelman, & Manolova, 2002). Filatotchev et al. (2009) find that high-tech SMEs in China, started by entrepreneurs who worked in more advanced foreign markets are more likely to perform better and be open to exporting. These results can have a large ramification for high-tech firms as gaining knowledge in different markets produces a positive input with stronger performances possible. Support for this is offered when a successful international strategy for a firm can be significantly positively influenced by an entrepreneur's relevant experience (Westhead et al. 2001b). When a firm possesses previous experience in exporting, this will have a critically positive impact on the probability of the business exporting (Roberts & Tybout, 1997).

3.4.4 Exporting and Finance

3.4.4.1 Sunk Costs Deterrent

The availability of finance is deemed to be one of the three main influences on whether SMEs will sell their products on a global scale (Graves & Thomas, 2008). Banks often reject loan applications from young SMEs that utilise a growth strategy whereby exporting is the fundamental method for robust returns (Riding et al., 2012). The lack of debt would be detrimental to some firms, but exporting is often viewed as the least resource heavy option when seeking to invest in foreign markets (Lu & Beamish, 2006). Similar perceived returns from exporting exist since small exporters and small domestic-based firms both distinguish the same level of risk and reward towards exporting (Moini, 1991). However, the crucial component which inhibits non-exporters from undertaking an international approach to business is the upfront capital needed to cover the initial expenses, known as sunk costs, which many non-exporting small firms deem too costly (Moini, 1991; Roberts & Tybout, 1997).

These sunk costs act as a barrier and inhibit firms from generating stable revenue and profits in international markets, due to their lack of available finance and liquidity (Chaney, 2016; Manova, 2012). Previous research has discovered that businesses based in the USA do not export due to the high initial expenses involved which act as a barrier (Moini, 1991). Further support for this identifies how sunk costs can have a severe impact on whether US manufacturing firms will export (Bernard & Jensen, 2004). Whether firms possess adequate capital to account for these sunk costs is an important component for exporting. Only firms which are not financially restricted and well resourced will tend to export, given the capital investment needed to support the sale of products in foreign markets (Chaney, 2016). When firms can meet the sunk costs and first begin to export, they are found to be highly leveraged with the majority of their assets in illiquid form (Greenaway, Guariglia, & Kneller, 2007) However, the proportion of small firms receiving an external source of capital for either exporting or innovation purposes without any problem tends to be substantially low (Ughetto, 2008). Sunk costs are proposed to have a large influence on the decision for a business to begin and to stop exporting, with firms that have previously exported will likely export again, particularly over concurrent years (Bernard & Jensen, 2004). Further analysis disseminates that once firms have met the sunk costs and are exporting, they will predominately continue to export throughout the near future (Roberts & Tybout, 1997). Further analysis denotes that for profit-seeking German firms, those that currently export will boost their probability of future exports next year by 50 percent (Bernard & Wagner, 2001).

3.4.4.2 Exporting Opens Financial Options

Contrary to the literature regarding sunk costs as a deterrent, exporting is found to advances a firm's financial position, while the idea that only adequately financed firms begin to export is deemed incorrect (Greenaway, Guariglia, & Kneller, 2007). The inability to gain adequate external capital is less inhibiting for firms that export compared to those that generate their cash flow from domestic sales alone (Campa & Shaver, 2002). An issue with the findings is that the intensity of exporting is not important and no relationship between the proportion of export revenue and a reduction in financing difficulties is found (Bellone et al., 2010). This finding would suggest that firms should export in order to gain financing sources.

Subsequently, Riding et al. (2012) discover that young firms with growth expectations possess an appetite for a variety of different finance sources, while those that export are partial towards equity. Businesses should begin exporting as it signals to investors that these firms are in a solid position with positive growth outlooks (Shaver, 2011). This is of particular relevance to SMEs and private firms, which do not have to divulge as much financial information as those firms on the stock market. One such way SMEs can negate the resource issue is to set up an alliance or partnership with firms in a new country to access that firm's resources (Gulati, 1998). This can allow for a less volatile entry into new markets and provide some sway against unwanted economic adjustments. This is supported by Johanson & Vahlne (2003) who illustrate that businesses which utilise support networks can improve their knowledge of the market, as a lack of familiarity is a major impediment to success. Small firms seeking growth will export as it is not resourced intensive (Bonaccorsi, 1992). Furthermore, exporting can change a firm's overall performance, which is a significant difference for firms regarding their capital structure (Bridges & Guariglia, 2008). These findings illustrate two important aspects of exporting; the first is how exports allow SMEs to grow financially, but perhaps more importantly, exporting provides an opportunity for firms to stay in business longer.

3.5 Theoretical Background Overview

The theoretical background has been demonstrated in the previous sections within this chapter, discussing the theories of capital structure, the determinants of capital structure, the relationship of high-tech SMEs and innovation with financing, the importance of exporting and the financing issues associated with exporting. This section provides an overview of previous analysis involving firm financing and capital structure. The analysis is broken down into 4 distinct tables within Table 3.1 to Table 3.4. These separate tables provide an insight into the previous research regarding capital structure and consist of; businesses, firms in the technology sector, SMEs, and finally, high-tech SMEs. The corresponding information provided for each academic paper notes the author, the year of publication, the data type and sources, the methodology used and the key findings from the research. This research overview consists of important sections in the understanding of capital structure.

Table 3.1: Previous studies investigating firm financing and capital structure

Author	Topic/Title	Data (sample size, year, country, type)	Methodology	Main Findings	Journal
Modigliani & Miller 1958	The cost of capital, corporation finance and the theory of investment	Businesses	Static partial equilibrium analysis with strict assumptions	Capital Structure (CS) doe not influence firm value due to its independence with the cost of capital.	The American Economic Review
Modigliani & Miller 1963	Corporate income taxes and the cost of capital: a correction	Businesses	Influence of interest and taxes introduced into their previous model	Interest payments are tax deductible: seen as a corporate tax benefit. Therefore debt is a tax shield for firms and the optimal capital structure is 99.9% debt.	The American Economic Review
Wippern 1966	Financial Structure and the Value of the Firm	A sample of large industrial listed firms	Regression analysis	Addtional use of debt inceases shareholder value, but this may be limited. Support the implementation of a financing sources mix towards the maximisation of shareholder value.	The Journal of Finance
Kraus & Litzenberger 1973	A State-Preference Model Of Optimal Financial Leverage		Undertakes analysis using both bankruptcy and tax advantage variables	The relationship between firm value and debt may not be concave given the threat of bankruptcy and other penalties. If a firm's revenue is less than its debt obligations: firms are wary of debt.	The Journal of Finance
Jensen & Meckling 1976	Theory of the Firm: Managerial Behaviour, Agency Costs and Ownership Structure	Publicly listed businesses	Agency theory, property rights and capital structure analysed for firm ownership	The capital structure of a firm has an impact on the cost of capital. Agency costs exist and maximising shareholder wealth will increase agency costs.	Journal of Financial Economics
Leland & Pyle 1977	Informational asymmetries, financial structure and financial intermediation		Theorised mathematical modelling and discussion	Signalling can arise from firm owners' risk-aversion, as information owners possess is stronger than outside investors. Owners will utilise their internal capital for high return investments, which can be a signal of the quality, reducing information asymmetries and increasing the firm value. Firms could utilise equity when the ROI is weaker.	The Journal of Finance
Ross 1977	Some notes on incentive-signalling models, activity choice and risk preference		Methodical modelling through the use of theorems and discussion	Managers possess more significant and important information about a business than external stakeholders do, which is implemented in decision making for the firm's future. Implementing different financing sources instead of the other can signal the future NPV outcome of a project	The Journal of Finance

				and the value of the business. Firms that take on large leverage ratios, portray an ability to pay off the debt due to the future cash flows the firm should receive, thus signalling a high-quality firm.	
Bradley et al. 1984	On the existence of an optimal capital structure: Theory and evidence	851 businesses consisting of 25 industries from 1962 to 1981	OLS, mean values, correlation matrix ANOVA,	Optimal leverage: inverse relationship with non-debt tax shields & expected financial distress costs. Debt: a negative relationship between R&D intensity & earnings volatility. Non-debt tax shields: strong positive relationship with debt.	The Journal of Finance
Myers 1984	The Capital Structure Puzzle		Discussion paper	Examines both the TOT and new POT produced with Majluf, which is briefly discussed as a preview for their 1984 paper. TOT is important; firms should balance debt use to gain optimum benefit. The POT is analysed in which firms should favour internal finance, then prefer debt and finally equity as the last option within their capital structure (CS). The impact of asymmetric information has a key role.	The Journal of Finance
Myers & Majluf 1984	Corporate financing and investment decisions when firms have information that investors do not have		Discussion paper	Information asymmetry exists in firms, as potential investors know less about the business and its value than management. Signalling can influence external finance choices. Firms should utilise financial slack (consists of internal financing until none remains), then prefer debt use and then external equity as the final option.	Journal of Financial Economics
Titman & Wessels 1988	The determinants of capital structure choice	469 US firms covering a 1974 to 1982 period.	LISREL system of analysis: structural and measurement model estimates simultaneously. Analysis of debt measures. Correlation matrix	Size has a negative relationship with short-term debt. Debt is negatively influenced by previous profitability. Debt is not supported by future growth, collateral worth, instability or non-debt tax shields. The individualism of a firm's business has a negative effect on the debt amount. Transaction costs can influence the CS of a firm. Businesses possess lower debt levels if they can charge their stakeholders more when in serious financial distress.	The Journal of Finance
Chaganti & Damanpour 1991	Institutional ownership, capital structure, and firm performance	40 pairs of US manufacturing firms in 40 industries over 3 years	Multiple regressions, the correlation matrix	The debt-to-capital ratio has a negative relationship with outside institutional shareholders size. Family finance can be a substitute for external finance providers. Institutional ownership on ROA, ROE, and P-E performances ratios are influenced by executive stock ownership.	Strategic Management Journal

Viswanath 1993	Strategic considerations, the pecking order hypothesis, and market reactions to equity financing		Discussion and Mathematical workings	The POT is not always a theory to follow. Businesses which are undervalued may benefit from issuing equity, even if retained earnings are available. The sale of equity should not always relate to overvaluation.	Journal of Financial and Quantitative
Leland 1994	Corporate debt value, bond covenants, and optimal capital structure			The value of debt is influenced by determinants such as taxes, the cost of bankruptcy, risk and bond covenants.	The Journal of Finance
Rajan & Zingales 1995	What do we know about capital structure? Some evidence from international data	Firm accounts and monthly stock prices of G-7 countries. The period from 1987 to 1991. Global Village and OECD database	Multiple Cross-sectional regressions were undertaken for each G7 countries	No understanding of the correlation between leverage and size. Leverage has a negative correlation with profitability. Larger firms which use more debt will notice this impact to a larger degree. Differences in debt levels are not easily explained by institutional characteristics, such as tangibility. More research is needed.	The Journal of Finance
Barclay & Smith 1995	The maturity structure of corporate debt	COMPUSTAT annual industrial and full-coverage files, CRSP, NYSE/AMEX and Nasdaq files. Industrial corporate sector. 1974 to 1992.	Pooled ordinary least squares, cross-sectional OLS, fixed-effects regression. Pearson correlation	Firms with more long-term debt are large, have limited growth options, or must adhere to regulations. Short-term debt is strongly positively related to information asymmetries. Debt maturity is influenced less by Industry effects compared to the business-specific considerations	The Journal of Finance
Helwege & Liang 1996	Is there a pecking order? Evidence from a panel of IPO firms	367 firms undertook an IPO in 1983. Time period: 1984-1992. Compustat and Compact Disclosure databases	Logit model, multinomial logistic regression	Likelihood of gaining external sources of capital is not correlated with a lack of internal finance. Businesses with sufficient retained earnings will not utilise external sources. The POT is not followed when firms can select finance from capital markets.	Journal of Financial Economics
Kochhar 1996	Explaining firm capital structure: The role of agency theory vs. transaction cost economics		Theoretical strategic management discussion and analysis	CS choices relate to two key reasons: agency theory and transaction cost economics. The capital structure can influence performance due to differing governance costs. A strong theoretical correlation exists between strategic and financial management.	Transaction Cost Economics
Graham 2000	How Big Are the Tax Benefits of Debt ?	87,643 firm-year observations 3 annual COMPUSTAT tapes	Summary statistics and regressions with dummy variables.	Firms which pay dividends use debt sparingly with low debt costs. Interest deduction has a capitalized tax-reducing benefit of roughly 10 percent of a firm's value. Large	The Journal of Finance

		databases. Time period 1973 allows for start-up, analysis1980 to 1994	Analysis of the kink in the marginal benefit of interest deductions.	growth firms that produce distinctive and special products sparingly use debt. Limited amount of collateral from assets means a cautious use of debt Large, profitable, liquid businesses use limited debt.	
Graham & Harvey 2001	The theory and practice of corporate finance: evidence from the field	Survey data: 392 firms and over 100 questions. 9 percent response rate.	Univariate analysis. Firms' size; either large or small description, Summary statistics, graphs, Correlation matrix.	Support for the pecking order theory (POT) and trade-off theories (TOT) exists. Findings do not support concern regarding asymmetric information, transactions costs, and free cash flows, amongst others. NPV and CAPM are both important in valuations, especially for larger firms. Financial flexibility and credit ratings significantly influence debt policy. Stock undervaluation and issue of diluting EPS influence equity, some support for POT.	Journal of Financial Economics
Ozkan 2001	Determinants of capital structure and adjustment to long run target: evidence from UK company panel data	390 UK firms with continuous 5 years of data. Time period: 1984 to 1996. DataStream data.	Panel data: GMM, OLS and Anderson-Hsaio (AH) estimation techniques	Firms with long-term target leverage ratio are adjusted to ensure debt at the level, to limit extra costs. A negative relationship exists between non-debt tax shields and the use of debt. Size, liquidity & profitability have a negative impact on debt use. Growth opportunities have a negative impact on leverage.	Journal of Business Finance
Baker & Wurgler 2002	Market timing and capital structure	2,839 COMPUSTAT firms with a known IPO date from Jay Ritter and the SDC. Time period: 1968-1998	3 separate regression tests to investigate the impact of prior market valuations of shares on the capital structure. Subsamples hold the number of years from IPO constant	Market timing is found to have a significant effect on the capital structure. Firms' shares that were overvalued by the market would issue new equity and those that were undervalued utilised tend to repurchase equity. This timing of the market would build up over the years to produce the current capital structure.	The Journal of Finance
Fama & French 2002	Testing trade-off and pecking order predictions about dividends and debt	Annual data of 3,000 firms Time period: 1965–1999.	OLS, Litner model regression. Panel regressions and theoretical	Profitable firms and firms with many investments will utilise less debt. Parts of both the pecking order theory and trade-off theory are supported.	Review of Financial Studies
Frank & Goyal 2003	Testing the pecking order theory of capital structure	Publicly traded American firms, cross-section analysis. Time period: 1971 to 1998.	Empirical regression analysis	Internal finance and retained earnings are not sufficient for investments; strong use of external finance exists. Debt is less substantial than equity. Younger, larger firms prefer POT; However, equity finance has become more important for all. POT is not supported by high-growth small firms.	Journal of Financial Economics

Frank & Goyal 2004	The effect of market conditions on capital structure adjustment	Non-financial US firms & aggregate data: Compustat data. Time period: 1952–2000. Annual data is changed to 1992 dollars using GDP deflator	Vector Auto regression (VAR) framework; analysing equity and debt individually.	A robust market -to -book ratio results in a reduction of debt the following year, but no influence on equity. Results suggest support for the trade-off theory.	Finance Research Letters
Brounen et al. 2006	Capital structure policies in Europe: Survey evidence	Survey data of 313 firms based in Europe, compared with US firms	Ordered logit regression, simple statistics, illustrations and discussion of survey results	A specific debt ratio is found to be important, thus supporting the static trade-off theory. The pecking order theory is also present but not due to information asymmetries. Publicly listed and private firms differ about their use of capital. Financial markets influence public firms' capital choices.	Journal of Banking & Finance
Frank & Goyal 2009	Capital structure decisions: Which factors are reliably important?	Non-financial US firms; Compustat and various public databases. Time period: 1950–2003. Annual data is 1992 dollars using GDP deflator	OLS, descriptive statistics, correlations of different leverage measures	Negative impact on market leverage on market-to-book assets ratio and profits. Market leverage has a positive relationship with tangibility and size. Dividend payments result in less debt. Similar results exist for book leverage, but the firm size and the market-to-book ratio results are inconsistent. POT and TOT influence is apparent.	Financial Management
Brav 2009	Access to Capital & Capital Structure of the Firm	Panel data on private and public non-financial UK firms. Time period: 1993 to 2003. FAME, SDC and WDI databases.	Pooled panel OLS, multinomial logit, Probit model, summary statistics, means & medians,	Private firms have debt use and will avoid external capital markets, resulting in high leverage levels. The CS will be volatile due to changes in firm financial performance. Public equity is cheaper than private equity for the respective firms due to information asymmetries & control issues.	The Journal of Finance
Cotei & Farhat 2009	The Trade-Off Theory And The Pecking Order Theory : Are They Mutually Exclusive?	US firms. 89,591 Total observations. Time period 1980-2001. Compustat database	The multivariate analysis examines the trade-off theory and the pecking order theory	POT and TOT are not independent of each other. Firms may change between either theory over time. POT has more support in the short term. TOT has greater traction for the long term. Debt capacity and information asymmetry have a significant impact on adjustment	North American Journal of Finance and Banking Research
Leary & Roberts 2010	The pecking order, debt capacity, and information asymmetry	34,470 firm-year observations 1980-2005. Compustat database	Binary logit, maximum likelihood, financing, deficit regressions	When the debt target capacity can change as per differing theories, the POT and TOT are relevant and mutually beneficial, not exclusive, Previously analysed determinants strongly influence CS. Less than 20% of firms follow the POT when a strict version influencing debt & equity usage is analysed.	Journal of Financial Economics

Frank & Goyal 2015	The profits-leverage puzzle revisited	Non-financial firms, annual data is 2000 dollar over via GDP deflation calculation. 179,021 firm-year observations. Compustat database. Time period: 1971 to 2009.	Variable distribution, quintile analysis and quantile regressions	Profitable firms' equity will increase, with leverage ratio decreasing. When profitability grows, firms will repurchase equity and issue debt. The opposite occurs with a decrease in profitability. When profitability grows, the leverage ratio shrinks. Profitability indirectly affects leverage ratios as it increases equity value.	Review of Finance

Notes: The Table provides a detailed description of key academic articles relating to the capital structure of mainly large, publicly listed businesses from 1958 up to 2015. The papers are presented in chronological order and provide six separate pieces of information consisting of the Author, Topic/Title, Data, Methodology, Main Findings and the Journal where the research was published.

Table 3.2: Previous analysis of capital structure and financing issues amongst technology-based firms

Author	**Topic/Title**	**Data (sample size, year, country, type)**	**Methodology**	**Main Findings**	**Journal**
Carpenter & Petersen 2002	Capital Market Imperfections, High Tech Investment, and New Equity Financing	2,400 publicly traded high-tech firms. Time period: 1981 to 1998. Compustat database	Summary statistics and percentile analysis of firm characteristics	Majority of small high-tech firms have difficulty obtaining debt finance. An IPO will result in firms utilising retained earnings as their major financing source with some equity.	The Economic Journal
Coleman, Cotei, & Farhat 2014	The debt-equity financing decisions of US start-up firms	4,928 firms' longitudinal data. U.S. Start-ups launched in 2004. KSS database	Bivariate-Probit model, Tobit two stage, descriptive statistics, predicted probability	Information asymmetries exist for start-ups and increase the problems in obtaining debt. Owner and firm characteristics help remove information asymmetries and improve the use of debt over equity. Large start-ups use more debt supporting TOT. Growth firms and those with patents use more equity than debt.	Journal of Economics and Finance
Castro, Tascón, & Amor-Tapia 2015	Dynamic analysis of the capital structure in technological firms based on their life cycle stages	European firms. Time Period: 2000 to 2012. 6,945 tech firms, 10,861 non-tech firms. Worldscope data	Two-step GMM, correlation matrix, fixed effects panel analysis	Different capital structures exist for high-tech and other firms within Europe. Information asymmetry for tech firms in some growth stages, predominately maturity. Shown by the POT. The main reason behind this is the influence of growth opportunities and the intangible assets difference. During all life cycle stages, tech firms use less debt.	Spanish Journal of Finance and Accounting

Notes: The Table provides a detailed description of key academic articles relating to the capital structure of large technology-based firms from 2002 up to 2015. The papers are presented in chronological order and provide six separate pieces of information consisting of the Author, Topic/Title, Data, Methodology, Main Findings and the Journal where the research was published.

Table 3.3: Previous studies of SMEs financing and their capital structure

Author	Topic/Title	Data (sample size, year, country, type)	Methodology	Main Findings	Journal
Berger & Udell 1998	The economics of small business finance: The role of private equity and debt markets in the financial growth cycle	USA 1993 NSSBF data	Bivariate analysis: sources of finance concerning size and age.	Firm size and age influence CS. Financial growth life cycle categorises SMEs' CS into 9 debt types and 4 equity forms. SME financing is volatile to the macroeconomic environment. Small firms can obtain debt, without considerable tangible assets.	Journal of Banking
Jordan et al. 1998	Strategy and financial policy in UK small firms	275 English SMEs. FAME database and questionnaire		Strategic and financial influences can explain the SME debt amount. Debt is negatively related to cash flow and innovation strategy. SMEs which undertake strategic innovation have lower debt. Sales and sales growth positive relationship with debt is not supported. SMEs follow POT.	Journal of Business, Finance and Accounting
Michaelas et al. 1999	Financial policy and capital structure choice in UK SMEs: company panel data	3500 UK Small firms from Lotus One-Source Database. Profit & Loss accounts, Balance Sheets. 10 year: 1986 to 1995.	panel data analysis: Least Squares Dummy Variable (LSDV) models using the fixed-effects model	Size, age, profitability, growth and future growth opportunities, asset structure amongst others influence short and long-term debt in small UK firms. Age and industry-specific effects influence the type of debt. Short-term debt ratios in SMEs decrease as the economy improves.	Small Business Economics
Hall et al. 2000	Industry effects on the determinants of unquoted SMEs' capital structure	3,500 unquoted SMEs using the 1995 profit and loss accounts and balance from the Lotus One-Source Database.	Surviving businesses. Multitude cross-sectional regressions models using dummy variables Pearson correlation matrix, industry breakdown.	Positive relationship: Long-term debt with asset structure & size. Negative relationship with age and long-term debt. Short-term debt is positively related to growth, negatively with age, profitability, size and asset structure. Industry influences debt apart from short-term debt relationship with growth Profitability has no impact on long-term debt in any industry.	International Journal of the Economics of Business
Gregory et al. 2005	An Empirical Investigation of the Growth Cycle: Theory of Small Firm Financing	954 SMEs interviewed from the National Survey of Small Business Finances. Must be financially viable	Multinomial logistic regression	Larger firms (employees) use long-term debt and equity more than retained earnings. Some support for the financial growth cycle	Journal of Small Business Management

López-Gracia & Sogorb-Mira 2008	Testing trade-off and pecking order theories financing SMEs	3,569 Spanish SME panel data over a 10-year from 1995 to 2004.	Generalised moments method (GMM) with two-stage least squares regression	Both pecking order and trade-off theories provide insight into SME capital structure (CS). The trade-off theory firm has greater trust due to the debt target. SMEs have different financing tendencies than larger firms, with growth opportunities and internal resources impacting SMEs CS.	Small Business Economics
mac an Bhaird & Lucey 2010	Determinants of capital structure in Irish SMEs	299 Irish SMEs survey data	Seemingly unrelated regression (SUR) analysis to examine the effects of industry and parameter estimates	Information asymmetries exist in every industry. Size, collateral provision, age and ownership structure have similar influences on all industries.	Small Business Economics
Lindstrand & Lindbergh 2011	SMEs' dependency on banks during international expansion	218 Swedish SMEs questionnaire data	Questionnaire data. Descriptive statistics and t-tests.	Banks are not involved in the internationalisation of SMEs' networks. SMEs which depend on banks when creating global business relationships have previously been clients.	International Journal of Bank Marketing
Çekrezi & Kukeli 2013	Capital Structure And Firm Performance: Small Non-Listed Firms	Cross-sectional data for 69 non-listed commercial firms. 96% of micro firms. Balance sheet data	Multiple regressions testing both ROE and ROA. Descriptive statistics	Short-term, long-term and Total debt has a negative relationship with ROA and positive with ROE. Tangibility has no significant impact, but the size and asset turnover have a positive relationship.	Journal of International Finance & Economics

Notes: The Table provides a detailed description of key academic articles relating to the capital structure of SMEs from 1998 up to 2013. The papers are presented in chronological order and provide six separate sections of information consisting of the Author, Topic/Title, Data, Methodology, Main Findings and the Journal where the research was published.

Table 3.4: Previous analysis of high-tech SMEs and their financing

Author	Topic/Title	Data (sample size, year, country, type)	Methodology	Main Findings	Journal
Giudici & Paleari 2000	The provision of finance to innovation: a survey of technology-based small firms	survey data: 46 small high-tech Italian firms	Probit analysis, Firm overview & characteristics. Results described in three main sectors	High-tech SMEs' access to finance is negatively correlated with age and size. Life stage has a positive relationship with access to finance (not statistically significant).	Small Business Economics
Hogan & Hutson 2005	Capital structure in new technology-based firms: Evidence from the Irish software sector	117 Irish New technology-based firms (NTBFs) using survey data.	Summary statistics, illustrations & discussion of survey results	NTBFs prefer internal sources of finance, then equity, the the use of debt. Few will utilise debt finance. Firms are aware of information asymmetries with banks, but not with VCs.	Global Finance Journal
Colombo & Grilli 2007	Funding gaps? Access to bank loans by high-tech start-ups	386 NTBFs from survey data	OLS, Tobit and marginal effects. Mean survey results, the correlation matrix	NTBFs utilise internal finance first, then seek external capital, mainly debt. NTBFs obtain 6 times less debt over than equity, suggesting an issue of credit rationing exists. Support for the POT.	Small Business Economics
Coleman & Robb 2011	Financing strategies of new technology-based Firms	3,972 US NTBFs created in 2004 with the time period: 2004 to 2007. KFS longitudinal survey data.	Multivariate regressions, descriptive statistics	Technology-based films use lower external debt and a stronger amount of personal finance, during the initial year. These firms can raise more capital in the initial year than other sectors, specifically growth based technology firms.	Review of Economics & Finance
Minola & Giorgino 2011	External capital for NTBFs: the role of bank and venture capital	UK Data Archive, 231 NTBFs and 2,289 SMEs longitudinal panel data.	Multivariate regressions, descriptive statistics, framework creation	POT is supported; when NTBFs use up internal capital, they then prefer debt. Younger firms, smaller firms and those with strong R&D activity often do not apply for bank debt. VC finance is sought by younger and unprofitable firms. Overall, NTBFs are similar to SMEs when seeking finance.	International Journal of Entrepreneur ship and Innovation Management
Coleman & Robb 2012	Capital structure theory and new technology firms: is there a match?	Over 4,000 US TBSFs. Longitudinal data from KFS	Multivariate regressions, descriptive statistics.	TBSFs use a different financing pattern than firms in other sectors. Descriptive statistics; they raise larger capital amounts than others, particularly strong growth firms. TBSFs' higher usage of equity and a lower amount of owner capital and debt. Regression analysis illustrates slow debt and insider financing usage, but a higher owner finance ratio. Some support to pecking order and life-cycle theories.	Management Research Review

Revest & Sapio 2012	Financing technology-based small firms in Europe: what do we know?	Discussion; no firm data	Conceptual, theoretical paper	European TBSFs finance use internal funds for new investments, mainly due to asymmetric information with capital markets. Due to the UK's VC growth, European VC firms are level with US counterparts.	Small Business Economics
Minola, Cassia, & Criaco 2013	Financing patterns in new technology-based firms: an extension of the pecking order theory	2,66 NTBFs and 3,104 Non-NTBFs using KFS longitudinal data	Probit and Tobit regressions	The pecking order theory is supported by those with considerable start-up capital. Tech-based firms have a preference for equity over debt after the use of internal finance. Entrepreneur’s age and experience both have a positive relationship with equity finance which is important for the preferred financing order of NTBFs.	International Journal of Entrepreneurship and Small Business
Serrasqueiro, Nunes, & da Rocha Armada 2014	Capital structure decisions: old issues, new insights from high-tech small- and medium-sized enterprises	290 high-tech SMEs with SABI database. 729 non-high-tech SMEs. Panel data. Time period 2000 to 2009	descriptive statistics, OLS , GMM, two-stage least-squares (2SLS) estimation method, fixed-effects two-stage least-squares (FE-2SLS)	High-tech SMEs CS is closely supported by the POT. A modified version exists for those that have used VC with equity preferred over debt when internal finance is not available. Issues regarding information asymmetry, technological uncertainty and market uncertainty impact high-tech SMEs' capital structure path.	The European Journal of Finance
Colombo, Croce, & Murtinu 2014	Ownership structure, horizontal agency costs and the performance of high-tech entrepreneurial firms	Unbalanced panel data of 255 Italian unlisted high-tech firms. Time period 1994 (or the later foundation date) to 2003. RITA database	Dynamic panel models (GMM-SYS). Total factor productivity (TFP) growth: firm performance measure.	A larger number of the owner-manager controlled firms is positive as it results in better high-tech firm performance; firms' resources increase while agency costs are limited faintly. Non-manager shareholders increase agency issues as not involved in the management of the high-tech firm. This becomes more positive for highly leveraged firms. When leverage becomes unsustainable with the threat of bankruptcy, owner-managers to improve firm efficiency.	Small Business Economics
Vanacker Heughebaert, & Manigart. 2014	Institutional Frameworks, Venture Capital and the Financing of European NTBFs	6,813 NTBFs from six European countries	Multivariate regression, the Probit model, pooled OLS, marginal effects	NTBFs with VC investment increases their probability of obtaining external finance. External equity obtainment improves with stronger shareholder protection rights. Firms utilise less debt and limited in obtaining debt with strict personal bankruptcy laws	Corporate Governance: An International Review

Notes: The Table provides a detailed description of key academic articles relating to the capital structure of high-tech SMEs. These papers have a more recent time frame compared to the previous tables, with dates of publication ranging from 2000 up to 2014, presented in chronological order. The table provides six separate sections of information consisting of the Author, Topic/Title, Data, Methodology, Main Findings and the Journal where the research was published.

3.6 Conclusion

This chapter provides an in-depth discussion and review of the literature regarding the determinants, theories and influence of capital structure, which presents a strong theoretical foundation. The key theories of capital structure are discussed in detail and are based on debt-tax shields, information asymmetries, default risk, agency issues, signalling and valuations. Further discussion demonstrates how researchers have empirically tested capital structure theories implementing different datasets and methodologies. The majority of these datasets consist of accounting information over a number of years, while others developed surveys to obtain data. The findings disclose that key characteristics can have an important influence on the capital structure and consist of firm size, profitability, firm age, and growth opportunities. Comparative to SMEs and high-tech SMEs specifically, intangible assets and human capital have a considerable impact on the financing. These key characteristics are critical determinants of capital structure.

The relationship between capital structure and high-tech SMEs is discussed and the relevance of previously analysed theories investigated. High-tech SMEs' connection with financing differs in comparison to large, publicly listed firms as per the literature. However, for some of the theories, the literature does not correspond to high-tech SMEs. To account for the gaps in the literature, the relationship between SMEs and high-tech firms is reviewed, with a large proportion of research not accounting for high-tech SMEs. Empirical evidence regarding the financing of innovation and high-tech SMEs is provided, but the majority of this research is from the turn of the millennium meaning the topic is relatively new. This is of particular note regarding exports, where prior literature has researched entities such as innovation, high-tech SMEs and exports and the relationship between exports and finance availability for SMEs. However, literature for the relationship between the capital structure of high-tech SMEs and exports is non-existent.

Finally, the chapter presents a detailed summary of crucial capital structure articles through tables that encompass the authors, publication year, the datasets, the methodology used, key findings and the journal of publication. The review is disseminated into four separate tables depending on the type of firms analysed in the research and consisted of large, mainly publicly listed firms, then technology-based firms, then SMEs and, finally, high-tech SMEs. The capital structure overview formulates the analysis into both the determinants and the influences of capital structure to further develop the theoretical framework. This overview combined with the prior capital structure review of theoretical and empirical analysis produces the foundation for the hypotheses under review and the models used within this thesis.

Chapter 4. Hypotheses Formulation

4.1 Introduction

The previous discussion concerning capital structure, high-tech firms, SMEs and export literature combined with the empirical results will be the foundation for the hypotheses under investigation within the thesis. In order to test the hypotheses, both quantitative and qualitative data used to provide results. The hypotheses are built upon the theoretical background and findings discussed throughout the literature review chapter. They are produced through the implementation of the pecking order theory, the trade-off theory, signalling theory, agency theory and the market timing theory.

The hypotheses aim to answer the four research questions, ensuring the direction of the thesis remains focused on the topic. The research questions under investigation are the following: 1. What are the sources of finance utilised by high-tech SMEs and how are they influenced by firm characteristics? 2. What effects do the capital structure, firm characteristics and human capital have on the goals and challenges of high-tech SMEs? 3. How do key firm characteristics and financing sources impact the exporting of high-tech SMEs? 4. What effects do the financing sources of high-tech SMEs have on their financial performance? Through the implementation of both quantitative and qualitative methods and data, these questions are investigated via the hypotheses. When analysing the capital structure of high-tech SMEs, it consists of a range of echelons such as the influence of firm characteristics on the capital structure of high-tech SMEs. The echelons then centre towards how the capital structure, human capital and firm characteristics of high-tech SMEs impact on the financial performance, exporting and finally the goals and objectives. While the previous empirical evidence has investigated capital structure determinants and the impact on financial performance, little to no study has investigated such research questions for high-tech SMEs. Furthermore, the effect of capital structure on the exporting of high-tech SMEs has not previously been undertaken, and little research has investigated the impact of capital structure on the goals and objectives of these firms. The development of the hypotheses will be undertaken in the next section, to investigate the research questions.

4.2 Development of Hypotheses

The hypotheses are developed around the theoretical literature review and the empirical evidence discussed in the previous chapter. The hypotheses have therefore been developed using the results of such research combined with capital structure theories, which aim to answer the four research questions.

4.2.1 Determinants

4.2.1.1 Size and SME Financing

SMEs are more likely to have financing difficulties with more substantial levels of uncertainty and risk existing for smaller new firms (Engel & Stiebale, 2013; Rosenbusch, Brinckmann, & Müller, 2013). A negative correlation exists with leverage and firm size total assets amongst private US businesses (Cole, 2013). The pecking order theory is more reliably used by larger firms (Helwege & Liang, 1996), suggesting the following hypothesis:

Hypothesis 1: The firm size of high-tech SMEs is positively related to internal finance.

Firm size is a key influence on capital structure (Rajan & Zingales, 1995; Titman & Wessels, 1988). The requirement of external capital is faced by many start-ups resulting in a lack of adequate available finance (Angelini & Generale, 2008). Previous research suggests larger SMEs amend their capital structure through different financial sources (Newman, Gunessee, & Hilton, 2012). As SMEs grow, the ownership of these firms are diluted (Schulze et al., 2001). These findings suggest the hypothesis:

Hypothesis 2: Firm size has a positive relationship with the ability to obtain adequate future capital for high-tech SMEs.

4.2.1.2 Age

Investors are wary of younger firms and start-ups due to their limited track record from which inhibits their assessment of the business (Faulkender, 2005; Hall, 2002). This resonates strongly with new high-tech firms as information asymmetries are strongly associated with younger firms combined with a more considerable investment risk (Gompers & Lerner, 1999; Rosenbusch, Brinckmann, & Müller, 2013). Young technology firms frequently find it more costly to utilise external capital than internal (Akerlof, 1970). As firms grow older, banks are more willing to provide debt (Petersen & Rajan, 1994). An inability to obtain adequate financing exists for younger SMEs beginning to undertake research (Demirel & Parris, 2015). Therefore, the following is proposed:

Hypothesis 3: Age has a positive influence on the ability to obtain adequate future capital for high-tech SMEs.

Start-up high-tech firms follow a modified version of the pecking order theory, with internal capital used primarily, then favouring equity over debt finance (Minola, Cassia, & Criaco, 2013). Older firms can keep more of their earnings, meaning they are likely to use internal finance (Berger & Udell, 1998; López-Gracia & Sogorb-Mira, 2008). The following is proposed:

Hypothesis 4: The age of high-tech SMEs has a positive relationship with internal finance.

The pecking order theory describes how internal finance should be used primarily, followed by a preference for debt finance (Myers & Majluf, 1984). Older businesses preserve their earnings, resulting in a negative relationship between debt and age under the pecking order theory (Berger & Udell, 1998; López-Gracia & Sogorb-Mira, 2008). High-tech firms can have issues in obtaining debt finance due to the deficiency regarding intangible assets (Colombo & Grilli, 2007). Indeed, NTBFs use equity over debt due to the limited availability of debt financing (Cosh et al., 2009). This suggests the hypothesis:

Hypothesis 5: The age of high-tech SMEs has a negative relationship with debt.

4.2.1.3 Profitability

A negative relationship between debt and profitability exists, as the most profitable firms possess low levels of debt (Rajan & Zingales, 1995; Titman & Wessels, 1988). The debt ratio and gearing of businesses are negatively correlated with profits (Fama & French, 2002; Frank & Goyal, 2003). A reduction in the short-term and long-term debt amongst profitable SMEs is supported by Sogorb-Mira (2005). Debt can signal poor performance and lower firm value (Fama & French, 1998). Given these engaging findings, the following hypothesis is suggested:

Hypothesis 6: Profitability has a negative effect on total debt use in high-tech SMEs.

Businesses owners keep firm information private and do not disclose to external stakeholders (Leland & Pyle, 1977). When the market does not price the firm at a fair level, businesses will often not provide new equity (Graham & Harvey, 2001). According to the signalling theory, if a firm with adequate financial slack seeks to issue new shares, it can be a negative signal of share overvaluation for investors (Myers & Majluf, 1984). Debt use may signal confidence and reduce information asymmetries, but can increase the threat of bankruptcy and costs for firms (Fairchild, 2005). Profitable high-tech SMEs may seek to issue equity given their limited comparable financial slack and so the following hypothesis is suggested:

Hypothesis 7: Profitability has a positive effect on equity use in high-tech SMEs.

4.2.1.4 Experience

Through a review of previous literature, venture capital firms seek to invest in businesses with skilful and knowledgeable founders (Shepherd & Zacharakis, 1999). New venture experience provides the firm with a better opportunity to gain adequate finance and stronger venture capital valuations (Hsu, 2004). Venture capital funds may use signals of human capital such as education level and start-up experience when deciding on whether to invest (Hsu, 2007). A lack of expertise or differing interests can result in reduced financial support such as venture capital for smaller technology firms (Revest & Sapio 2010). The following is proposed:

Hypothesis 8: Previous start-up experience has a positive relationship with external equity finance in high-tech SMEs.

4.2.1.5 Intangible Assets and Future Growth

A negative relationship exists between high-growth companies and leverage, as such firms continuously utilise less debt finance (Barclay, Smith Jr., & Morrellec, 2006; Smith & Watts, 1992). Firms with a high percentage of intangible assets have difficulty in obtaining and thus using debt (Colombo & Grilli, 2007; Rajan & Zingales, 1995). Most start-ups must deal with their vulnerability to information asymmetry and the issue of insufficient collateral (Binks & Ennew, 1996). Firms with a strong amount of tangible assets will use more debt, according to the trade-off theory (Rajan & Zingales, 1995). Subsequently, a negative relationship between future growth opportunities and debt use exists (Barclay, Smith Jr., & Morrellec, 2006). This leads to the following hypothesis:

Hypothesis 9: A negative relationship exists between future growth opportunities and the total debt in high-tech SMEs.

When management uses their private information and issues new shares, it can be interpreted as a negative signal of harmful information regarding the future growth of the firm (Myers & Majluf, 1984). Businesses that decide to issue new equity can have this interpreted as a negative signal by the market, resulting in a higher cost of equity (Greenwald, Stiglitz, & Weiss, 1984). Firms will only issue new shares when the price is deemed adequate or better (Graham & Harvey, 2001). Under the signalling theory, if current shareholders have information regarding the firm's strong future growth and profits, they will oppose the issuance of new shares to ensure their returns are not diluted (Norvaisiene, 2012). These findings suggest the hypothesis:

Hypothesis 10: A negative relationship exists amongst future growth opportunities and equity in high-tech SMEs.

External finance is difficult to obtain by young, innovative SMEs due to the level of R&D and subsequent information asymmetries with possible stakeholders (Hall, 2002). R&D intensity can be a proxy for intangible assets, where firms with larger intangible amounts have significant difficulty in obtaining debt (O'Brien, 2003). R&D expenses can signal unobserved growth opportunities and firms with higher debt levels will often have no such expenses (Fama & French, 2002). Small businesses focused on R&D are most likely to get their loan applications rejected (Freel, 2007). Given this information and previous findings regarding future growth opportunities, the following hypothesis is put forward:

Hypothesis 11: R&D expenditure has a negative relationship with internal finance in high-tech SMEs.

Intangible assets can provide valuable future growth opportunities due to the knowledge-based competitive advantages they may create (Barney, 1991; Hitt et al., 2001). Intangible assets are difficult to transfer to other businesses, making it difficult when seeking external finance (Brierley, 2001; Revest & Sapio, 2012). Signalling theory suggests that owners will utilise their internal capital for high return investments (Leland & Pyle, 1977). The problem of asymmetric information is more substantial for firms with more intangible assets that are difficult to adequately value, which diminishes the opportunities to gain external finance (Clarysse, Heirman, & Degroof, 2003; Harris & Raviv, 1991). Thus, the following hypothesis is proposed:

Hypothesis 12: Intangible assets have a positive relationship with internal finance in high-tech SMEs.

4.2.2 Financial Performance

High-tech start-ups employ a modified version of the pecking order theory with internal finance as the primary source until it is no longer a viable option (Minola, Cassia, & Criaco, 2013). A key reason is to remove themselves from the threat of bankruptcy and dilution of ownership (Minola, Cassia, & Criaco, 2013). The modified packing order theory generates support to minimise high-tech SME problems associated with information asymmetry, technological uncertainty and market uncertainty (Serrasqueiro, Nunes, & da Rocha Armada, 2014). Innovation awareness is important as the SMEs and businesses that often receive less external finance are innovative (Freel, 2007; Mason & Pierrakis, 2013). This finding offers support for the belief that internal finance can be crucial for high-tech SMEs. Often the innovative firms generate the largest market share in their respective industries and become the major force (Gompers & Lerner, 2001). Thus, the use of internal finance should signal strong financial performance. According to the signalling theory, when firms use internally generated capital this can be deemed as a positive signal of strong future investments by the market (Giudici & Paleari, 2000). This signalling theory suggests that owners will utilise their internal capital for high return investments (Leland & Pyle, 1977). The following hypothesis is suggested:

Hypothesis 13: Internal finance signals a positive relationship with the financial performance of high-tech SMEs.

Previous analysis proposes that a negative relationship exists between debt and financial performance, as low leverage firms tend to be profitable (Harris & Raviv, 1991; Margaritis & Psillaki, 2010; Smith & Watts, 1992; Titman & Wessels, 1988). However, when a firm decides to utilise debt, it can be a signal of firm strength since the firm must deal with the repayments associated with additional debt (Masulis, 1983). Competitors know that leverage increases the probability of bankruptcy and that such firms will be perceived to possess a strong outlook on future cash flow (Brander & Lewis, 1986). The financial performance of firms would increase if the debt were taken on; otherwise, the firm would fall into bankruptcy issues. Debt finance can disseminate a signal of higher quality to the market as large equity ownership is not as costly for strong quality businesses (Schmid Klein, O'Brien, Peters, 2002). Under favourable market conditions, debt can lead to higher net profits (Norvaisiene, 2012). However, Fama & French (1998) find that the use of debt is a signal of poor performance and lower value overall. 50 percent of high-tech firms believe debt does not provide a positive signal of future performance to the market (Hogan & Hutson, 2008). Furthermore, debt is found to have a negative impact on profitability (Rajan & Zingales, 1995; Titman & Wessels, 1988). While the information is inconclusive, the following hypothesis is suggested:

Hypothesis 14: Total debt has a negative relationship with the financial performance of high-tech SMEs.

Building on the prior discussion, previous research has demonstrated that high gearing levels are negatively correlated to profitability (Drobetz & Fix, 2005; Fama & French, 2002). A negative relationship exists between future earnings and the maturity level of debt which exists (Flannery, 1986). Indeed, poor performing quality firms often cannot obtain and sustain multiple short-term debt policies (Stohs & Mauer, 1996). Given this information, the following hypothesis is proposed:

Hypothesis 15: The use of long-term debt has a negative relationship with the financial performance of high-tech SMEs.

A main issue that has halted innovation for smaller businesses and affected NTBFs is the availability of financial sources (Hoffman et al., 1998; Minola & Giorgino, 2008). Short-term debt has a positive correlation with financial performance as it improves firm profitability (Abor 2005; Salawu & Awolowo 2009). Higher quality businesses should issue short-term debt to signal and account for their undervaluation as debt maturity, and future earnings have an inverse relationship (Flannery, 1986). Short-term debt positively impacts the market performance of firms and has a strong positive influence on their financial performance (Abor, 2005; Zeitun & Tian, 2007). The following hypothesis is proposed:

Hypothesis 16: The use of short-term debt has a positive impact on the financial performance of high-tech SMEs.

Innovation which comprises of R&D expenses can place considerable financial burdens on high-tech SMEs due to their substantial fixed costs (Symeonidis, 1996). To ensure benefits accrue for the current shareholders, under the signalling theory, the issuance of a share is often viewed as bad news (Myers & Majluf, 1984). When firms are expected to generate losses due to poor performance, they will aim to gain new shareholders so that the losses are diluted for the current owners (Schmid Klein, O'Brien, Peters, 2002). New equity finance can signal negative news due to the extra costs associated with it compared to debt finance (Cosh et al., 2009). Both Ross (1977) and Leland & Pyle (1977) claim that an increase in equity signals a decrease in firm value. Subsequently, when new shares are issued, they signal bad news and likely poor financial performance, meaning the following hypothesis is proposed:

Hypothesis 17: The use of equity finance signals the negative relationship with the financial performance of high-tech SMEs.

The threat of bankruptcy and financial distress are a major factor that can disrupt the fulfilment of required capital when firms are seeking a targeted debt ratio (Myers, 1984). The trade-off theory is used by larger firms and provides an insight into the importance of a targeted debt ratio (Fama & French, 2002; Frank & Goyal, 2004). The debt ratio is negatively correlated with profits (Fama & French, 2002; Frank & Goyal, 2003). Accordingly, firms that seek to implement debt finance will find it more difficult to generate profits. The market timing theory is opportunistic and driven by share price changes; however, firms will seek to rebalance towards an optimal targeted debt ratio in the long term, supporting the trade-off theory (Huang & Ritter, 2009; Kayhan & Titman, 2007; Leary & Roberts, 2005). The information contributes to the following proposed hypothesis:

Hypothesis 18: Possessing a target debt ratio will have a negative relationship with the financial performance of high-tech SMEs.

Firm growth is affected by the founder's technical work experience, predominantly about the entrepreneurial knowledge acquired (Colombo & Grilli, 2005). The entrepreneurs of high-tech SMEs that obtained experience in advanced overseas markets tend to have stronger performances (Filatotchev et al., 2009). Incubators provide an opportunity for start-ups to financially grow as they provide firms with the use of assets at a cheaper than market rate (Revest & Sapio, 2012). Due to the acquired knowledge, start-up experience can have a serious impact on a firm's performance (Bandura, 1986; Davidsson, Low, & Wright, 2001). The previous use of incubators by a firm can signal strong firm quality to outside investors and customers (Colombo & Grilli, 2006). The following hypothesis is proposed:

Hypothesis 19: Experience in an incubator or accelerator program will have a positive relationship with the financial performance and profitability of high-tech SMEs.

4.2.3 Challenges

4.2.3.1 Capital

Given the characteristics of innovation, internal sources of finance are often not sufficient to sustain the expenses of SMEs, therefore, they must obtain external capital to reach their full market potential (Beck & Demirguc-Kunt, 2006). Inadequate access to finance is one of the most difficult challenges, which SMEs must address when seeking to improve their future skill set and growth (Lange et al., 2000). The majority of innovative young businesses need significant capital from outside sources to afford to turn their idea into a successful reality and meet their goals and objectives (Schneider & Veugelers, 2010). It is neither marketing nor competition but the lack of finance which can have detrimental effects on innovative SMEs in fulfilling their long-term objectives (Canepa & Stoneman, 2008). Given this inability to cover expenses without external finance, the following hypotheses are proposed:

Hypothesis 20: Internal finance has a negative relationship with the ability to meet expenses for high-tech SMEs.

Hypothesis 21: The use of external finance has a positive influence on the ability to gain adequate future capital for high-tech SMEs.

4.2.3.2 Staff

TBSFs have a higher usage of equity instead of debt finance as per the modified pecking order theory for high-tech firms (Hogan & Hutson, 2005; Coleman & Robb, 2012). This suggests such businesses are less susceptible to bankruptcy issues, although equity financing involves greater information asymmetries (Minola et al., 2013). The capital structure of high-tech SMEs is influenced by matters that regard information asymmetry, technological uncertainty and market uncertainty (Serrasqueiro et al., 2014). The market-timing theory suggests that firms should only issue debt when undervalued by the market (Baker & Wurgler, 2002). When NTBFs obtain sufficient capital, it signals a positive outlook to prospective capable employees, while reducing issues associated with new businesses (Brinckmann et al., 2011). Given this information, the following is suggested:

Hypothesis 22: Debt has a negative relationship with the challenge of obtaining future staff for high-tech SMEs.

4.2.4 Goals and Objectives

4.2.4.1 Sell the Business

Ensuring NTBFs possess sufficient finance to complete proposed work and obtain their business objectives is a substantial issue. NTBFs must deal with financing difficulties which are compounded by technology-based information asymmetry issues (Carpenter & Petersen, 2002). A key reason is due to their limited amount of tangible assets which dilutes their position as collateral (Robb & Coleman, 2010). Business owners know more information about their firm than external investors and lenders (Leland & Pyle, 1977). Under the signalling theory when firms sell new equity, it can be viewed as a poor signal by the market, resulting in a higher cost of equity (Greenwald, Stiglitz, & Weiss, 1984). Therefore, high-tech SMEs are unlikely to sell the entire business in the short term due to higher costs and lower value and the following hypothesis is suggested:

Hypothesis 23: Equity use positively increases the likelihood of selling the business after 5 years for high-tech SMEs.

An advanced education level and management experience within start-ups positively signal a high-quality business and entrepreneur, reducing information asymmetries (Kim, Aldrich, & Keister, 2006). Human capital is critical when examining matters of goals and financing (Chandler & Hanks, 1998; Watson, Hogarth-Scott, & Wilson, 1998). Entrepreneurs with previous financial success, such as habitual entrepreneurs, can repeat the start-up process with new firms due to the excitement involved in such transactions (Spivack, McKelvie, & Haynie, 2014). This can result in selling the firm within a short space of time. Experience is a critical part of synthesising into the knowledge of when to sell the firm or hold out long term. The number of hours an entrepreneur works can be viewed as a signal for investors of future success (Cassia & Minola, 2011). Strong start-up experience provides the firms with opportunities to gain adequate finance and improved valuations from venture capitalists (Hsu, 2004). This can ease the pressure on having to be sold while allowing them to grow long term. Given this information, the following hypothesis is proposed:

Hypothesis 24: Experience decreases the likelihood of selling the business after 5 years for high-tech SMEs.

4.2.4.2 IPO and Mergers

Previous start-up experience can considerably affect a firm's objectives and goals (Westhead et al., 2003; Westhead, Wright, & Ucbasaran, 2001). Entrepreneurs that previously sold a business can use the experience and wealth for new ventures or investments, known as entrepreneurial recycling (Mason & Harrison, 2006). The founder's previous experience can affect the firm's key objective towards an IPO (DeTienne & Cardon, 2012). The following hypothesis is put forward:

Hypothesis 25: Experience increases the likelihood of an IPO for high-tech SMEs.

An IPO can prove to be a strong signal of a firm's quality but are not primarily undertaken to remove information asymmetries (Ritter & Welch, 2002). When entrepreneurs believe their firm has a truly innovative product or service, they will select an IPO strategy or eventual sale to another business (DeTienne, McKelvie, & Chandler, 2014). Small high-tech firms find obtaining external finance an obstacle intensified by substantial involvement with R&D (North et al., 2013). The threat of bankruptcy is more prevalent for firms with growth opportunities, resulting in the preference for equity finance and lower debt levels for smaller firms (Minola, Cassia, & Criaco, 2013; Myers, 1977; Ozkan, 1996). Misvaluations can occur on a greater scale with IPOs and can be used to examine the market timing theory (Alti, 2006). High-tech firms can be a risky investment but can also make huge returns with a significant rise in their value if they become listed. Given this information, the following hypothesis is suggested:

Hypothesis 26: Internal finance increases the likelihood of an IPO for high-tech SMEs.

High-tech firms have a severe issue in securing sufficient finance (North, Baldock, & Ullah, 2013). Their subsequent use of internal finance supports the pecking order theory and averts the firm from the burden of debt repayments. The market views the use of internally generated capital as a positive signal due to perceived strong future investments (Giudici & Paleari, 2000). The modified pecking order theory disassociates high-tech firms from the threat of bankruptcy and instead predicts the use of equity even when issues relating to information asymmetry are apparent (Minolam, Cassia, & Criaco, 2013). This financing approach would enable such high-tech SMEs to become a stronger business for mergers, compared to a similar firm that is highly leveraged. Equity finance can dilute the ownership and decrease the overall value of the firm due to negative signals regarding the firm (Myers & Majluf, 1984). A merger may provide a considerable network of capital providers and investors for growth while still providing shareholders with respective ownership. Thus, the following hypothesis is proposed:

Hypothesis 27: Equity has a negative relationship with completing a merger for high-tech SMEs.

4.2.5 Exporting

Sunk costs associated with exporting can severely impact on firms seeking to export as they act as a barrier to international markets for businesses that have insufficient finance available (Chaney, 2016). Exporting is often viewed as a sign that a business has a positive economic position (Ganesh-Kumar et al. 2001). In previous literature that examines technology start-ups, both profitability and firm growth were discovered to represent two crucial reasons for international expansion (Oviatt & McDougall 1994; McDougall & Oviatt 1996). UK manufacturers that are in a heatlhy financial situation will export more than less successful businesses that rely solely on the domestic market (Greenaway, Guariglia, & Kneller, 2007). Upfront expenses significantly influence participation in foreign markets through exporting if the profit is not sufficient (Roberts & Tybout, 1997). The following hypothesis is suggested:

Hypothesis 28: Profitable high-tech SMEs have a positive relationship with exports.

Previous literature has disseminated that firms which export are often strongly positively correlated with size (Bonaccorsi, 1992). Firms seeking to export will need available capital to do so due to restrictions associated with sunk costs (Manova, 2012). As SMEs grow, a critical strategy for their progression is to undertake businesses in different countries (Barringer & Greening, 1998). Exporting is positively influenced by both firm size and productivity, resulting in larger firms gaining a superior probability of exporting (Bernard & Wagner, 2001). The following hypothesis is put forward:

Hypothesis 29: Firm size has a positive relationship with exports in high-tech SMEs.

The availability of finance strongly impacts on an SME's ability to sell their products or services globally (Graves & Thomas, 2008). When young SMEs deem exporting as a critical component of their business plan and growth strategy, banks will refuse their loan applications (Riding et al., 2012). Given the limited assets associated with smaller firms they should be more risk-averse when entering foreign markets (Erramilli & D'Souza, 1993). This suggests that debt is a poor choice of finance for firms wanting to export, since it must be paid back with interest and carries the risk of bankruptcy, unlike internal finance or equity. However, when businesses first begin to export and meet the sunk costs involved, they are highly leveraged with a large proportion of illiquid assets (Greenaway, Guariglia, & Kneller, 2007). While the literature is undecided, the following hypothesis is suggested:

Hypothesis 30: Debt has a positive relationship with exports in high-tech SMEs.

The proportion of small companies receiving an external source of capital for either exporting or innovation purposes without any problem tends to be substantially low (Ughetto, 2008). Only firms which are not financially restricted and are well resourced will tend to export, given the capital investment needed to support the sale of products in foreign markets (Chaney, 2016). The crucial component which inhibits non-exporters from undertaking an international approach to business is the upfront capital for sunk costs, which many non-exporting small firms deem too costly (Moini, 1991). Commercialising knowledge is a critical component of a business seeking to sell on international markets to allow them to grow and gain market share (Autio, Sapienza, & Almeida, 2000). Sunk costs have a significant influence on whether a firm exports (Roberts & Tybout, 1997). This suggests that the removal of information asymmetries using equity finance could help improve the exports for high-tech SMEs and pay for the sunk costs. Riding et al. (2012) find that young firms with growth expectation that export will prefer the use of equity finance. The following is suggested:

Hypothesis 31: Equity has a positive relationship with exports in high-tech SMEs.

The capability for SMEs to sell their products internationally is predominately affected by the availability of finance (Graves & Thomas, 2008). Initial upfront exporting expenses can have a detrimental impact on firms seeking to export when they possess limited capital due to the financial restrictions associated with these sunk costs (Chaney, 2016; Manova, 2012) These findings propose that external sources of capital are necessary for firms to benefit from exporting. Loan applications from young SMEs are often declined by banks when they plan to utilise exporting as an essential component of their growth strategy (Riding et al., 2012). However, other findings suggest that a positive relationship exists between external finance and exporting for smaller firms (Bellone et al., 2010). Given this information, the following hypothesis is presented:

Hypothesis 32: Internal finance has a positive relationship with domestic sales in high-tech SMEs.

R&D activities are discovered to have a positive relationship with exporting (Alvarez & Robertson, 2004). Young firms with growth expectations apply to a variety of different financial sources, while those who exported optimised towards equity (Riding et al. 2012). Firms tend to begin exporting when they have increased production, have a new product or service and are successful (Bernard & Bradford Jensen, 1999). Cassiman & Golovko (2011) disseminate how SMEs with product innovation are positively correlated with exporting. The following hypothesis is suggested:

Hypothesis 33: R&D investment has a positive impact on the likelihood to export for high-tech SMEs.

4.2.5.1 Information Asymmetry and Patents

Due to the innovative technical aspects of R&D and projects, high-tech SMEs must contend with a high proportion of information asymmetries (Bhattacharya & Ritter, 1983; Revest & Sapio, 2012). Businesses which work at the cutting edge of technology have established greater remuneration from exporting as they increase their insights into innovation in global markets (Salomon & Jin, 2010). Tangible goods will have fewer information asymmetries than intangible goods. Throughout the entire process of exporting tangible goods, firms gain intangible knowledge from international markets (Grossman & Helpman, 1991). SMEs that sought to export were unlikely to obtain external finance (Riding et al., 2012). This can be due to information asymmetries and so the following hypothesis is proposed:

Hypothesis 34: Limited information asymmetry has a positive relationship with the exports of high-tech SMEs.

World-leading technology and innovation-based businesses that export will have a strong application for patents (Salomon & Jin, 2010). Patents provide an opportunity for firms to generate new customer sales since their work has legal protection (Holgersson, 2013). Previous research demonstrates how exports are strongly and positively correlated with patent applications (MacGarvie, 2006). Patents can be a signal of quality whereby firms that obtain a patent will gain trade improvements (Hsu & Ziedonis, 2013). With this information, the following hypothesis is proposed:

Hypothesis 35: Patents have a positive relationship with the exports of high-tech SMEs.

The hypotheses produced in the previous sections have been created in order to investigate the determinants of capital structure, examine the influence of financing choices on financial performance, analyse the importance of human capital and capital structure on the challenges and objectives and explore the effect of firm characteristics and finance on exports. A summary of the hypotheses is presented in Table 4.1, and they provide the foundation to investigate high-tech SME capital structure via the testing of models that are developed and discussed in Chapter 5.

Table 4.1: List of hypotheses for investigation

Determinants	
Hypothesis 1	The firm size of high-tech SMEs is positively related to internal finance
Hypothesis 2	Firm size has a positive relationship with the ability to obtain adequate future capital for high-tech SMEs
Hypothesis 3	Age has a positive influence on the ability to obtain adequate future capital for high-tech SMEs
Hypothesis 4	The age of high-tech SMEs has a positive relationship with internal finance
Hypothesis 5	The age of high-tech SMEs has a negative relationship with debt
Hypothesis 6	Profitability has a negative effect on total debt use in high-tech SMEs
Hypothesis 7	Profitability has a positive effect on equity use in high-tech SMEs
Hypothesis 8	Previous start-up experience has a positive relationship with external equity finance in high-tech SMEs
Hypothesis 9	A negative relationship exists between future growth opportunities and the total debt in high-tech SMEs
Hypothesis 10	A negative relationship exists amongst future growth opportunities and equity in high-tech SMEs
Hypothesis 11	R&D expenditure has a negative relationship with internal finance in high-tech SMEs
Hypothesis 12	Intangible assets have a positive relationship with internal finance in high-tech SMEs
Financial Performance	
Hypothesis 13	Internal finance signals a positive relationship with the financial performance of high-tech SMEs.
Hypothesis 14	Total debt has a negative relationship with the financial performance of high-tech SMEs
Hypothesis 15	The use of long-term debt has a negative relationship with the financial performance of high-tech SMEs
Hypothesis 16	The use of short-term debt has a positive impact on the financial performance of high-tech SMEs
Hypothesis 17	The use of external finance signals the negative relationship with the financial performance of high-tech SMEs
Hypothesis 18	Possessing a target debt ratio will have a negative relationship with the financial performance of high-tech SMEs
Hypothesis 19	Experience in an incubator or accelerator program will have a positive relationship with the financial performance and profitability of high-tech SMEs
Challenges	
Hypothesis 20	Internal finance has a negative relationship with the ability to meet expenses for high-tech SMEs
Hypothesis 21	The use of external finance has a positive influence on the ability to gain adequate future capital for high-tech SMEs
Hypothesis 22	Debt has a negative relationship with the challenge of obtaining future staff for high-tech SMEs
Objectives	
Hypothesis 23	Equity use positively increases the likelihood of selling the business after 5 years for high-tech SMEs
Hypothesis 24	Experience decreases the likelihood of selling the business after 5 years for high-tech SMEs
Hypothesis 25	Experience increases the likelihood of an IPO for high-tech SMEs
Hypothesis 26	Internal finance increases the likelihood of an IPO for high-tech SMEs
Hypothesis 27	Equity has a negative relationship with completing a merger for high-tech SMEs
Exports	
Hypothesis 28	Profitable high-tech SMEs have a positive relationship with exports
Hypothesis 29	Firm size has a positive relationship with exports in high-tech SMEs

Hypothesis 30	Debt has a positive relationship with exports in high-tech SMEs
Hypothesis 31	Equity has a positive relationship with exports in high-tech SMEs
Hypothesis 32	Internal finance has a positive relationship with domestic sales in high-tech SMEs
Hypothesis 33	R&D investment has a positive impact on the likelihood to export for high-tech SMEs
Hypothesis 34	Limited information asymmetry has a positive relationship with the exports of high-tech SMEs
Hypothesis 35	Patents have a positive relationship with the exports of high-tech SMEs

Notes: The table provides a list of the 35 hypotheses that will be used to analyse the capital structure of high-tech SMEs, which are sectioned into 5 distinct topics: determinants, financial performance, challenges, objectives and exports.

4.3 Variables

In order to test the developed hypotheses, it is important to employ adequate variables. Both the dependent and independent variables are built upon previous studies and focus on the firm, human and financial characteristic. Since the capital structure is critical for this study, capital variables consisting of internal and external finance are used, while firm attributes are utilised as independent variables. The results will not only demonstrate whether independent variables have an influence on the dependents but also the strength and course of the effect. The financial performance, objective, challenges and exporting topics implement various dependent variables to answer the four research questions previously discussed. The relevance and importance of implementing two separate data sets in this study, one from unique questionnaire data and the other from an online database are now discussed. This is followed by the presentation and definition of the independent and dependent variables from the two separate datasets.

4.3.1 Implementing Two Separate Datasets

4.3.1.1 Triangulation and Benefits to Research

Prior research has attested that quantitative data provides analysis that produces the strongest and best quality results (Sechrest, 1992). However, this viewpoint has been criticised under a positivist paradigm whereby qualitative data may offer additional information, and so quantitative data should not be the default choice (Guba & Lincoln, 1994). Qualitative methods can be used to account for some of the criticisms and limitations regarding quantitative research (Bamberger, Rao, & Woolcock, 2010). Furthermore, the use of qualitative data can provide the context for research and investigate perspectives of topics through impactful variables often ignored in quantitative datasets. However, the sole use of survey data for econometric analysis is not always encouraged, as the over-use of closed-ended questions can produce results which strongly relate to quantitative data and posses similar drawbacks (Rao & Woolcock, 2003). The overall research process can be improved in the main areas of research design, data collection and analysis by combining qualitative and quantitative approaches

(Sieber, 1973). Qualitative data can improve the quantitative approach in areas such as conceptualisation, variable development and construing and verifying quantitative findings, while quantitative data provides an initial foundation of information and assesses the generalisation of qualitative data and reveals the novel importance of such findings (Sieber, 1973).

Given this information, the use of a mixed methods approach, while not new, has gained traction due to the reaction from quantitative and qualitative researchers to produce new combined ideas (Johnson, Onwuegbuzie, & Turner, 2007). Campbell & Fiske (1959) propose that by implementing multiple research methods, this can triangulate the research to produce findings that deal with the actual critical components of the topic. Subsequently, combining a robust quantitative dataset with a qualitative dataset provides the opportunity for more informative insights that improve the quality and distinctiveness of the total data through data triangulation. This is known as between-methods triangulation since it implements more than one paradigm and corresponding dataset, which assists in the removal of specific paradigm weaknesses and improves the research value (Denzin, 1978). The production of richer more developed data, the provision of greater confidence in the results and the comprehensive nature involved can be used to examine different theories are some of the advantages of triangulation (Jick, 1979).

For research topics that are often dominated by one particular sole method, the implementation of mixed methods and different datasets can improve the understanding of the topic (Johnson & Onwuegbuzie, 2004). In order to implement this research method, it is important that both datasets complement each other, by providing a combination of data, which is not available from a sole dataset. The synergy of two datasets that obtain their information using two distinct styles is of significant importance when investigating a research topic such as the capital structure of high-tech SMEs. Three reasons why qualitative and quantitative research should be merged are discussed by Rossman & Wilson (1985) who state that it can instigate new ideas and views due to the inconsistencies that occur from two datasets, triangulation allows for the authentication of each dataset and finally it provides an opportunity to develop richer, informed data. The results of a mixed methods analysis are often more robust due to the different datasets in examining the same topic. In comparison to a single research method, the benefit of mixed methods provides additional value to the results owing to improved validity (Hurmerinta-Peltomäki & Nummela, 2006).

4.3.1.2 Combination of Datasets from Ireland and Europe

The implementation of two distinct qualitative and quantitative datasets via the between-methods triangulation will provide the previously discussed benefits to the research process (Denzin, 1978). It is important to select regions that have complementary aspects to benefit the research. While high-tech SMEs based in European countries including Ireland are analysed in the quantitative dataset, firms based in Ireland are used in the qualitative dataset in order to produce the between-methods triangulation. While the location is important and Ireland is a country within Europe, when seeking to determine justification for complimentary datasets under mixed methods analysis it is critical to expanding further. Subsequently, for the topic of high-tech SMEs' capital structure, it is important to note 3 main justifications that are crucial and consist of; 1) the role and importance of SMEs, 2) business innovation and high-tech productivity, and, 3) the issue of financing. Critical details of these 3 subjects have been provided throughout Chapter 2 and will be discussed further to validate the combination and benefits of Ireland and Europe for between-methods triangulation in this topic.

1) The first justification relates to the importance of SMEs in both Europe and Ireland. As discussed in Chapter 2.1, Irish SMEs and European SMEs have very similar characteristics. The first similarity provided in Table 2.2 provides the percentage of total firms that are SMEs, with SMEs in Ireland accounting 99.7 percent and the EU-28 SMEs consist of 99.8 percent. This demonstrates the reliable comparison of both regions, given the almost exact proportion of businesses that are SMEs. The second piece of information analyses the percentage of people employed by SMEs. In Ireland, SMEs account for 70.9 percent of employment, while the EU-28 has an almost parallel value of 66.9 percent, strengthening the justification of using these two regions. The final part finds notes that the value added by SMEs within Ireland account for 46.7 percent, while SMEs based within the EU-28 produce a similar range but slightly stronger 57.8 percent. Overall, the characteristics of SMEs within Ireland and Europe are very similar, providing a strong justification to implement Ireland and Europe as the two regions for the between-methods triangulation.

2) The second area where Ireland and Europe possess a positive relationship relates to the importance and implementation of innovation and high-tech productivity within SMEs. The significance of the technology sector and growth is discussed in Chapter 2.3, and relevant information relating to the parallels between Ireland and Europe is provided. Figure 2.1 demonstrates the importance of production within the high-tech and medium-high-tech manufacturing industries for job creation and growth within the EU. According to the information in Chapter 2.4, Ireland is shown to possess the highest

percentage of innovative businesses within Europe with 36 percent between 2012 and 2014, which is favourable to the EU average of 24 percent. Presented in Figure 2.2, this expresses how innovation is a chief component within firms in Ireland and an adequate region for researching high-tech firms. The comparative importance of innovation for both Ireland and Europe is further addressed and shown in Figure 2.3 where the percentage of SMEs that have a product or process innovation with the EU average at 33 percent, while the SMEs in Ireland represent 45 percent. This presents the importance of innovation and illustrates the relationship Ireland enjoys as a hub of innovation for both SMEs and large businesses. High-tech SMEs have a critical value upon the growth and success of the European Union, and indeed, the implementation of enhanced innovation and R&D are critical objectives for the Europe 2020 strategy due to their sustainability and growth characteristics (European Commission, 2010a). The information presented in Table 2.2, Figure 2.2 and Figure 2.3 exhibit how Ireland can be used to develop a robust understanding of high-tech SMEs through the qualitative dataset in the research, with European firms based in the quantitative dataset.

3) The final subject that verifies the use of both Ireland and Europe as corresponding locations for this research relates to finance and the financing issues. As mentioned in Chapter 2.7, 570 various policies have been put into practice since 2011 throughout the EU to assist SMEs in obtaining a range of finance sources under the Access to Finance programme (European Commission, 2018a). The importance of access to finance is discussed in Chapter 2.7 where the European Commission state that the biggest challenge European SMEs must face is access to finance (European Commission, 2014). This relates strongly to the SMEs in Ireland, where gaining adequate capital is imperative for growth and investment (Economic and Social Research Institute, 2014).

The discussion within Chapter 2.7 also notes that European banks, impacted by the financial crisis, have a preference for firms with limited risk from asymmetric information such as larger, older and well-known businesses compared to SMEs (ESMA Securities and Markets Stakeholder Group, 2012). This finding supports comparable outcomes within Ireland, whereby a considerable decrease in debt finance from banks has occurred for Irish SME bank applications in the past 5 years as illustrated in Figure 2.13 (Department of Finance, 2017). The SMEs throughout the regions may no longer seek to apply for debt finance, given previous rejection, as they believe they will not be successful. However, Figure 2.5 illustrates that the percentage of loan rejections decreased for European SMEs within 2016, by a considerable scale since 2008, particularly compared to 2014. The loan rejection rate for the OECD and Ireland stand at 15 percent and 16 percent respectively, as Figure 2.6 exemplifies. In comparison to European SMEs in Figure 2.5, there is a significant drop for Irish SMEs in 2015 compared to the 2011 rejection rate of 30 percent. This further demonstrates how both regions are positively correlated in the area of SME finance. A strong correlation exists with Ireland where new lending for Irish SMEs, illustrated in Figure 2.14, has increased since December 2013, with a 50 percent increase in new debt from August 2015 to June 2016 alone. This demonstrates further similarities in the financing of SMEs in Ireland and Europe.

A marked enhancement in the ability of European SMEs to obtain bank loans and trade credit has occurred and with regard to bank loans, a 12 percent increase has occurred between 2013 and 2016, according to Figure 2.10. This is consistent with SME lending in Ireland, previously discussed in Chapter 2.10, which increased in the annual growth rate by 16.5 percent by Q4 2017 (EY-DKM, 2018). This considerable similarity further justifies how Ireland robustly compares to Europe as a satisfactory region for the qualitative dataset aspect of the research. Figure 2.7 examines the importance of access to finance for SMEs, and it illustrates how Ireland follows a similar pattern to the eurozone average with a small decline in its importance from 2013 to 2016, with it deemed a medium level issue (European Central Bank, 2016). Within Chapter 2.7, it is discussed how the EC aims to implement regulations in order to integrate the European Venture Capital Fund (EuVECA) abilities for investment into SMEs which are part of the SME Growth Markets (European Commission, 2018d). This is of critical importance, as demonstrated in Figure 2.15, whereas of March 2017, 6 percent of Irish SMEs had applied for non-bank debt and of this, just 1 percent of Irish SMEs have sought venture capital finance. This supports the belief that European SME markets are quite illiquid, which reduces the likelihood of public equity investment and it is an area under review by the EC (ESMA Securities and Markets Stakeholder Group, 2017). Given the information provided throughout the three chief subjects, Ireland is found to be an outstanding region to undertake qualitative research the topic of innovative high-tech SMEs and their capital structure, in combination with European quantitative dataset. This will result in the development of more precious and evolved data, the comprehensive examination of theories and stronger confidence in results due to the triangulation (Jick, 1979). The implemented datasets are now discussed and in detail throughout Chapter 5.

4.3.2 Variables Employed in Multiple Regression Models

The variables implemented in the hypotheses testing consist of these mentioned throughout the literature review chapter. The Orbis secondary dataset is used in the analysis throughout Chapter 6, and the corresponding variables are described in Table 4.2

and Table 4.3. The primary questionnaire dataset is implemented in the investigations within Chapters 7 and 8, with the variables outlined in Table 4.4 and Table 4.5. The improvement of the analysis by implementing different datasets is supported by Bouchard (1976) who demonstrates that more than one method can increase the validity of research findings.

4.3.2.1 Orbis Dataset

A key issue regarding research in the SME sector is obtaining reliable, up-to-date and useful data. Issues relating to many databases both in Europe and the USA often are not available or a variety of distinct details are blank. Indeed, limited information regarding revenue and expenses are provided and often in a broad spectrum approach by many databases. The Orbis database is used in this analysis and it consists of firm-level data of both private and public European businesses. The database is produced by Bureau van Dijk and contains critical business criteria such as balance sheet, profit and loss accounts and business information on an annual period. The data spans multiple countries and industries and has been utilised in the previous analysis of capital structure (Brounen et al. 2006; Santos, Moreira, & Vieira, 2014; Grilli & Murtinu 2014; Goddard, Tavakoli, & Wilson, 2005; Psillaki & Daskalakis 2009; Mac an Bhaird & Lucey 2014).

The SME definition provided by the European Commission is utilised for data collection and analysis. Primarily, a company is an SME if it employs no more than 249 employees. Secondly, a firm can no longer be classified as an SME if it generates over €50million in revenue or if their total assets are valued over €43million (European Commission, 2012). The high-tech sector is an engaging area to investigate given that it covers a broad range of different areas, under one arching roof. Subsequently, in order to define the firms effectively, the high-tech Nomenclature of Economic Activities (NACE) Rev.2 benchmarks codes are implemented (Eurostat, 2014). The NACE is known as the statistical classification of economic activities in the European Community and is supported through the use of all its members. In total there are over 7,300 high-tech SMEs based in 20 different countries and encompassing a 10 year period within the sample size for the analysis. This results in a total of 73,000 observations comprising over 50 separate total variables for each firm. The broad range of countries will produce relevant results, given that this specific data has not been previously utilised for the proposed research area. The dependent variables used to test the previously created hypotheses are described in Table 4.2, and the independent variables are described in Table 4.3.

Table 4.2: Description of dependent variables from the Orbis database

Dependent Variable Code	Dependent Variable	Dependent Variable Description
EBITDAMARG	Earnings before interest, tax, depreciation and amortisation margin	(EBITDA / Operating revenue) * 100
EQUITYV	External equity	Value of (Capital + Other shareholders funds)
EXPORTPEROR	Export percentage	(Exports / Operating revenue) * 100
EXPORTREV	Export revenue	Log of the turnover generated from foreign markets
GEARDA/ TDEBTRO	Gearing assets ratio	(Total debt divided by total assets) * 100
GEARDC	Gearing capital ratio	(Total debt divided by capital) * 100
GEAREQ	Gearing equity ratio	((Non-current liabilities + Loans) / Equity) * 100
LTDEBTV	Long-term debt	Debt value which has a larger lifespan than one year
PROFMARG	Profit margin	Profitability (Profit before tax / Operating revenue) * 100
ROANETINC	Return on assets using net income	(Net income / Total Assets) * 100
ROAPROF	Return on assets using profits	(Profit before tax / Total assets) * 100
ROENETINC	Return on equity using net income	(Net income / Equity) * 100
ROEPROF	Return on equity using profits	(Profit before tax / Equity) * 100
STDEBTV	Short-term debt	Debt Value which has a lifespan of less than one year
TTDEBTV	Total debt	Value of (Short-term debt + long-term debt)

Notes: This table provides a list of the dependent variables obtained from the Orbis database, employed in the hypotheses testing in Chapter 6. The variable code used in the econometric models and the corresponding description for each variable listed is provided.

Table 4.3: Description of independent variables from the Orbis database

Independent Variable Code	Independent Variable	Variable Description
AGE	Firm age	Log of number of years the business has been in operation
CASHFLOW	Firm cash flow	Log of (Profit for period + Depreciation)
CURRATIO	Current ratio	Current assets divided by current liabilities
EBITDAMARG	EBITDA Margin	(EBITDA / Operating revenue) * 100
EMPL	Firm employees	Log of the number of employees
EQTARATIO	Equity ratio	(Equity divided by total assets) * 100
EQUITY	External Equity	Log of Equity Value
FUTGROWOPP	Future growth opportunities	(Intangible assets divided by fixed assets) * 100
INTANGGROW	Intangible assets growth rate	Intangible assets difference compared to the previous year (%)
LTDEBTRO	Long-term debt ratio	(Long-term debt divided by total assets)* 100
PATENT	Firm patents	Log of the number of patents the firm has registered
PATENTY	Firm Patent	Whether the firm has a patent or not
PROFTBL	Profitability	(Pre-tax profits divided by total assets) * 100
SALEGROW	Sales growth	Sales difference compared to the previous year in percentage
SIZEAST	Firms size measured by assets	Log of Total Assets(Fixed assets + Current assets)
SIZESALE	Firm size measured by sales	Log of Sales
STDEBTRO	Short-term debt ratio	(Long-term debt divided by total assets) * 100
TANGFIXASS	Tangible fixed assets	Log of All tangible assets such as buildings, land, machinery
TDEBT	Total debt	Log of (Short-term debt + long-term debt)
TDEBTRO / GEARDA	Total debt ratio	(Total debt divided by total assets) * 100

Notes: This table provides a list of the independent variables obtained from the Orbis database, employed in the hypotheses testing in Chapter 6. The variable code used in the econometric models and the corresponding description for each variable listed is provided.

4.3.2.2 Questionnaire Dataset

A critical rationale for this study is to provide a novel contribution to current cross-topic literature which envelopes SMEs, the high-tech sector, capital structure, financial performance, objectives and challenges and exports. To ensure the analysis is both relevant and beneficial from both a practical and theoretical viewpoint, it was decided to produce and utilise primary data, to examine further the research undertaken through the Orbis database. The data used consists of primary data from high-tech SMEs based in Ireland surveyed via a questionnaire. A critical reason for using a novel dataset and also a secondary data is that secondary databases can often ignore areas which would present enlightening and informative findings. By implementing primary data as well, this can uncover new findings only touched on briefly through secondary databases given their structure and limitations.

However, the generation of primary data through the use of a questionnaire can take up a substantial amount of time and effort. To achieve this preliminary research was undertaken regarding suitable firms, and then 1,000 suitable SMEs in the high-tech sector in Ireland were invited to participate through an online survey provider. To ensure high-quality data, only the chairman, CFO, CTO CEO, majority owner, managing director/general manager or founder were requested to complete the survey. This confirmed the robustness of the data given the knowledge such roles entail, as opposed to more junior level employees. The overall quantity of firms participating in the survey provides robust confidence in the high-quality of the data, which is of the utmost importance in such qualitative research. In total 100 high-tech SMEs completed the survey and met the criteria for the SME definition regarding employee numbers and annual revenue (European Commission, 2012). While the overall quantity of firms participating suffered, the value and robustness of the data remained very strong. This is central for qualitative data as otherwise, the analysis would be in a reduced position, with the results suffering. When testing the hypotheses previously produced within the chapter, the dependent variables are described in Table 4.4, while the independent variables are defined in Table 4.5.

Table 4.4: Description of dependent variables from the primary questionnaire dataset

Dependent Variable Code	Dependent Variable	Variable Description
CHALL	Firm challenges	Main challenges which firms will face in the next 3 years (categorical variable)
DEBT	Debt percentage	Total debt finance as a percentage of total capital employed
DOMESTIC	Domestic sales percentage	Percentage of total sales based in Ireland
EBITDA	Earnings before interest, tax, depreciation and amortisation	Log of EBITDA
EMEA	EMEA without Ireland and UK total sales proportion	Percentage of total exports sales from Europe, the Middle East and Asia excluding Ireland & the UK
EQUITY	Equity percentage	Total equity finance as a percentage of total capital employed
EXPORT	Exports now	Whether the firm has generates sales through exports or not (binary variable)
EXPORTS	Export percentage of sales	Percentage of total sales that are exports
INTRNL	Internal finance percentage	Total internal finance as a percentage of total capital employed
OBJCT	Firm objectives	The long-term primary objective of the high-tech firms (categorical variable)
PROF	Firm profitable	Whether the firm is profitable or not (binary variable).
REV	Revenue	Log of the Total annual revenue
ROW	Rest of the world total sales proportion	Percentage of total sales which are exports from the remaining Rest of the world
UK	UK total sales proportion	Percentage of total sales which are exports from the United Kingdom
USA	USA total sales proportion	Percentage of total sales which are exports from the United States of America

Notes: This table provides a list of the dependent variables obtained from the questionnaire dataset, employed in the hypotheses testing in Chapter 7 and Chapter 8. The variable code used in the econometric models and the corresponding description for each variable listed is provided.

Table 4.5: Description of independent variables and from the primary questionnaire dataset

Independent Variable Code	Independent Variable	Variable Description
AGE	Firm age	Log of the number of years the business has been in operation
ALTMD	Alternative finance mid-term	Whether using alternative finance sources in the mid-term is envisaged (binary)
APLYBNK	Applied to a bank	The last time the firm applied for a bank loan (categorical variable)
DEBT	Debt percentage	Total debt finance as a percentage of total capital employed
EMPL	Firm employees	Log of the number of employees
EQUITY	Equity percentage	Total equity finance as a percentage of total capital employed
EXPER	Experience	Log of the number of businesses involved in during the initial stage.
EXPORT	Exports now	Whether the firm generates sales through exports or not (binary variable)
INACC	Incubator Accelerator	If the firm has used incubator or accelerator services(binary variable)
INFOASYM	Information Asymmetry	Range regarding the banks understanding of the SME high-tech sector (ordinal)
INTANGPERC	Intangible assets percentage	Percentage of the firm's total assets which are intangible
INTRNL	Internal finance percentage	Total internal finance as a percentage of total capital employed
PROF	Firm profitable	Whether the firm is profitable or not (binary variable)
R&D	Research and development	Percentage of turnover invested in research & development (represents future opportunities)
RATIOTARG	Debt Ratio Target Value	Debt ratio target
RISKPREF	Firm risk preference	A measure of risk preference via a prefered asset type with differing values (categorical variable)*
ROI	Return on investment	The percentage value for the required return on investment
ROR	Require rate of return	The percentage value for the required rate of return
SAMRKEXP	Sales and marketing expense percentage	Percentage of turnover invested in sales and marketing
SIZETURN	Firm size measured by turnover	Log of annual turnover
TARGDEBT	Targeted Debt Ratio	Whether the firm has a target debt ratio (binary variable)

Notes: This table provides a list of the independent variables obtained from the questionnaire dataset, employed in the hypotheses testing in Chapters 7 and Chapter 8. The variable code used in the econometric models and the corresponding description for each variable listed is provided. *RISKPREF is a categorical variable that utilises three options of different assets to derive a perceived risk level for the firm. The options available consist of; low worth tangible assets valued correctly (no risk), medium worth intangible assets valued adequately (some risk) or high worth intangible assets that may have been incorrectly valued (risky).

Chapter 5. Research Philosophy, Methodology and Research Design

5.1 Research Overview

Research is described as a progression towards intellectual invention, breakthrough and communication of new findings, which can alter the perceived knowledge and comprehension people currently possess about the world (Ryan, Scapens, & Theobold, 2002). Finance research encompasses analysis upon social issues through an adequate scientific investigation, which is described as social scientific research (Ryan et al., 2002). Without research and inquisitiveness, humankind would possibly not have progressed and plausibly could be still in the Stone Age.

Ontology is incorporating a viewpoint of what is reality and how it can be formed, further deciphering what knowledge can be gained (Guba & Lincoln, 1994). This is further expanded by how it relates to the research of what is real and the existence of concepts and objects (Ryan et al., 2002). In essence, ontology investigates what the shape and nature of reality is and what knowledge can be obtained from this?

Epistemology is defined as a relationship between, what can be discovered, the knowledge holder and the prospective knowledge holder(Guba & Lincoln, 1994). Indeed, the critical issue of epistemology relates to which path to follow to acquire knowledge and if it is the justified true belief, as defined by Plato (Ryan et al., 2002).

The methodology is the final component of research. Its main principle relates to the procedures and steps for a person, or prospective knowledge holder, to undertake in order to find what they believe to be known (Guba & Lincoln, 1994)?

These three components produce a research paradigm on which to base the research. This depends on the researcher's response to the separate parts and once focused, provide a paradigm to utilise (Guba & Lincoln, 1994).

5.1.1 Paradigms

The idea of a paradigm was predominately brought into discussion by Thomas Kuhn (1962) and it is described as the link between how we view and label things from a research perspective. A paradigm is explained as "the basic belief system or worldview that guides the investigator, not only in choices of the method but in ontologically and epistemologically fundamental ways" (Guba & Lincoln 1994 p.105). A research paradigm is further discussed as a defined set of beliefs, values and assumptions which a group of researchers fully agree upon when undertaking research (Johnson, Onwuegbuzie, & Turner, 2007). The importance of the research paradigm is not to be taken lightly for many areas of research, and thus a range of paradigms are in existence. This is supported by Donaldson (1995) who finds 15 different paradigms in use amongst researchers. It is a topic which has coined the term the "Paradigm Wars" given the hostility between key research paradigms when conducting research, which illustrates the importance it can have in understanding and replicating findings (Gage, 1989). A paradigm may be subjected to a range of criticism, but a satisfactory conclusion to these problems will occur only if a new, more developed and conversant paradigm evolves from the discussion (Gage, 1989). Kuhn (1962) believes that paradigms can follow a life cycle, whereby over time new paradigms will become the standard and replace older more criticised processes relating to subjects. It is found that any research paradigm can be appropriately integrated with both quantitative and qualitative methods, but this paradigm is a critical component of research (Guba & Lincoln, 1994).

5.1.2 Positivism and Postpositivism

Popper (1968) demonstrates how it is not philosophically possible to verify that analysis, as using the verification theory is an adequate approach. Indeed, given an infinite number of times, the experiment is undertaken; it must produce the same results to maintain the theories support. Given this, the theory of falsification is supported, whereby the difficulty of ensuring facts exist is no longer practical, and instead, the finding with one difference proves that the conceived theory may not exist and is incorrect. Two important paradigms will be presented and provide an overview of the key concepts which contribute to their approach to research.

5.1.2.1 Positivism

Positivism is the received view which has been at the forefront of social science for nearly half a decade. Although Popper did not overly follow a positivist approach, his discussion and rationale have proved critical with the falsification (Ryan et al., 2002). Guba & Lincoln (1994) describe positivism using the following three measures:

Ontology: Based on realism, where knowledge relates to the way things are. Research can unite to provide the true undertaking of the topic at hand.

Epistemology: An objectivist and dualist approach. Subjective analysis is deemed not important; as the researcher is independent of the topic and influences, so therefore, do not occur throughout the research.

Methodology: An experimental and calculating method is undertaken. Research questions and the use of hypothesis testing are the core concept of this analysis. These are then empirically tested to verify their standing in the research words, through a calculated approach which ensures that certain conditions do not influence the outcome.

5.1.2.2 Postpositivism

Positivism has been viewed as a label not sufficient for many quantitative researchers since it has been overtaken by new scientific philosophies (Yu, 2005). Postpositivism is a newer paradigm in comparison and seeks to fix key criticisms related to positivism. Guba & Lincoln (1994) demonstrate the three core concepts of postpositivism using the same measures previously shown:

Ontology: Based upon critical realism in which reality can be apprehended, while containing defects and the flaws of the intellect of humans and obdurate phenomena influence this reality. Critical realism encompasses a reality which is cortically examined by multitudes of analysis to ensure it closely resembles reality (Cook & Campbell, 1979).

Epistemology: An objectivist and modified dualist approach, where dualism is disregarded as it is unable to uphold the rationale. Objectivism, as discussed in positivism, remains in place. External protection of objectivity is now supported through the critical tradition and community to ensure its strength. Falsification is a key component of the analysis, particularly in research which includes replication.

Methodology: An edified experimental manipulative approach where critical multiplism is used to falsify hypotheses. Due to the stronger use of qualitative data and techniques, there is an initiative to remove critical issues relating to positivism. Ascertaining the purpose and rationale of actions is crucial as well as the collection of situational information and the use of discovery as a tool of enquiry (Strauss & Corbin, 1990).

Both paradigms' objectives have been shown to comprise of explanations of the topic, and ultimately the prediction and control (Von Wright, 1971). While the nature of knowledge for positivism relates to verified hypotheses, which are held as fact, postpositivism uses non-falsified hypotheses to produce only probable facts. (Guba & Lincoln, 1994) This is a significant difference as postpositivism recognises current fact or law which can change in the future. Finally, the accumulation of knowledge is viewed as the process whereby findings and facts are grouped, to produce more efficient generalisations. In turn, this can help increase confidence and predictability for future research (Guba & Lincoln, 1994). Given this overview of the components of each paradigm and also the objectives and nature of the findings, the postpositivist approach is undertaken in this research. A chief criterion is due to the implementation of both qualitative and quantitative data when investigating the topic of capital structure amongst high-tech SMEs.

5.2 Methodology

While researchers that utilise quantitative data state it is unbiased, precise and neutral, many critical elements of the topic are difficult to synthesise into figures without a general context of the overall conditions, which is a major issue with solely utilising quantitative data (Rao & Woolcock, 2003). Compared to qualitative data, quantitative data often produces the most robust and best quality results (Sechrest, 1992). However, as discussed in the previous chapter under the positivist paradigm, qualitative data may offer more information and provide insights, which quantitative data may fall to provide (Guba & Lincoln, 1994). Quantitative methods are optimally used to analyse changes in influences and the effects of variables but are unlikely to help understand the process involved (Rao & Woolcock, 2003). Additional support for qualitative data is found when implementing qualitative methods that assist in removing some critiques and restrictions associated with quantitative research (Bamberger, Rao, & Woolcock, 2010). Adequately worded questions in interviews and questionnaires can address possible heterogeneity involved and, such quantitative analysis can remove or exclude key elements (Rao & Woolcock, 2003). When qualitative methods are implemented, they provide a critical understanding of the influences but not the strength of the influences, however, implementing a combination of both methods should generate comprehensive results (Rao & Woolcock, 2003). Subsequently, undertaking a mixed methods approach will produce and improve the robustness of the results.

5.2.1 Mixed Methods Research

Solely using survey data for econometric analysis can produce a range of problems and shortcomings, often due to the nature of closed-ended questions, which are strongly associated with quantitative data (Rao & Woolcock, 2003). Mixed methods are defined as research which combines both qualitative and quantitative data collection, methods, techniques, concepts and analysis within a single study (Johnson & Onwuegbuzie 2004; Hurmerinta-Peltomäki & Nummela 2006). When focusing on the path to attaining knowledge, mixed methods considers various stances, perceptions and attitudes (Johnson Onwuegbuzie, & Turner, 2007). The key benefit of utilising a mixed methods approach is that predominately the strengths of one compensates for the weakness of the other (Rao & Woolcock, 2003). Campbell & Fiske (1959) are known as the first researchers to illustrate the implementation process of multiple research methods for the intention of validation. Mixed methods research can assist in closing the gap between quantitative and qualitative research (Onwuegbuzie & Leech, 2005). This is an important statement, as often they are both seen as methods which possess little resemblance with each other.

Three processes to integrate both quantitative and qualitative methods as a mixed research method exist. The first is known as the parallel approach, which suits governmental research and occurs when two separate teams research the topic each through one of the methods before the results are combined for analysis (Rao & Woolcock, 2003). The remaining two techniques are sequential and iterative processes, which are known as participatory econometrics. Quantitative and qualitative methods are implemented throughout the entire research process by the same researchers, with the sequential technique utilising different approaches in a sequence, whereas the iterative approach is comparable but can inform and alter the questionnaire design throughout the research process (Rao & Woolcock, 2003). Although additional technical work is involved, the strongest results are produced by utilising participatory econometrics (Rao & Woolcock, 2003). Bouchard (1976) further establishes that such an approach improves the validity of research and reinforces this inference as this occurs when the results are equivalent between the different analysis methods. If the results from both methods are different, this gained knowledge can be implemented to alter the interpretation of the results and thus improve the comprehension of the topic, which can be a strong objective (Onwuegbuzie & Leech, 2004).

5.2.1.1 Qualitative Methods Benefits to a Quantitative Approach

Research undertaken by Rao & Woolcock (2003) declare that implementing a quantitative approach when combined with qualitative methods will benefit the research with 3 of the most critical reasons presented below:

- By implementing an approach which also incorporates qualitative methods, it opens the entire research process to be impacted by the participants that can result in unexpected and substantial findings (Rao & Woolcock, 2003).
- Furthermore, it is a robustness check for the analysis since if the results from the two separate methods are severely different, it could be a signal of poor data quality or methodology issues in either method (Rao & Woolcock, 2003).
- Finally, a combined method provides an opportunity to measure previously unobservable issues through a qualitative approach which can alter the interpretation of the overall results given the contextualisation of the quantities data (Rao & Woolcock, 2003).

Overall, such a methodology can result in a new thinking and judgment approach, as two separate data sources are used with their issues (Rossman & Wilson, 1985). The results of a mixed methods analysis provide robustness in findings and an improvement in the validity, due to the different data sets analysing the same topic. (Hurmerinta-Peltomäki & Nummela, 2006). Given this information and description of the methodology, the research undertaken within the thesis will be mixed methods. A crucial rationale for this is due to a limited mixed methods approach to capital structure, especially amongst SMEs. Regarding mixed method analysis for high-tech SMEs capital structure, the author is unaware of any such research in existence. Subsequently, mixed methods provide a strong ability to generate valid and robust findings which will help disseminate accurate findings on topics, such as the capital structure in high-tech SMEs. As previously discussed, analysing research questions through a mixed methods approach can result in a clearer answer.

5.3 Previous Uses of Firm Survey Data on Financial Research

5.3.1 Primary Survey Data Analysis

The first component of the mixed methods research will incorporate a qualitative approach. In order for this to be undertaken, a questionnaire was produced and sent to the relevant businesses, once they were researched and deemed suitable for the analysis. A selection of analysis on capital structure has occurred since the turn of the century. The following research encompassed original datasets, due to the implementation of a survey enquiry, to generate the data. A selection of such studies utilising surveys to capture data are presented below.

5.3.1.1 Capital Structure Surveys

Graham & Harvey (2001) use survey analysis to examine the capital structure of 392 businesses based in the USA. The chief financial officer (CFO) was asked to complete the survey to provide greater strength in the answers, given the financial nature of the topic. The firms were a combination of both private and public entities. Bancel & Mittoo (2004) research capital structure through the implementation of the survey and generate a smaller sample of 87 businesses, consisting of 14 different countries. One difference in this analysis is that private businesses are not in the sample and so the analysis is based solely on public firms. An engaging use of survey data was produced by Brounen et al. (2006) which produced a survey using the same questions as Graham & Harve (2001), but with European firms, as opposed to those in the USA. In this research, they generated a sample of 313 businesses based in four different European countries and ss per Graham & Harvey (2001), both public and private firms are included in the research. The results are compared to US firms regarding the pecking order theory and information asymmetries through the findings by Graham & Harvey (2001) and also Bancel & Mittoo (2004) who researched European firms. This approach provides an interesting detail regarding the differences and similarities between European and American firms and also those which are public and private. Implementing primary surveys can present significant data that financial databases do not possess.

Further survey analysis is undertaken by Graham & Harvey (2013) in which US CFOs are again questioned about the risk premium and importance of equity. They received an 8 percent response rate and on average 352 responses from firms. This is another interesting approach to survey data, by analysing the firms again over a given time period to see if goals or financing has changed from the previous survey. Stucki (2013) uses a survey method which incorporates such an approach by implementing follow up surveys, years later. It examines how successful the start-ups are and whether financing issues influence their survival and profitability. A total of 630 firms completed three individual surveys. Regression analysis and descriptive statistics were used to present the findings. Hogan & Hutson (2005) analyse survey data of NTBFs which operate in the software sector. Their findings from a database of 117 firms are presented through summary tables and descriptive statistics. The impact of venture capital funding on firms, the VC managers' pre-planned exit strategy and the impact of equity finance were analysed by Cumming & Johan (2008), in which 35 VC fund managers that invested in 223 businesses completed surveys and interviews, to create the dataset. Mac an Bhaird & Lucey (2010) analyse the determinants of capital structure on SMEs through the use of surveys, with a sample size of 299 Irish firms. When analysing the importance of finance to innovation for TBSFs which operate in Italy, 46 private firms are analysed about their ability to obtain external debt and equity finance (Giudici & Paleari, 2000)

5.3.1.2 Innovation, Internationalisation and Export Surveys

The importance and impact of innovation and exporting and internationalisation have also been researched through surveys to generate a primary dataset. Research into the creation of knowledge and innovation of SMEs is undertaken by Purcarea, del Mar Benavides Espinosa, & Apetrei, (2013). They generate a sample size of 161 Romanian SMEs based in different industries. The importance of exporting in relation to the attainment of knowledge is researched by Love & Ganotakis (2013) who seek to find the impact on performance innovation. Under this survey, 412 high-tech SMEs based in the UK comprise the sample set. 62 new venture manufacturing firms based in the USA were surveyed, examining their performance and the influences on entering new international markets (McDougall & Oviatt (1996), The issues of internationalisation is researched by

(Westhead, Wright, & Ucbasaran, 2001) who implement surveys to produce data for their analysis. A follow-up survey is undertaken 6 years after the initial, which provides a keen insight into the influence of financial and human capital to export. A total of 621 SMEs based in Great Britain from the manufacturing, services and construction industries completed both surveys.

5.3.2 Secondary Survey Data Analysis

The importance of primary survey data should not be undervalued, as, given the time, effort and commitment in producing such a dataset is not an easy task. However, the use of secondary survey datasets has also been used in the topic of capital structure. This type of survey data is comprised of non-unique datasets which are available to all researchers and are not tailored specifically to the topic at hand. They are readily available databases, sometimes through a paywall which incorporates surveys to generate their figures.

A positive attribute is that often the sample sizes are much larger and the time and effort to generate adequate databases for analysis, is considerably less. A major benefit of this type of survey data is that the time frame is monumentally shorter in comparison to designing questions for the topic to ensure the best and most useful data is provided. Also, the data is downloadable and not reliant on survey participants to complete it within a specific time frame, as given its nature, the data already exists for researchers to use. There is no guarantee that questionnaires or surveys developed by researchers will gain adequate respondents, mainly if it consists of a random sample and the participant has no incentive other than to provide details for research. While this can be a critical element of primary data surveys, the elements and questions incorporated have been created and refined to gain maximum knowledge and information. However, for secondary survey datasets, the researcher must solely deal with the questions asked by the survey makers, and so questions cannot be configured to encompass certain topics. An issue that can arise is that researchers may use the data to produce similar analysis and results; thus the contribution of such research can be substantially diminished. A selection of relevant research articles, which utilise such survey data, will now be discussed.

5.3.2.1 OECD and World Bank Data

Salomon & Jin (2008) utilise manufacturing firms' survey data undertaken by the Fundacion Empresa Publica in examining patents over some time and the impact of exporting on gaining knowledge. It also uses GDP data from the Global Insight database and R&D data from the OECD. A global survey examining the businesses environment, undertaken by the World Bank, is the data used to analyse growth obstacles for businesses, in which smaller firms have the biggest obstacles (Schiffer & Weder, 2001).

5.3.2.2 USA Data Analysis

Cole (2013) undertakes analysis based on small firms, the data sources in use consist of the Survey of Small Business Finances (SSBFs) four independent surveys of firms based in the USA incorporating the years from 1987 to 2003. Berger & Udell (1998) analyse the importance of size and age on the capital structure of small businesses and predominately use data from the 1993 SSBF dataset.

Bernard & Bradford Jensen (1999) analyse the relationship between exports and strong performance compared to non-exporters. The data used consists of Longitudinal Research Database (LRD) of the Bureau of the Census and also the Census of Manufactures (CM) and the Annual Survey of Manufactures for years between the censuses. The period covers from 1984 to 1992. On average there were 50,000 to 60,000 manufacturing firms in the analysis for each year.

5.3.2.3 Kauffman Firm Survey

The Kauffman Firm Survey (KFS) comprises longitudinal survey data of businesses based in the USA. The KFS is used by Robb & Coleman (2010) to examine NTBFs financing strategies, in particular, the difference between those owned by men and those owned by women. Men are found to raise substantially more capital in the first five years in business. The KFS dataset is used again in 2011, with over 4,000 firms examined to investigate whether any capital structure theories are implemented by NTBFs in the USA (Coleman & Robb, 2011). In 2014, an investigation into external financing and the decision to implement debt or equity for start-ups were undertaken by Coleman, Cotei, & Farhat (2014). The study uses the KFS dataset and illustrates how a range of characteristics such as size and intangible assets can influence the US start-ups. Other researchers have also undertaken analysis with the KFS regarding SMEs and capital structure issues.

Robb & Robinson (2014) investigate 5,000 new US firms using the KFS from their initial year to the following few years. They find that debt finance from the entrepreneur is a highly used source of capital compared to friends and family finance. These findings are also supported by Cassia & Minola (2011) who also analyse 5,000 US firms from the KFS database and show that NTBFs use less finance from friends and family and have a more considerable dependence on external debt. Although the firm types are different, the result remains mainly the same and can illustrate the issue of using the same dataset for similar analysis. Subsequently, they provide robustness to each other, if not a discovery. Finally, Cassar (2014) using the JFS data, examines the importance of industry and prior experience in 3,355 start-ups and 2,304 entrepreneurs. When focusing on a firm's performance, high-tech firms' industry experience is found to improve the forecast performance of entrepreneurs.

5.3.2.4 European Based Survey Databases

Bellone et al. (2010) examine the impact of external finance on exporting behaviour between French firms. Two different databases are combined for use in the analysis. The first is an annual survey of firms in the manufacturing sector, Enquete Annuelle d'Entreprises (EAE), and secondly, the DIANE database, produced by Bureau van Dijk, which possess financial figures unavailable in the EAE survey. 5,700 businesses were examined as the sample size when analysing exporting benefits.

Pickernell, Senyard, et al. (2013) produced a sample using the data from the 2008 UK Federation of Small Businesses (FSB) which consisted of over 8,000 responses. The analysis examined the differences between young and older businesses access to resources such as finance and the future growth preference of the businesses. The same survey database was utilised in another research paper by Pickernell, Jones, et al. (2013) which examined SMEs relationship between variables such as innovation, human capital and e-commerce. The impact on innovation by financial issues is examined by Canepa & Stoneman (2008). They use the second and third Community Innovation Surveys based on UK firms and the surveys consist of cross-sectional data over 2 years for each type.

The survey dataset used to research Italian NTBFs is the Research on Entrepreneurship in Advanced Technologies (RITA) database, created by Politecnico di Milano (Colombo, Grilli, & Piva, 2006). The dataset is used to examine the determinants of over 500 high-tech start-ups concering the creation of partnerships between other organisations. The article investigates topics such as size and patents upon NTBFs (Colombo, Grilli, & Piva, 2006). The RITA survey databases are used to ascertain whether an issue exists between NTBFs and their ability to obtain bank debt finance (Colombo & Grilli, 2007). This analysis consists of 386 Italian firms and finds that they have a preference for internal capital. Bertoni, Colombo, & Grilli (2011) investigate high-tech start-ups using the RITA survey database, with a sample size of 538 firms over a 10 year period. Panel data is used to analyse the influence of venture capital finance on firm growth.

5.4 Research Design, Questionnaire Design and Responses

5.4.1 Research Design

As previously discussed, this research incorporates a postpositivist paradigm, using a mixed methods approach. The mixed methods approach includes quantitative data from the Orbis database and also survey data. The qualitative method is used due to some of the key questions asked in the survey which focuses on the finances, challenges, experiences and objectives of the firm and owner. The research encompasses a hypothesis and theory testing approach through a research investigation of high-tech SMEs' capital structure. Notably, the relationship which exists between financing options and main aspects such as intangible assets, size, exports, patents and objective are analysed. The survey focuses on Irish firms and the database incorporates European firms for analysis. Survey data is important due to the analysis it can provide regarding the outlook and opinion of firms, not available through financial databases (Davidsson & Wiklund, 2007). The research objective seeks to answer a number of critical questions:

1. *What are the sources of finance utilised by high-tech SMEs and how are they influenced by firm characteristics?*

2. *What effects do the capital structure, firm characteristics and human capital have on the goals and challenges of high-tech SMEs?*

3. *How do key firm characteristics and financing sources impact the exporting of high-tech SMEs?*

4. *What effects do the financing sources of high-tech SMEs have on their financial performance?*

Answering these questions will provide a greater understanding of capital structure within high-tech SMEs and what impact finance has on these chief topics.

A survey was created and sent to Irish high-tech SME participants and a financial database of European high-tech SMEs was also used for analysis of the capital structure. It is important to note that although this survey comprises a range of subjects, while much hard work, time and effort is taken up in creating a survey which gathers strong data to answer key questions (Rowley, 2014). 6 specifications of research design are discussed by Low & MacMillan (1988) which should be addressed clearly when seeking to examine entrepreneurs. Some of the most critical decisions will be discussed.

The first issue which must be examined is the specific purpose of the research (Low & MacMillan, 1988). This is important as previous research does not have a specific goal in the analysis and so providing a precise objective to the research amongst different analysis will prove beneficial to a greater understanding and outcome of the research. Subsequently, the specific objective of this research is to examine the impact of capital structure amongst high-tech SMEs through its determinants, impact on financial performance, relationship with intangible assets, goals and challenges and exports. Through a combination of Irish survey data and European financial dataset will produce synergy to allow a greater understanding of this topic. An imperative benefit of questionnaires is that compared to interviews a large sample of people and firms can be involved in the dataset, including those in different spread out locations (Rowley, 2014). As per their fifth decision, a substantial time frame is also incorporated with the analysis of the data from the Orbis database which is over 10 years and will prove worthwhile as a snapshot in time is analysed through the survey data. Low & MacMillan (1988) promote the research into longitudinal studies, and so panel data will be used to account for the periods in the data.

5.4.2 Sample Frame Survey Selection

When analysing the UK business sector, it is found that no single business register exists for the public to use (Curran & Blackburn, 2001). This is also the case for firms based in Ireland, and so it is difficult to quantify the total population which could be analysed through a survey method. An issue of SME research is that no such listing of total companies exists and this is particularly true when creating a breakdown into individual sectors, such as the high-tech. Subsequently, the estimation of the result concerning the total population is an issue with such data. Dillman (2007) notes that survey research can analyse a population about specific characteristics within certain confidence levels. Without knowledge of the total population, the sample size may be a strong representative of the firms or a very weak one.

A method to atone for this issue is by utilising a list of the firms from relevant data sources in the industry. Audretsch & Elston (1997) previously used data from banks to generate a relevant database. In this study, Bank of Ireland provided a list which they had created over some years of 1,000 Irish high-tech SMEs. Unfortunately only half the firms possessed contact details and so the remaining 500 firms were investigated individually in order to obtain an adequate number of email addresses for which to send an invitation to the survey. Further analysis regarding the products or services they offered, was embarked to ensure the firms were in the high-tech sector.

When analysing small high-tech firms based in the UK, Westhead & Storey (1997) used a sample of businesses which were located in science parks to generate a list of relevant firms for analysis. They also found high-tech SMEs which were not located in such science business parks, resulting in a total sample size of 188 high-tech films for analysis.

Reviewing such business and science parks was an approach undertaken to obtain more firms who could meet the criteria to participate in the survey be part of the sample for analysis. Incubator hubs such as The Guinness Enterprise Centre and The National Design and Research Centre were selected. The SMEs based in these entities were analysed to ensure they matched the appropriate criteria for the high-tech sector and then added to the initial database provide by Bank of Ireland.

The research follows the path taken by Westhead & Storey (1997) since some of the firms are based in such centres, while the remaining businesses are based elsewhere. Interestingly 100 firms form the sample size, which is strong when allowing for 188 analysed by Westhead & Storey (1997), considering the population difference between Ireland and the UK. Given that the industry was again verified, with the revenue generated and the number of employees in the business, three firms which completed the survey were removed. The reason for this is under the EC definition, they were large firms, not SMEs, due to the number of employees (European Commission, 2012). Subsequently, the sample size consists of firms that fully completed the survey and open to analysis, consisting of 100 high-tech SMEs.

5.4.3 Questionnaire Design and Development

Questionnaires and surveys are most beneficial when there is sufficient knowledge regarding a topic and asking relevant, strong questions can result in gaining new knowledge and a stronger insight into the topic (Rowley, 2014). It further develops an ideology that questions should be created to provide data which can answer the research questions posed, when possible. While this may not always be the case, asking sufficient questions regarding a particular topic may result in relevant information to extrapolate data for unanswered research questions. The questionnaire was administered through email, which included a cover letter and also a web link to gain access to it via Fluid Surveys, as my supervisor had access to his own account. The questionnaire was accessed through the online survey provider, in which the analytics could be tracked in a real-time manner. A prerequisite for completing the survey was that only the CEO, CFO, CTO, Chairman, Majority Owner, Founder, Managing Director or General Manager were the respondents and confirmed in one of the first questions asked. This would provide more robust data, due to the knowledge of the businesses which these roles entail, as opposed to a junior manager or sales representative. It is crucial that the participant will answer questions asked when creating a questionnaire (Rattray & Jones, 2007) and so this must be encouraged by design. In essence, there is no point in asking interesting and probing questions as often the majority of respondents will ignore such questions as they are often only willing to provide certain levels of information. In relation to questions about capital structure and financing, particularly for smaller firms which have extremely close links to the owner's income, these should not pry too heavily for research samples (Ang, 1992).

The questions used in the questionnaire and research itself are influenced by either previous research, prior experiences or sometimes both. These aspects can change the perspective on the researcher's goals from the analysis, via the research questions as research which is built upon previous findings and theory is known as deductive research (Rowley, 2014). This is a significant issue to acknowledge and demonstrates the critical role of understanding previous topic research. If researchers do not, they may use the same questions analysing similar industries or firms. While this may not provide groundbreaking findings, as perhaps proposed, it may instead provide support or oppose previous results. Subsequently obtaining an insight into previous theory and results is an important area when developing a questionnaire. The correct use, creation, and implementation of questionnaires can result in quick and cheap data collection, compared to other methods available (Bowling, 1997).

It is critical that the correct question types are used to gain the best data available. Rattray & Jones (2007) discussed the different question styles which can be used to gain insight into a questionnaire. The first relates to a closed question which can limit the knowledge gained from the responses since a simple answer is provided (Bowling, 1997). Subsequently, it is discussed how open-ended questions encompassing a qualitative approach are enormously beneficial when the subject matter has little prior research. Frequency scales are another question type, in which the respondent chooses a point on the scale that relates to their belief of the question at hand. An example could be how well does your bank understand your business sector, with the answers ranging from; possesses little understanding, to, possess a large understanding. They provide greater insight than closed questions and are often used to obtain knowledge on perceptions and beliefs (Bowling, 1997). The importance of adequate questions is discussed by Rowley (2014), who declares that the researcher must relate to the research question and goal of the analysis when deciding on the question type. Furthermore, it is important to note that if a neutral option were not available for frequency scale questions, it can cause issues. An example would be if an sufficient understanding option was not available in relation to the banking question, this can result in participants unsure how to answer and subsequently, non-response bias can occur due to this issue (Burns & Grove, 1987).

However, most questionnaires will utilise a range of different question types to ensure the best data is obtained.

Sometimes, given the context of the analysis, some participants will not provide specific details, often financial data which they prefer not to disclose (Cox, Elliehausen, & Wolken, 1989). This is an issue which has to be addressed in the question creation first and then the data analysis as a final option. It can cause a severe impact on the analysis and topic under examination, particularly if crucial data such as debt value when examining the capital structure. It is best practice to review certain elements with a sample of proposed participants, discuss with practitioners in the field and also review previous literature. This will ensure the questions are valid in content (Bowling, 1997; Priest, McColl, Thomas, & Bond, 1995). It is crucial when discussing the influence of wording and structure of the questions as it can influence the outcome of the participants' answers (Baker & Foy, 2008). Finally, specific sections which analyse topics such as goals and challenges, current financing and firm characteristics should consist of questions together and in order (Rowley, 2014). This makes sense as it allows respondents to generate information regarding a particular topic for some questions. This topic focused approach to questioning should allow them to produce more realistic data and in a quicker time too. Indeed, the wording, layout and question type can sometimes produce response bias, and so the questionnaire should deal with more intrusive and engaging topics in the middle or end of the questionnaire (Rattray & Jones, 2007).

5.4.4 Questionnaire Testing and Pilot Study to Improve Responses

Before the survey was emailed to the high-tech SMEs, the questionnaire went through rigorous changes and alterations to ensure the most exact and interesting questions would be asked to gain the best data available. The advice was solicited from professionals who work closely with high-tech SMEs and are involved in the supply of finance. This included the head of technology lending at Bank of Ireland, Adrian Mullet and his team and their marketing department. Academic knowledge and support were initially supplied by Ciaran Mac an Bhaird, who previously used survey data for examining capital structure in SMEs. Douglas Cumming has investigated the impact of venture capital finance through surveys and interviews, was also consulted on question types and areas of interest. My supervisor, Brian Lucey, who has previously undertaken this type of research, ensured the questions were relevant and would produce the data sought. Although it took time to produce a number of drafts through the implementation of their recommendations, the findings from the paper have produced a unique dataset with a focused scope of topics not already covered in detail, particularly for high-tech

SMEs. Before the questionnaire could begin, an application was submitted to the Trinity Business School's research ethics committee. This was to ensure we would not break any guidelines and followed best practice, given the nature of financial issues involved in the questionnaire. The ethics committee provided clearance to undertake the research and strict guidelines were followed to maintain the anonymity of respondents where possible.

To ensure the survey would work fluidly with no issues a pilot study was undertaken in which 20 of the firms were randomly selected and provided with details to undertake the study. Three firms completed the survey and feedback was asked of them regarding any issues in question structure or wording. Given this feedback, some minor changes were completed on some of the questions relating to frequency scales and those with two or three parts. The average time taken to complete the survey was 25 minutes, and this was due to the range and amount of questions involved at over 35 questions. While this may be many questions, they were deemed essential given the topics analysed and so it was quite an extensive and time-consuming questionnaire compared to other surveys previously mentioned.

Previous research has demonstrated that providing notice of a questionnaire can improve the response rates (Dillman, 2007); however since these were cold emails, it was decided not to increase their intrusion levels. Subsequently, the participants received an email which included a cover letter as shown in the appendix section and a web link. A university association can add gravity to the questionnaire and encourage more participants to take part according to (Dillman, 2007). Following this knowledge, the logos for both Trinity Business School and Bank of Ireland were prominent on the opening page of the survey. The cover letter explained that the research was being undertaken as a joint venture between Trinity College Dublin and Bank of Ireland to investigate the high-tech sectors' relationship with capital structure and other important topics which were mentioned. After the cover letter, a unique link was provided to the firm in question; the email was sent from my Trinity email address, through the use of the email system in place from Fluid Surveys. This could track which respondents had opened the link, partially completed and fully completed the questionnaire. Previous studies have suggested that use of motivation of the monetary kind can improve the response rates (Cooper & Yu, 1983). Bank of Ireland kindly offered to enter each participant into a draw for an Apple IPad as an incentive to complete the survey.

The most useful techniques to improve the response rate are to follow-up and send reminders and also incentives through monetary earnings (Kanuk & Berenson, 1975). Two separate reminder emails were produced; the first, three weeks after the original email and then another three weeks after the first reminder email. The survey system removed those who had fully completed the email from the subsequent emailing list and not asked to submit twice nor had an unnecessary intrusion.

5.4.5 Response Rate

One issue with the use of an online survey is that some participants may have a software installed which sends emails that are not part of the contact list directly to spam or junk mail folders (Sills & Song, 2002). However, this is similar to using phone questionnaires with an incorrect phone number. In essence, researchers are relying on something or often someone else, such as a filter email check or a phone call transfer, so that the person can complete the survey.

Non-response bias is a crtical aspect of surveys, given the results could vary significantly if those who did not participate completed their questionnaires. One method used to test for non-response bias resonates with the analysis and comparison of data from those who responded quickly and those who completed the survey last after numerous reminders. This is the case as previous research states that late participants will likely have similar answers to non-respondents if they would have participated (Oppenheim, 1966). No issues existed between the late and early survey participants answers and this suggests that non-response bias in data should not raise any disquiet. Baruch (1999) analyses the response rates of questionnaires and finds that on average the response rate is 55.6 percent with a relatively high standard deviation of 19.7 percent. However, as time passed on, a decline in the response rate occurred. When analysing surveys which need top management or people from the business to participate, the rate is significantly smaller with 36.1 percent and a standard deviation of 13.3 for firms in the USA. Indeed this lower value from senior people is supported by Denison & Mishra (1995) who gained just 21 percent of responses from business CEOs. In this research, a 10 percent response rate was gained, which given the type of inquiry and size of the firms, is justifiable. 100 completed questionnaires can provide sufficient results for statistically significant analysis, provided that it is not divided further into sectors which can impact the significance (Rowley, 2014). The criteria for the dataset has by definition already adjusted for subgroups. Therefore the 100 responses will allow for detailed analysis regarding capital structure in high-tech SMEs.

5.5 Data

5.5.1 Survey Data Overview

In relation to this survey an SME is defined as a business with no more than 249 staff members, a turnover of less than €50million and a balance sheet total of less than €43million (European Commission, 2012). In total 160 high-tech businesses answered at least 10 of the questions, the number of valid questionnaires completed in full was 103. However for the survey results, there are 100 total high-tech SMEs which are investigated as one firm's number of employees was greater than 250, while two of the firms generated sales were larger than €50milliom thus under the official SME definition these firms were excluded from the analysis (European Commission, 2012). Subsequently, for the survey results, there are 100 total high-tech SMEs providing results. While the overall quantity of firms participating did suffer, the value and robustness of the figures remain strong. Subsequently, as without this value, the qualitative nature of analysis would be in a detrimental position, with the results suffering. Overall a 10 percent response rate was achieved which is similar to the usual response rates for surveys (Curran & Blackburn, 2001b). The incorporated questions utilised ranges for answers as opposed to unique values, to allow a better grasp of the high-tech sector in Ireland. Questions revolving around revenue, profits and growth are answered using bands of values, because revenue of the firm positively correlates to the owner's personal income (Ang, 1992). Other questions include frequent scales and results from such questions can be treated as interval data, which allow them to be involved in parametric tests (Bowling, 1997; Burns & Grove, 1987).

5.5.1.1 Size, Age and Revenue Overview

The age profile of these firms compared to both the revenue and employees within the businesses are provided in Table 5.1 and Table 5.2. They illustrate how a good proportion of differences exist between the data. It is worthwhile to illustrate the types of firms which are examined in this survey, to provide a greater understanding when examining the financial performance, capital structure, future opportunities, goals, exports and challenges regarding these firms. Table 5.1 provides a breakdown of the number of employees in the firms as well as the total number of years the businesses have been in operation. These firms are categorised using the European Union's definition for micro, small and medium-sized companies using these components as well the firm's revenue figures (European Commission, 2012).

Table 5.1: The age profile of the high-tech SMEs compared to employee numbers

	Micro		**Small**		**Medium**	
Years	1 Sole Employee	2 to 9 Employees	10 to 20 Employees	21 to 49 Employees	50 to 249 Employees	Total
Up to 2 Years	0	16	2	0	0	18
2 to 4 Years	4	14	3	1	1	23
5 to 10 Years	3	8	3	4	3	21
11 Years+	1	8	7	13	9	38
Total	**8**	**46**	**15**	**18**	**13**	**100**

	Years	Employees
Mean	8.235	32.33
Std Dev	5.683	48.99
Pearson chi2 (12)	= 39.556	Pr = 0.000
Likelihood-ratio chi2 (12)	= 45.793	Pr = 0.000
Fisher's exact	= 0.000	

Notes: The table represents a breakdown of the high-tech SMEs into the 3 distinct SME types: Micro, Small and Medium. The table illustrates the number of employees within the firm and the corresponding age of the firm. Additional descriptive information about the data such as the mean values is provided. Tests are provided to prove the validity of the results, such as Fisher's exact test.

When examining the age of the businesses the greatest proportion is represented by 11 years and older, with 38 percent of the firms. This is expected given the prior research undertaken by Irish software firms had a figure of 19 percent for such an age category (Hogan & Hutson, 2005). Table 4.1 provides an engaging insight for the firms within the sample data, as this portrays an evenly dispersed proportion of firms concerning both the firm age and number of employees. Such a large amount of older firms is interesting given the number of micro firms in the dataset, at 54 percent. While substantially large when analysing SMEs in all sectors within the EU, 90 percent of these businesses possess less than 10 staff members (Mettler & Williams, 2012). Unsurprisingly, older firms employ the greater amount of people. While a substantial proportion of employment is part of the micro and small business categories, this could account for the larger amount of small and medium-sized firms in existence, having a substantial employment amount. 41 percent of the businesses are less than 5 years old meaning they were created during the recession and at the beginning of the economic recovery in Ireland, meaning it is an interesting range of ages and sizes for analysis of high-tech firms. Firms which are 11 years or older and those which have between 2 to 9 employees are the most common charactersitcs for high-tech firms, with 28 percent and 46 percent, respectively, However only 8 percent of the high-tech SMEs within the total sample possess both of these features.

Table 5.2: The revenue profile of the high-tech SMEs compared to employee numbers

	Micro		Small		Medium	
Revenue	1 Sole Employee	2 to 9 Employees	10 to 20 Employees	21 to 49 Employees	50 to 249 Employees	Total
< €250,000	7	29	0	0	0	36
€0.25m to €1mil	1	16	7	2	0	27
€1m to €2.5mil	0	0	5	7	0	12
€2.5mil to €5mil	0	0	2	5	3	10
€5,000,000+	0	0	1	4	10	15
Total	**8**	**46**	**15**	**18**	**13**	**100**
	Years	Revenue				
Mean	8.235	€1,733,333				
Std Dev	5.683	€2,106,646				

Notes: The table provides a breakdown of the high-tech SMEs into the 3 distinct SME types: Micro, Small and Medium. The table illustrates the number of employees within the firm and the corresponding annual revenue value that was generated. Additional descriptive information about the data such as the mean values and standard deviations is provided.

In relation to revenue, over half of the firms have revenue of €1million or less, while all of the high-tech SMEs that generate at least this amount have a minimum of 10 employees. Furthermore as per analysis, the firms which have the largest amount of employees, unsurprisingly, have the highest revenue amounts and the same applies for smaller firms which have smaller sales values. Both of these figures provide an interesting breakdown of the firms analysed and the current characteristics of high-tech SMEs, which will provide foundations for further analysis within the paper. The revenue of these firms have a large proportion within the lower amounts, with 36 percent generating less than €250thousand and 63 percent of the businesses generating less than €1million in a year. 15 percent of the high-tech SMEs have revenue in the highest category of €5million or more. The firm characteristics findings illustrated in this table will provide a solid foundation when undertaking further analysis. The main sections which are analysed and disseminated within the thesis correspond to the relationship of capital structure with such essential variables as the number of employees, business size and revenue.

5.5.2 Database Data Overview

A key issue regarding research in the SME sector is obtaining reliable, up-to-date and useful data. Many databases, both in Europe and the USA, are missing a variety of distinct details, or are often not available. One such example of research relating to SMEs is the National Survey of Small Business Finances (NSSBF), based upon US firms, which has not provided publically accessible data since 2008. Another is the European Commission in collaboration with the European Central Bank which produces a database relating to the Survey on the Access to Finance of Enterprises (SAFE). This database is accessible and updated on an annual basis and provides some strong data, but focuses primarily on the access and use of external sources of finance. Limited information regarding revenue and expenses are provided and often in a broad spectrum approach. Subsequently, in order to gain strength, the use of the Orbis database, previously known as the Amadeus database, was utilised. The database is produced by Bureau van Dijk and consists of firm-level data of both private and public European companies encompassing key criteria such as balance sheets, profit and loss accounts or company information annually. The data spans multiple countries and industries and has been utilised in the previous analysis of capital structure (Brounen et al. 2006; Santos, Moreira, & Vieira, 2014; Grilli & Murtinu 2014; Goddard, Tavakoli, & Wilson 2005; Psillaki & Daskalakis 2009; Mac an Bhaird & Lucey 2014).

When defining an SME, the definition provided by the European Commission for data collection and analysis is used. Primarily, a company is an SME if it employs no more than 249 employees. Secondly, a firm can no longer be classified as an SME if it generates over €50,000,000 in revenue or if their total assets are values over €43million (European Commission, 2012). The high-tech sector is an engaging area to investigate given that it covers a broad range of different areas, under one arching roof. In order to define the firms effectively, we utilise the high-tech NACE Rev.2 benchmarks codes (Eurostat, 2014). The NACE is known as the statistical classification of economic activities in the European Community and is supported through the use of all its members. Subsequently, the critical rationale for data selection instigated the following for each firm:

1: Only businesses adhering to the high-tech NACE Rev. 2 codes are included.

2: The number of employees could not exceed 249 for any of the 10 years under analysis.

3: The revenue did not exceed €50million for all of the selected time periods.

4: The total assets of a firm could not be valued over €43million throughout the entire 10-year span of analysis.

5: The businesses were all based in Europe.

6: The data search included both active and inactive businesses.

7: Subsidiaries were not included.

8: The category of the firm type selected were small and medium business, for robustness.

9: Financial data covered the years 2007 to 2016 when available.

Given this criterion, a total of over 7,300 high-tech SMEs based in 20 different countries, throughout a 10 year period encompasses the sample. The breakdown of the country base for these firms is presented in Table 4.1. This results in a total of 73,000 observations comprising over 100 separate total variables. The broad range of countries will produce relevant results, given that this specific data has not been previously utilised for the proposed research area. The research using this panel data addresses important topics not often examined, particularly for European high-tech SMEs.

5.6 Panel Data

Panel data consists of data that combines cross-sectional observations over a range of time periods regarding the same firms, countries, occasions and people (Baltagi, 2005) Cross-sectional data, denoted by *i,* combines with the second component, time series analysis, denoted by *t* (Hsiao, 2007). This is extended by Greene (2003) who declares that panel data utilises the cross-sectional data of the time aspect as a method to predict economic effects. The impact of time is not to be underestimated within panel data, as its effects have the same level of importance as cross-sectional in the analysis (Wooldridge, 2001). Panel data can recognise and compute the effects that neither time-series nor cross-section data can (Hsiao, 2003; Klevmarken, 1989). The analysis that utilises panel data is found to be better than both cross-section and time series analysis since the issue of observation number deficiency does not occur (Bayrakdaroglu et al., 2013). Compared to analysis through either cross-sectional or time series data alone, panel data can find and compute effects often not available in one-dimensional data (Brooks 2002; Baltagi 1995). Panel data improves the reliability of the parameters under analysis due to the reduction in interactions among the variables, which improve the information flow (Hsiao, 1986) When researching behavioural issues it can provide a more significant opportunity for analysis. Furthermore, implementing panel data allows the researcher to control omitted variable impacts, test more complicated hypotheses which can lead to the discovery of dynamic relationships and produce more exact predictions for specific outcomes through the pooling of data (Hsiao, 2007).

5.6.1 Unbalanced Panel Data

Unbalanced panel data occurs when the sample of participants' information over successive time periods is incomplete since some participants may not have data available throughout the entire period due to their circumstances (Arellano & Bond, 1991). This occurs often for business data, but it does not have a significant impact on the analysis provided that each participant supplies information on a minimum number of successive time periods (Arellano & Bond, 1991).

5.6.2 Panel Data Growth

Under the Social Sciences Citation index in 1986 just 29 journal papers utilised the keywords of panel data or longitudinal data, but by 2005 this had increased by over 2,600 percent to 773 papers, demonstrating the substantial growth of this data types popularity in more recent decades (Hsiao, 2007). This growth is expanded by Baltagi (2005) whereby panel data was implemented into US research during the 1960s but only began in Europe during the 1980s. While social science research began to utilise panel data in the turn of the century, according to Griliches & Hausman (1986) economic research had become universal by the mid-1980s. This illustrates the differences in such data and how it has become important in the analysis of businesses and people, as opposed to economic data. Econometric research that implements panel data has grown significantly due to three key reasons, the first of which consist of previous methodologies being challenged often through other data types such as panel data (Hsiao, 2007). The second reason for such growth relates to the improvement in capabilities to undertaken complex research and implement multifaceted models and finally, the greater availability of panel data in the past 2 decades in comparison to previous accessibility has assisted in such escalation in use (Hsiao, 2007). The use of panel data in econometric regression has seen an uptake in use over the past 15 years and analysis using this data type has proved beneficial in a considerable array of literature examining capital structure (Bayrakdaroglu, Ege, & Yazici, 2013; Bridges & Guariglia, 2008; Ozkan, 2001; Sogorb-Mira, 2005; Zeitun & Tian, 2007).

5.6.3 Panel Data Benefits

Panel data provides more insightful information, higher efficiency, strengthens the degrees of freedom and also decreases variable collinearity, which allows for more precise and robust results (Hsiao, 2003; Klevmarken, 1989). Implementing panel data allows the researcher to controls individual unit and time heterogeneity, which cannot be performed in the analysis using time-series data and cross-sectional data (Hsiao, 2003; Klevmarken, 1989). Some of the main benefits of panel data are discussed:

5.6.3.1 Removes and Controls for Bias

The figuration and characteristics of panel data provide researchers with the capabilities to implement statistical techniques that can evade or lower the impact of omitted variable bias (Michaelas, Chittenden, & Poutziouris, 1999; van der Wijst & Thurik, 1993). Within regression analysis of panel data, the intercept term can engage and absorb the omitted variable bias effect, since it captures data on the units individuality and the dynamics at various points in time throughout the time period, which provides for time and individual heterogeneity (Hsiao, 1986; Hsiao, 2007). Carpenter, Fazzari, & Petersen (2018) demonstrate that panel data can control individual firm effects so that results from cross-sectional regression analysis are not biased. Through the analysis of individual means' deviations, the 'within' aspect of data, panel data can remove some primary sources of bias (Griliches & Hausman, 1986).

5.6.3.2 Covariance and Degrees of Freedom

Panel data econometrics implements the covariance approach analysis to account for and manage the 'individual effects' through an estimation of coefficients from the data's 'within' aspect (Griliches & Hausman, 1986). Within this aspect, covariance is defined as the calculation of two random variables' joint variability (Rice, 2007). Panel data provides a platform to identify and measure errors-in-variables models, without external instruments being implemented (Griliches & Hausman, 1986). In comparison to cross-sectional data, panel data increases the degrees of freedom and sample variability given the substantial amount of data points, and this affords greater precision in deducing model parameters (Hsiao, 2007).

5.6.3.3 Collinearity

Econometric analysis benefits from improved efficiency in the results due to a large number of data moments, which combines time and cross-section data, reducing the independent variables' collinearity (Hsiao, 1986) Furthermore, implementing panel data into the analysis can reduce the issues of multicollinearity and also exhibit higher levels of significance (Baltagi, 2005).

5.6.3.4 Greater Deduction - Control Group

Panel data offers advantages that cross-sectional data cannot, such as providing its type of control group since the participants must occur multiple times, which can produce more legitimate causal deductions (Allison, 2009). When analysing the capital structure of firms, panel data analysis provides an ability to control for hidden effects that can relate to the parameters involved (Bayrakdaroglu, Ege, & Yazici, 2013). Variables that change over time for participants, such as policies, plus variables that cannot be measured or observed like business culture differences, can all be controlled through panel data analysis (Torres-Reyna, 2007). Panel data can provide information which cross-section data cannot, such as changes relating to an individual or firm, affording greater analysis into adjustment changes that occur due to economic alterations (Angus, 1995). Panel data can also produce more computable analysis and assessable statistical deductions since the data type allows researchers to undertake various changes to estimators which can identify new models (Griliches & Hausman, 1986; Hsiao, 2007).

5.6.4 Panel Data Limitations

An issue with panel data suggests that it is hard for researchers to utilise it optimally since only a severely limited amount of graduate sociology programmes integrate panel data training (Vaisey & Miles, 2017). Sometimes measurement errors can be distorted due to the poor wording of questions, incorrect choice of participants, memory errors or the erroneous input of the response (Baltagi, 2005; Kalton, Kasprzyk, & McMillen, 1989). There can be non-responses from participants, who refuse to take part initially, while this can become more severe over time due to attrition when respondents stop providing information after some successive participation (Baltagi, 2005; Ridder, 1992). The design and collection of information for panel data can result in a variety of issues, particularly in relation to data management and collection for panel surveys (Kasprzyk, Duncan, Kalton, & Singh, 1989). For some panel data, the time period can be on an annual basis and cover a short period, but increasing the time periodcan be highly costly and enhances the likelihood of attrition (Baltagi, 2005). It is critical that panel data has a significant period; otherwise considerable bias can occur (Roberts & Tybout, 1997). The issue of cross-section dependence can arise when macro panel data does not take cross-country dependence into consideration, which can then produce incorrect conclusions (Baltagi, 2005). Cross section independence is significant for many unit root tests, and so this issue should not be disregarded (Baltagi, 2005).

5.7 Fixed and Random Effects

5.7.1 Overview

In relation to regression analysis, panel data provides the ability to eradicate or evade omitted variable bias, by utilising variable-intercept models that can implement time specific and/or business type effects (Hsiao, 1986) The variable intercept models can be estimated using either fixed effects (FE) or random effects (RE) (Michaelas, Chittenden, & Poutziouris, 1999). They both use the components of panel data to estimate the unobserved time-constant, unit-specific data, *vi,* that can impact the participants responses, but the FE model permits the observed independent variables to be correlated with the unobserved time-constant factors of the participant, while the RE model does not allow a correlation (Vaisey & Miles, 2017). It is suggested that the FE model presumes that endogeneity of the independent variables occurs due to the random individual effects, while the RE model deduces that independent variables have exogeneity with the individual effects (Mundlak, 1978). For such variable-intercept models, the cross-section and time-based effects can be considered as either fixed constants or random variables, if implemented through fixed-effects or random-effects models respectively (van der Wijst & Thurik, 1993).

Unobserved heterogeneity effects can be presumed to be one of the following three options; fixed parameters through the FE model, random variables through the RE model or a combination of both through a mixed effects model (Hsiao, 1986). Producing legitimate deductions on structural parameters, β, by controlling the effect of unobserved heterogeneity, γit , is the critical issue for panel data analysis (Hsiao, 2007). A different approach to both the RE and FE models is presented by Bell, Fairbrother, & Jones (2018). For both models, the variance of Level-1 entities, such as the individual participants, follows a normal distribution. Level-2 entities such as the country of the participant are notable in discerning between the RE and FE model. The random effects of level-2 units in the RE model are assumed to be random from a normal distribution, while they are considered to be unrelated in the FE model, with the random effects for individuals deemed to be dummy variables (Bell et al., 2018). The higher level variance is related to these dummy variables, which stops the acknowledgement of any other variables (Bell et al., 2018). The FE and RE models are two of the most used methods when undertaking panel data analysis (Vaisey & Miles, 2017).

5.7.1.1 Model Selection

It is proposed that deciding on whether to implement a fixed or random effects requirement should not be an issue of hypothesis testing but instead dealt as a model selection concern (Hsiao & Sun, 2000). In order to assign which model is best to implement for the analysis, a specification test can be implemented, such as the Hausman test (Bayrakdaroglu, Ege, & Yazici, 2013). When the coefficients are relevant the FE model is to be used, and if they are irrelevant the RE model is undertaken (Hausman & Taylor, 1981). If the error terms of different individual participants are correlated, then the RE model should be used instead of the FE model according to the Hausman test (Torres-Reyna, 2007).

5.7.2 Fixed Effects Model

The fixed effects model tests the hypothesis that group-specific fixed effects are not the same as each other in order to confirm the existence of effects (Bayrakdaroglu, Ege, & Yazici, 2013). The individual effects of businesses are deemed to be a fixed effect in this type of model (Greene, 2008). Critical cognisance of the FE model proposes that because unobserved variables remain the same throughout time, therefore other influencers must affect the predicted variable when it changes (Stock & Watson, 2003). FE models have significant strength since they can control for all variables which remain the same over time for the participants but do have a constant impact on the results (Vaisey & Miles, 2017). The time-constant qualities are solely associated with each participant and are not to be correlated with any other participant's qualities (Torres-Reyna, 2007). The coefficient values of observed time-varying descriptor variables are estimated with FE models which then only use within-respondent variation, since they utilise the panel data to remove both the observed and unobserved time-constant factors, such as the place of birth (Vaisey & Miles, 2017). The coefficients are expected to adjust among both the units and time or just among the units, under the FE model (Bayrakdaroglu, Ege, & Yazici, 2013). Subsequently, the variation in performance of units is determined by the differences in the fixed effects (Yaffee, 2003).

5.7.2.1 Fixed Effects Strengths

Since the FE model controls for all of the individuals' time-constant dissimilarities, the results from the FE regression analysis are not biased due to omitted time-constant features (Kohler & Kreuter, 2009). When seeking to examine the reasons for changes within an entity, the FE model can produce substantial findings (Torres-Reyna, 2007). Overall, compared to other methods the FE model has broader support for implementation by researchers (Allison, 2009; Halaby, 2004)

5.7.2.2 Fixed Effects Weaknesses

The first issue regarding the FE model is that it cannot produce the coefficient estimates for descriptor variables which are time-constant, such as place of birth since it only implements within-respondents (Vaisey & Miles, 2017). The second weakness of the FE model is that parameter estimates produce larger standard errors due to less variation in the model, although thiis more acceptable than wrongly implementing the RE model (Vaisey & Miles, 2017).

5.7.3 Random Effects Model

The RE model consists of a regression which contains a random constant (Greene, 2003). Due to the decrease in the level of significance associated with FE models, the RE model was created and in this model, the constant coefficients of units are expected to remain the same (Bayrakdaroglu, Ege, & Yazici, 2013). The RE model works on the principle that the individual effects of units are unplanned and that the constant is randomly established in order to attain the error or unconsidered explanatory variables (Bayrakdaroglu, Ege, & Yazici, 2013; Tunay, 2009). The difference between the FE and RE models relates to whether a correlation exists between aspects of the unobserved individual effects and the independent variables, or not (Greene, 2008; Torres-Reyna, 2007). To account for time dependency, the unexplained residual variance within the entities is categorised into two groups, with the higher-level residual denoting the random effect (Bell & Jones, 2015). Random effects are associated with the lack of correlation between the unobserved effect and the observed independent variables (Wooldridge, 2001). Given this, the RE model should be implemented if it is expected that the dependent variable is impacted by the differences across units (Torres-Reyna, 2007).

5.7.3.1 Random Effects Strengths

Positive aspects of the RE model are that regardless of sample size increases, the parameters remain the same and that both within and between group variations are employed in the regression estimation (Hsiao, 1986). The fixed effects model would take in the constant variables through the intercept (Torres-Reyna, 2007). The RE model proves appropriate when implementing a time-constant dummy variable for regression analysis such as the industrial sectors since it would not be calculated using the FE model (Hsiao, 1986; Torres-Reyna, 2007; Zeitun & Tian, 2007). For the majority of researchers, it is suggested that a well-sepcificed RE model can provide far superior findings than the FE model (Bell, Fairbrother, & Jones, 2018). Furthermore, RE models can be generalised and extended by integrating different extensions to the model, which is a chief advantage (Bell & Jones, 2015).

5.7.3.2 Random Effects Weaknesses

The RE model can produce omitted variable bias, since all of the specific aspects which could influence the independent variables may be inaccessible for analysis (Torres-Reyna, 2007). The non-correlation between unobserved heterogeneity and observed independent variables within the RE models may be infringed and therefore, bias exists (Vaisey & Miles, 2017). Regarding level-2 entities, the belief that a normal distribution is a basis for the random effects may not be accurate in reality (Beck & Katz, 2007). Finally, utilising RE can result in a large number of variables which are to be analysed, but the range of available data may not satisfy the estimation criterion for the model (Matuschek et al., 2017)

5.8 Econometric Models

5.8.1 Orbis Analysis Models

The data used to test the models in this section that use the Orbis dataset are described in Table 4.2 and Table 4.3 in Chapter 4. As discussed in the previous section, the fixed effects model accounts for the effect of heterogeneity, whereas the random effect allows for the inclusion of variables which do not change over a period of time, for example, the founder's date of birth or first name. Indeed, fixed effects are used when the analysis involves researching the influence of determinant variables that change over time. The random effects model believes that variation is random and not correlated with any of the variables within the model. Whether there is a correlation between the influence of the unobserved entity and the explanatory variables is the main difference between the models (Greene, 2008). If differences amongst entities do not occur or are not significant, then the fixed effects model should be used. Certain variables will be excluded from the model given this approach, such as the founders' date of birth, which does not change over time. The non-changing variables over time of one firm should not have any correlation with other firms' variable as they are specifically related to the entity. The fixed effects and random effects models are proposed as the following (Torres-Reyna, 2007):

5.8.1.1 Fixed Effects Model Example

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \cdots \beta_n X_{nit} + Z_2 E_2 + \cdots Z_n E_n + \delta_2 T_2 + \cdots \delta_t T_t + e_{it} \qquad \text{(FE Model)}$$

In panel data analysis; i is the entity (specific company) and t is the time (year)

Y_{it} :	The dependent variable
β_o:	The constant within the model
X_{nit} :	A descriptor (independent) variable
β_n:	The coefficient for the corresponding descriptor variable
E_n:	An entity which is a dummy variable (with n-1 entities)
Z_n:	The coefficient for the corresponding dummy variable
T_t:	Time is a dummy variable (with t-1 periods)
δ_t:	The coefficient for the corresponding dummy time descriptor variable
e_{it}:	The error term.

5.8.1.2 Random Effects Model Example

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \cdots \beta_n X_{nit} + \alpha + U_{it} + e_{it} \qquad \text{(RE Model)}$$

In panel data analysis; i is the entity (specific company) and t is the time (year)

Y_{it} :	The dependent variable
β_o:	The constant within the model
X_{nit} :	A descriptor (independent) variable

β_n: The coefficient for the corresponding descriptor variable

α: The unknown intercept for each entity

U_{it}: Error term related to between entities

e_{it}: Error term related to within entities

In order to decipher which model to use, the Hausman test analyses the error terms and the constant and if they are found to correlate, then the random effects model should be utilised. When the dependent variable is altered, but the unobserved variable does not vary throughout the period, it resonates with impacts not related to fixed characteristics (Stock & Watson, 2003). Under the Hausman test, the null hypothesis states that little difference exists between the fixed effects and random effects model; if this is rejected, then fixed effects should be utilised (Gujarati, 2011).

The Hausman test was undertaken for the majority of the models and fixed effects were found to be best suited for the analysis. However, the models analysing export revenue utilise random effects as PATENTY is a time inherent variable and thus would be removed in a fixed effects model despite being a key part of the analysis. The independent and dependent variables used to test the hypotheses previously discussed are described in Table 8.2 and Table 8.3. All three measures of debt leverage; LTDEBTRO, STDEBTRO and TDEBTRO were utilised in the previous analysis regarding SMEs' capital structure, leverage analysis and financial policies (Michaelas, Chittenden, & Poutziouris, 1999; Sheikh & Wang, 2013; Sogorb-Mira, 2005). The inclusion of the three debt variables for research within econometric models will provide analysis regarding the complete correlations of debt. GEAREQ has been used in prior studies and proved a suitable variable with similarities to complementary gearing values (Goddard, Tavakoli, & Wilson, 2005). In order to find if time-fixed effects should be included, the Wald test is undertaken to test the interaction with the dependent. For all of the models, the Wald test results in Prob > F = 0.000, meaning the null is rejected. It is a categorical variable for time, similar to what Zeitun & Tian (2007) undertook when producing individual yearly dummy variables and including them in their model. The results for this test are provided in Appendix E.

5.8.1.3 Instrumental Variables Regression

Instrumental Variables (IV) regression is an analysis method used to gain a "consistent estimator of the unknown coefficients of the population regression function when the regressors, X, is correlated with the error term, u" (Stock & Watson, 2007 p.421).

There are two types of independent variables according to this method, those which are correlated with the error term and those which are uncorrelated with the error term, known as endogenous variables and exogenous variables, respectively. It is a concept first construed by Wright (1928) when analysing simultaneous causation issues, in relation to supply and demand interactions. This analysis is used when there is an expected correlation with part of an independent variable, X, and the error term. IV regression analysis seeks to examine the part, which is uncorrelated with the error term and provide the relevant results. In order for this to occur, additional variables are implemented into the model to obtain the uncorrelated results of these endogenous variables. The additional variables are known as instrumental variables or instruments, Z, and their coefficient results are not provided in the second stage analysis results. The instruments are used to provide valid results of the regressor, X, as there can be more than one correlated regressor in the model. It is important to note that the minimum amount of instrumental variables, Z, which must be included in the model is the same as the number of correlated regressors, X. In order for the analysis to be valid, this must occur. These instruments must meet two criteria: 1. They must be relevant, in which variation is related to the exogenous regressors, and 2. they must be exogenous due to the variation of the regressors which are caught by the instruments (Stock & Watson, 2007).

Once the instruments have been selected and they meet the minimum numerical requirement in comparison to the endogenous variables, the results examining the impact on the dependent variable is undertaken through the IV estimator; two-stage least squares (TSLS). This comprises of two separate stages in which the first stage removes the correlated section from the regressor, X, and the second stage is used to analyse the model with the uncorrelated part of X and provide a coefficient result (Stock & Watson, 2007). Stock & Watson (2007) provide an insight into the models used in the analysis as shown below. The general IV regression model (The second stage of TSLS):

$$Y_{\mathrm{i}} = \beta_0 + \beta_1 \mathrm{X}_{1\mathrm{i}} + \cdots + \beta_{\mathrm{k}} \mathrm{X}_{\mathrm{ki}} + \beta_{\mathrm{k}+1} \mathrm{W}_{1\mathrm{i}} + \cdots + \beta_{\mathrm{k}+\mathrm{r}} \mathrm{W}_{\mathrm{ri}} + u_{\mathrm{i}} \qquad \text{(TSLS Stage 2)}$$

Y_{i}	Dependent variable
u_{i}	Error term: measuerment error and also omiited variables
$\beta_0 \ldots . \beta_{\mathrm{k}+\mathrm{r}}$	Regression coefficients
$\mathrm{X}_{1\mathrm{i}} \ldots . \mathrm{X}_{\mathrm{ki}}$	The number of k endogenous variables, possibly correlated with u_{i}
$\mathrm{W}_{1\mathrm{i}} \ldots . \mathrm{W}_{\mathrm{ri}}$	The number of exogenous variables, uncorrelated with u_{i}
$\mathrm{Z}_{1\mathrm{i}} \ldots . \mathrm{Z}_{\mathrm{mi}}$	The number of instrumental variables

As mentioned, the instrumental variables are used in the first stage of the analysis to produce uncorrelated results for the endogenous regressors. The first stage of the TSLS initiates analysis on these variables regarding both the instruments and exogenous variables: The following equation illustrates the first stage:

$$X_{\mathrm{i}} = \pi_0 + \pi_1 \mathrm{Z}_{1\mathrm{i}} + \cdots + \pi_{\mathrm{m}} \mathrm{Z}_{\mathrm{mi}} + \pi_{\mathrm{m}+1} \mathrm{W}_{\mathrm{mi}} + \cdots + \pi_{\mathrm{m}+\mathrm{r}} \mathrm{W}_{\mathrm{ri}} + v_{\mathrm{i}} \qquad \text{(TSLS Stage 1)}$$

$\pi_0 \ldots\ldots \pi_{\mathrm{m}+\mathrm{r}}$	Unknown regression coefficients
$\mathrm{Z}_{1\mathrm{i}} \ldots . \mathrm{Z}_{\mathrm{mi}}$	The instrumental variables.
$\mathrm{W}_{1\mathrm{i}} \ldots . \mathrm{W}_{\mathrm{ri}}$	The number of exogenous variables, uncorrelated with u_{i}
X_{i}	The endogenous variables, possibly correlated with u_{i}
v_{i}	An error term

This analysis will be applied to all of the equations previously discussed for the 3 key topics. This additional research will be used to compare results and findings. The IV fixed effects models is used in the research and will allow an interesting insight into this topic while examining endogeneity and causality issues. The use of this model analysis includes all of the investigations undertaken with the fixed effect regression and random effects regression analysis. The results of the IV regression are provided in Appendix C will demonstrate if endogeneity is apparent throughout the model and whether it is a better option than such OLS analysis.

5.8.1.4 Dynamic Panel Data

The final analysis type undertaken in this chapter is dynamic panel models. In dynamic panels, the model takes the past values of dependent variables and utilises them as regressors. While this is an interesting concept, it can also result in an increase in the probability of many issues with the analysis; such as autocorrelation. This is of particular note over time, as the dependent variables' values throughout the previous time stages can affect the outcome. To account for this Generalized Methods of Moments (GMM) are used as the estimator, which utilises moment conditions to providee the estimators (Nielsen, 2005). Stock & Watson (2007 p.778) declare that GMM is a "method for estimating parameters by fitting sample moments to population moments that are functions of the unknown parameters". Furthermore, the GMM selects parameters to fit multiple equations in which the GMM estimator minimises the quadratic objective function for efficiency in the analysis (Stock & Watson, 2007). The dataset under analysis consists of panel data and so the GMM model which incorporates time series data is provided below as the moment condition. This declares that all lagged variables could be valid instruments in the analysis and is presented below:

$$E(u_t, |Y_{t-1}, X_{t-1}, Z_{t-1}, Y_{t-2}X_{t-2}, Z_{t-2} \ldots.) = 0$$

One such example of a dynamic panel data model is the classical linear version (Stata Corporation, 2013). The lagged dependent variables correlate with the unobserved panel-level effects. This results in an issue with the consistency of the standard estimators (Stata Corporation, 2013). To deal with this issue, the GMM estimators were incorporated into the dynamic panel data model by Arellano & Bond (1991). It provides most useful for datasets with low amount of periods but many panels. The model consists of the following:

$$Y_{it} = \sum_{j=1}^{p} a_j Y_{i,t-j} + X_{it} B_1 + W_{it} B_2 + v_i + e_{it} \qquad i+= 1 \ldots. N \qquad t = 1, \ldots. T_i \quad \text{(A-B GMM)}$$

B_1	k_1 x 1 vector of parameters for estimation
B_2	k_2 x 1 vector of parameters for estimation
T	Time periods observed
a_j	Parameters for estimation
W_{it}	1x k_1 vector of endogenous or predetermined covariates
X_{it}	k_1 x 1 vector of exogenous covariates
v_i	Panel level effects
e_{it}	Independent and identically distributed (i.i.d.) over the whole sample with variance σ^2_e

With many panels and few periods, the Arellano–Bond estimator is constructed by first-differencing the model to remove the panel-level effects and then to use instruments to form moment conditions. Working on previous research, particularly by Arellano & Bover (1995), a new estimator is produced by Blundell & Bond (1998) which incorporates the moment conditions whereby instruments are composed of additional lagged differences for the level equation. The sole additional condition for this is that $E = [v_i \Delta y_{i2}] = 0$ holds for all i, as per the dynamic panel data model (Stata Corporation, 2013).

They build upon this model due to two key reasons that the lagged-level instrumental variables can become weak. Firstly, the autoregressive process can become too persistent and secondly, the ratio of the variance of v_i to the variance of e_{it} can become too big.

(Blundell & Bond, 1998). The dynamic panel model used in this analysis is the named Arellano–Bover/Blundell–Bond analysis and is used to test all of the previously mentioned analysis models, but through this estimator and with the inclusion of time lags. As per the previous discussed dynamic model, it also incorporates GMM estimator,$\hat{a}$.

$$\hat{a}. = \hat{a}_{\text{dif}} = \left(\bar{y}'_{-1} Z A_N Z' \bar{y}'_{-1}\right)^{-1} \bar{y}'_{-1} Z A_N Z' \bar{y}$$

$\bar{y}'_i$ The (T-2) vector $(\Delta y_{i3}, \Delta y_{i4} \ldots\ldots \Delta y_{iT})$

$\bar{y}'_{-1}$ The (T-2) vector $(\Delta y_{i3}, \Delta y_{i4} \ldots\ldots \Delta y_{i,T-1})$ (Blundell & Bond, 1998)

The Arellano–Bover/Blundell–Bond analysis is provided inAppendix D and focuses on same topics as those used with the fixed effects and random effects models, providing extra robustness and analysis to the findings. One key area to note is that two-year lags were used for the most relevant independent variables, while a one-year lag for the dependent variables is implemented in the models.

5.8.1.5 Influence of Debt and Equity upon Financial Performance

$Performance_{\text{it}}$ accounts for the following 6 variables used independently which represent financial performance. They consist of the following:

ROANETINC

ROAPROF

ROENETINC

ROEPROF

PROFMARG

EBITDAMARG

In order to test the influence of debt upon the financial performance of high-tech SMEs, the following models are used:

$$Performance_{\text{it}} = \beta_0 + \beta_1 DEBTRO_{it} + \beta_2 EMPL_{it} + \beta_3 CASHFLOW_{it} + \beta_4 FUTGROWOP_{it} + \beta_5 SALESGROW_{it} + \beta_6 SIZEAST_{it} + e_{it} \quad (1)$$

$\text{DEBTRO}_{\text{it}}$ represents each of the corresponding 3 variables which are used independently in their own regression analysis. Thus they are represented by:

LTDEBTRO

STDEBTRO

TDEBTRO

When investigating the impact of equity upon financial performance on high-tech SME, the corresponding model is undertaken:

$$Performance_{\mathrm{it}} = \beta_0 + \beta_1 EQRATIO_{it} + \beta_2 EMPL_{it} + \beta_3 CASHFLOW_{it} + \beta_4 FUTGROWOP_{it} + \beta_5 SALESGROW_{it} + \beta_6 SIZEAST_{it} + e_{it} \quad (2)$$

5.8.1.6 Determinants of Capital Structure

The variables present below, relate to the variables described in section 4.3 and will be integrated into the models previously discussed, using the formats below in order to provide robust results for the dependent variable given the independent variables provided.

Gearing Values:

$$GEAR_{it} = \beta_0 + \beta_1 SIZESALE_{it} + \beta_2 CURRATIO_{it} + \beta_3 TANGFIXASS_{it} + \beta_4 PROFTBL_{it} + \beta_5 FUTGROWOPP_{it} + \beta_6 EMPL_{it} + e_{it} \quad (3)$$

$GEAR_{it}$ represents each of the corresponding 3 variables which are used independently in their own regression analysis. Thus they are denoted as:

GEARDA

GEARDC

GEAREQ

Total Values:

$$DEBTV_{it} = \beta_0 + \beta_1 EMPL_{it} + \beta_2 CURRATIO_{it} + \beta_3 EBITDAMARG_{it} + \beta_4 FUTGROWOP_{it} + \beta_5 SIZEAST_{it} + \beta_6 PROFTBL_{it} + e_{it} \quad (4)$$

$DEBTV_{it}$ represents each of the corresponding 3 variables which are used independently in their own regression analysis. Thus they are represented by:

LTDEBTV

STDEBTV

TDEBTV

$$EQUITYV_{it} = \beta_0 + \beta_1 EMPL_{it} + \beta_2 CURRATIO_{it} + \beta_3 EBITDAMG_{it} + \beta_4 FUTGROWOP_{it} + \beta_5 SIZEASST_{it} + \beta_6 PROFTBL_{it} + e_{it} \quad (5)$$

5.8.1.7 Influence of Short and Long-term Debt, Equity and Patents on Exports

$$EXPORT_{it} = \beta_0 + \beta_1 EQUITY_{it} + \beta_2 TDEBT_{it} + \beta_3 SIZEAST_{it} + \beta_4 EMPL_{it} + \beta_5 PATENTY_{it} + \beta_6 AGE_{it} + \alpha + U_{it} + e_{it} \quad (6)$$

$EXPORT_{it}$ represents each of the corresponding two variables which are used independently in their own regression analysis. Thus they are denoted as:

EXPORTREV

EXPORTPEROR

5.8.1.8 Robustness and Misspecification Tests

The following misspecification and robustness tests are also undertaken for this dataset and regressions, and the results and output are presented in the Appendix. Given the nature of panel data, certain tests are not applicable or restricted, and the following tests are undertaken in relation to the discussed regression models. Two of the most used tests for model selection criteria are the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) (Frank & Goyal, 2009). Both the AIC and BIC can be used to compare several different models simultaneously, which is a positive aspect compared to the likelihood ratio test when reporting model fit statistics (Matuschek et al., 2017). The findings for AIC and BIC are provided in Appendix E.5, and they examine cross-sectional heteroskedasticity and autocorrelation (Byoun, 2008). While the BIC is inefficient but consistent, the AIC more efficient but less consistent, resulting in either prediction criteria is better than the other (Brooks, 2008). A specification test was produced in order to test for non-linearity amongst linear square regression analysis (Ramsey, 1969). It is known as the regression specification error test (RESET) and used to examine linear models (Tsay, 2005). Through the test for misspecification of functional form, the Ramsey RESET test checks whether a model should be linear (Brooks, 2008). The output is provided in Appendix E.6. The RESET test has produced stable outputs when examining functional form misspecification; however, if a model is rejected, the test fails to offer a focused guide (Wooldridge, 2012).

Among time series datasets such as panel data, unit root testing has become more standard (Wooldridge, 2012). The Dickey-Fuller test is used in panel data to test for unit roots throughout the time series (Baltagi, 2005). The augmented Dickey-Fuller test analyses whether all variables are stationary, and tests the series for non-stationarity (Brooks, 2008; Hsiao, 2003). If a unit root is discovered, this means that the standard assumptions and approximations of large samples periods are not valid (Wooldridge, 2012). The Dickey-Fuller tests are found to be robust and over time have demonstrated strong results through a range of topics (Greene, 2002). The output for the Dickey-Fuller tests are provided in Appendix E.3. Another test that can produce a more exhaustive analysis into unit-root stationarity is the Phillips-Perron test (Brooks, 2008). A key difference between this test and the Dickey-Fuller test is that it allows for auto-correlated residuals by implementing an automatic correction (Brooks, 2008). The Phillips-Perron tests are not very specific and can be used in a variety of topics, but have issues relating to the properties of small samples (Greene, 2002). Finally, the tests have a strong correlation with similar results of the augmented Dickey-Fuller test when analyzing the existence of unit roots (Brooks, 2008). The results of the Phillips-Perron tests are available in Appendix E.3. The Wooldridge test can examine the issues of endogeneity and non-observed heterogeneity of the descriptor variables (Serrasqueiro Nunes, & da Rocha Armada, 2014). The Wooldridge test output is provided in Appendix E.7. and is isused to check panel data variables for first-order autocorrelation (Arvanitis & Tzigkounaki, 2012). Serial correlation can result in the coefficient's standard errors being reported as smaller than they are and with a higher R-squared value (Torres-Reyna, 2007).

The Wald tests can check the independent variables for joint significance (Drobetz & Fix, 2005). The Wald statistic tests the joint significance of the asymptotically distributed independent variables with the null of no relationship (Arellano & Bond, 1991). The modified Wald test is used for fixed-effects models to test for heteroskedasticity (Torres-Reyna, 2007), and the test results are provided in Appendix E.8. The Breusch-Pagan test is used to check for heteroskedasticity (Yaffee, 2003). Since the late 1970s, researchers have implemented the Lagrange Multiplier to test econometric models, with a benefit that other models are not needed for estimations (Wooldridge, 2012). The Lagrange multiplier method tests the impact on the first order conditions for a maximum of the likelihood of enforcing the hypothesis (Breusch & Pagan, 1980). The LM test is more useful, since approximating the restricted model is easier (Breusch & Pagan, 1980). The Breusch-Pagan LM test can assess whether heteroskedasticity is present (Baltagi, 2005), and the findings are produced in Appendix E.9. The LM statistic can test for heteroskedasticity, omitted variables, serial autocorrelation and other model specification issues (Wooldridge, 2012).

5.8.2 Survey Analysis Models

When undertaking regression analysis, it was deemed necessary to combine the sources of finance into the three distinct types discussed in detail in the pecking order theory by

Myers & Majluf (1984). This is due to the valid responses that meet the criteria. Subsequently, the sources of finance examined in regression analysis are: internal: external debt and external equity. The variables used in the models are described in Table 4.4 and Table 4.5.

5.8.2.1 Regression Analysis: Determinants and Financial Performance

This analysis addresses determinants of the financing sources implemented by high-tech SMEs and the effect of capital structure and firm characteristics on financial performance. The results for these models are produced in Chapter 7. The ensuing regression models are used by analysing the determinants on high-tech SME financing sources.

$$INTRNL = \beta_0 + \beta_1 EMPL + \beta_2 AGE + \beta_3 R\&D + \beta_4 EXPER + \beta_5 ROI + \beta_6 INTANGPERC + e \quad (1)$$

$$DEBT = \beta_0 + \beta_1 EMPL + \beta_2 AGE + \beta_3 R\&D + \beta_4 EXPER + \beta_5 ROI + \beta_6 INTANGPERC + e \quad (2)$$

$$EQUITY = \beta_0 + \beta_1 EMPL + \beta_2 AGE + \beta_3 R\&D + \beta_4 EXPER + \beta_5 ROI + \beta_6 INTANGPERC + e \quad (3)$$

Once the determinants have been investigated, the next stage of regression analysis is to examine the impact of financing sources on the financial performance of high-tech SMEs.

$$EBITDA = \beta_0 + \beta_1 INTRNL + \beta_2 DEBT + \beta_3 EQUITY + \beta_4 TARGDEBT + e \quad (4)$$

$$EBITDA = \beta_0 + \beta_1 INTRNL + \beta_2 DEBT + \beta_3 EQUITY + \beta_4 TARGDEBT + \beta_5 INACC + e \quad (5)$$

$$EBITDA = \beta_0 + \beta_1 INTRNL + \beta_2 DEBT + \beta_3 EQUITY + \beta_4 TARGDEBT + \beta_5 INACC + \beta 6RISKPREF + e \quad (6)$$

Logistic regression is undertaken as the final performance measure.

$$PROF_i = \beta_0 + \beta_1 INTRNL + \beta_2 DEBT + \beta_3 EQUITY + \beta_4 TARGDEBT + \beta_5 INACC + e \quad (7)$$

Where $PROF_i$ is an indicator binary dependent variable that equals 1 if the firm is currently profitable; otherwise, if not the value equals 0, so that:

$$Pr\ (PROF_i = 1 | INTRNL, DEBT, EQUITY, TARGDEBT, INACC) = \beta_0 + \beta_1 INTRNL + \beta_2 DEBT + \beta_3 EQUITY + \beta_4 TARGDEBT + \beta_5 INACC + e \quad (8)$$

5.8.2.2 Regression Analysis: Goals and Challenges

The next topics under analysis comprise of both the future goals and challenges of the high-tech SMEs and whether the capital structure has a significant role within these crucial topics for such firms. The results for these models are produced in Chapter 8. In order for this analysis to be undertaken, the dependent variable for both the goals and challenges are categorical variables comprising a range of different results. Subsequently, for such an investigation to be undertaken successfully, multinomial logistic regression analysis will be undertaken. The relative risk ratio (RRR) is used in the analysis of multinomial logistic regression models. In order to comprehend the results, the findings of RRR utilises a composition between the risk of the option of the dependent variable and the base outcome, which is compared to the risk of the selected outcome for the analysis. For simple logistic regression, the dependent variable only has two results, and so, when analysing them, it is the probability of one occurring which allows an insight into the other corresponding result. However, given that a multinomial revolves around a dependent variable with more than two categorical options, the odds ratio would not suffice. Subsequently, when analysing the results, one of the outcomes is used as the reference group which is then discussed as the comparison to the other outcomes as part of the overall findings. While this may not be as straightforward as examining independent variables influence as per OLS regression analysis, or even logistic regression as previously discussed, once understood it is beneficial.

The risk ratio values are of critical importance to comprehend since they are compared to the base outcome within the results. In the instance where the risk ratio has a value of 1, it is determined to find no change in risk between the base and alternative outcome. When the risk ratio is greater than 1, greater risk exists that the outcome result under analysis will happen in comparison to the base outcome. However, when the risk ratio is less than 1, this means that the risk is lower for the specific outcome and thus the actual base result is more likely to occur. To summarise, it is a very beneficial method for analysis using categorical dependent variables, provided that the base model makes sense for that role and is comparable. This is ensured for the analysis further on within the research.

Multinomial distributions follow a linear model:

$$\eta_{ij} = log \frac{\pi_{ik}}{\pi_{iK}} = \alpha_k + \beta_k X_k^{'}$$

α is the constant while , β_k denotes the vestor of coeffieceints;

whereby $k = 1 -> K - 1.$

η_{ij} illustrates the results from the response, i, which fall into the category, j, thus a wide range of results are provided though multinomial distributions.

In relation to the future challenges facing these high-tech SMEs, the following model is used, with CHALL as the dependent variable.

$$\eta_{ij} = log \frac{\pi_{ik}}{\pi_{iK}} = \beta_0 + \beta_1 INTRN + \beta_2 DEBT + \beta_3 EQUITY + \beta_4 AGE + \beta_5 EMPL \quad (1)$$

This model can be rearranged and also interpreted as:

$$logit(y = 1) = log\left(\frac{p(y = 1)}{1 - (p = 1)}\right)$$
$$= \beta_0 + \beta_1 INTRN + \beta_2 DEBT + \beta_3 EQUITY + \beta_4 AGE + \beta_5 EMPL + e$$

$$for\ i = 1.\ldots n \quad (1)$$

The next model will provide results for the future objectives of high-tech SMEs and how capital structure and founder experience can influence the decisions. The dependent variable is OBJCT.

$$\eta_{ij} = log\ \frac{\pi_{ik}}{\pi_{iK}} = \beta_0 + \beta_1 \text{INTRN} + \beta_2 DEBT + \beta_3 EQUITY + \beta_4 EXPER \quad (2)$$

This model can be rearranged and also interpreted as:

$$logit(y = 1) = log\left(\frac{p(y=1)}{1-(p=1)}\right) = \beta_0 + \beta_1 INTRN + \beta_2 DEBT + \beta_3 EQUITY + \beta_4 EXPER + e$$

$$for\ i = 1.\ldots n \quad (2)$$

The multinomial logistic results are disseminated using the relative risk ratios (RRR) which identify the risk of being in the selected outcome compared to the reference outcome. In order to comprehend the results, the findings of RRR utilises a comparison between the risk of being one option of the dependent variable and the risk of the selected outcome for the analysis. Subsequently, a range of different findings will be compared to this base outcome. If the RRR value is less than 1 then it shows that the base outcome is preferred. Furthermore, the RRR for preferring the specific outcome compared to the base outcome would decrease by the RRR factor, given the remaining model variables stay constant. Similarly, if the RRR is greater than 1, the relative risk for preferring the specific outcome compared to the base increases by that factor, once the other variables are constant.

5.8.2.3 Regression Models: Influence on Exports and Domestic Sales

The ensuing regression models are used by analysing the determinants the revenue location of high-tech SMEs and whether the capital structure, debt preferences, experience or the use of capital influences the region of sales. The results for these models are produced in Chapter 8.

$$DOMESTIC = \beta_0 + \beta_1 PROF + \beta_2 INTRNL + \beta_3 DEBT + \beta_4 EQUITY + \beta_5 SIZETURN + \beta_6 APLYBANK + \beta_7 INFOSYM + \beta_8 TARGDEBT + \beta_9 EXPER + \beta_{10} R\&D + \beta_{11} SAMRKEXP + e \quad (1)$$

$$EXPORTS = \beta_0 + \beta_1 PROF + \beta_2 INTRNL + \beta_3 DEBT + \beta_4 EQUITY + \beta_5 SIZETURN + \beta_6 APLYBANK + \beta_7 INFOSYM + \beta_8 TARGDEBT + \beta_9 EXPER + \beta_{10} R\&D + \beta_{11} SAMRKEXP + e \quad (2)$$

$$EMEA = \beta_0 + \beta_1 PROF + \beta_2 INTRNL + \beta_3 DEBT + \beta_4 EQUITY + \beta_5 SIZETURN + \beta_6 APLYBANK + \beta 7 INFOSYM + \beta 8 TARGDEBT + \beta 9 EXPER + \beta 10 R\&D + \beta 11 SAMRKEXP + e \quad (3)$$

$$USA = \beta_1 + \beta_1 PROF + \beta_2 INTRNL + \beta_3 DEBT + \beta_4 EQUITY + \beta_5 SIZETURN + \beta_6 APLYBANK + \beta 7 INFOSYM + \beta 8 TARGDEBT + \beta 9 EXPER + \beta 10 R\&D + \beta 11 SAMRKEXP + e \quad (4)$$

$$UK = \beta_0 + \beta_1 PROF + \beta_2 INTRNL + \beta_3 DEBT + \beta_4 EQUITY + \beta_5 SIZETURN + \beta_6 APLYBANK + \beta 7 INFOSYM + \beta 8 TARGDEBT + \beta 9 EXPER + \beta 10 R\&D + \beta 11 SAMRKEXP + e \quad (5)$$

$$ROW = \beta_0 + \beta_1 PROF + \beta_2 INTRNL + \beta_3 DEBT + \beta_4 EQUITY + \beta_5 SIZETURN + \beta_6 APLYBANK + \beta 7 INFOSYM + \beta 8 TARGDEBT + \beta 9 EXPER + \beta 10 R\&D + \beta 11 SAMRKEXP + e \quad (6)$$

To evaluate the different influences on export locations, dependent variables which encapsulate the different export regions for the high-tech SMEs, as well as an overall export variable, are employed. The number of observations also influenced the variables which could be used independently due to the high dependence on domestic sales and this influenced the regional export analysis. The rest of the world was included although a limited number of observations exists which may result in insignificant results. Once the determinants have been investigated through OLS regression analysis, the final stage of the export analysis involves a logistic regression which examines the probability of a firm exporting based on the independent variables, utilising a predicted probability method for in-depth analysis of the outcome given certain risk factors. The findings will be illustrated via both the log odds and the odds ratio as often the results can be misinterpreted which can provide an unsound conclusion.

The relationship between the logistic regression model and how it provides the log-odds (logit) is displayed below as:

$$log\left(\frac{p(Yi = 1)}{1 - p(Yi = 1)}\right) = ln(Odds_i) = \alpha + \sum_{k=1}^{k} \beta_k X_{ik}$$

In relation to the analysis being undertaken, logistic regression analysis is used to decipher what variables influence whether the firm exports or not, with EXPORT as the dependent variable, using the following model:

$$Logit(p(x)) = \log\left(\frac{p(x)}{1-p(x)}\right) = \beta_0 + \beta_1 PROF + \beta_2 INTRNL + \beta_3 DEBT + \beta_4 SIZETURN + \beta 5APLYBANK + \beta 6TARGDEBT + \beta 7R\&D + \beta 8SAMRKEXP + e \qquad (7)$$

The first step is to generate the logistic regression base statistics, and from this perspective, it is important to interpret them through, predicted probability, log odds and marginal effects. Both log odds and the odds ratio results will be undertaken as well as the goodness of fit procedures such as the link test, the Wald test and tests of collinearity. The link test is used to test for single-equation models, as it investigates the presence of a specification error. The key concept is that any additional predictors should not be statically significant if the model is correct. The test provides the linear predicted value and linear predicted value squared for use within the model. The predicted variable needs to be significant but for the link test when significant linear predictive value squared occurs, this illustrates a specification error (Umanah, 2015). Indeed this can often indicate that omitted variables could be an issue or the model has adequacy issues (Pregibon, 1980). Therefore, the model would need to be adjusted under this test if such a result is presented. The Wald test when used after logistic regressions, determines the coefficients regarding their suitability as predictors. It investigates this by instigating that the two coefficients being analysed are equal to zero simultaneously and if the null is not rejected then the variables should be removed from the model. Furthermore, the Receiver Operating Characteristic (ROC) test will seek to determine if the model and variables provide an adequate explanation as to the predictive power of these firms when exporting. It utilises both sensitivity and specificity testing for the observed outcomes and whether they are predicted correctly (Hosmer, Lemeshow, & Sturdivant, 2013). Once these are found to have passed the tests, the predicted probability for both the bank application and debt within capital structure variables would be provided. This analysis will provide further insight into how capital structure can influence the probability that high-tech SMEs will export or not.

5.8.2.4 Robustness Tests and Sensitivity Analysis

The subsequent tests are implemented regarding the discussed regression models that are undertaken through the survey dataset. While survey data is limited, the tests are produced, and the results and output are presented in Appendix F and referred to in Chapter 7 and Chapter 8. Propensity score matching (PSM) was produced by Rosenbaum & Rubin (1983), and it is a procedure that uses balancing scores to match firms by implementing a treatment group variable into the analysis. The output is provided in Appendix F.3. In order to assess these propensity scores, there is matching between firms from the control group and the treatment group (Spyros Arvanitis & Stucki, 2013). The results of the treated firm are then distinguished against the results of the comparison group firms (Spyros Arvanitis & Stucki, 2013). Statistical techniques such as PSM and IV can remove some selection bias and strengthen the match of comparison and project groups, but it does not clear all challenges such as important missing information (Bamberger, Rao, & Woolcock, 2010). Matching focuses on an area of interest relating to the specific causal effect and in this procedure all variables are confounding, apart from the treatment variable (DiPrete & Gangl, 2004). When a perfect matching occurs either on the propensity score or separate covariates, this removes any chance bias from the variables (DiPrete & Gangl, 2004). However, it is important to note that a limitation associated with this procedure relates to the observed covariates; the assignment to treatment should be ignorable (DiPrete & Gangl, 2004).

Matching methods are not robust against "hidden bias" due to unobserved variables that impact assignment to treatment and the outcome variable (DiPrete & Gangl, 2004). Testing the sensitivity of estimated outcomes about identifying assumption variations are noteworthy, due to increased use of matching approach to estimate average treatment influences (Caliendo & Becker, 2010). A strategy to address this is the Rosenbaum bounds approach, which can adjust the strength of the influence of an unmeasured confounding variable into treatment selection to weaken the implications about causal effects from the matching analysis (Caliendo & Becker, 2010; DiPrete & Gangl, 2004). According to Aakvik (2003) when the outcome is binary, the Mantel-Haenszel test statistic can be used instead of Rosenbaum bounds, with the test resulted provided in Appendix F.2. This follows a similar technique as Rosenbaum Bounds, testing for the presence of hidden selection bias and the use of a treatment variable (Caliendo & Becker, 2010). The results for the Rosenbaum Bounds analysis is provided in Appendix F.1. Due to the basis of random sampling, the entities in the control and treatment groups should be quite similar (Caliendo & Becker, 2010). The issue of sample selection bias can be controlled by a two-step procedure first proposed by Heckman (1979) by the implementation of a control function. The first step entailed producing a probit model and the second estimated the order probit model for the determinants of the dependent variable (Brooks, 2008). This PSM method can estimate the influence of the treatment on the treated entities, through the difference-in-difference matching estimators in regression analysis (Halaby, 2004). The econometric techniques proposed by Heckman can be used to account for any sample selectivity issues (Angus, 1995), and the results are available in Appendix F.4.

Chapter 6. European High-Tech SMEs: The Determinants and Influence of Capital Structure and Innovation

6.1 Introduction

In this chapter, some of the hypotheses produced in Chapter 4 are tested by estimating regression coefficients through a range of the models developed in Chapter 5. This chapter will seek to provide insight regarding the following topics: Do profitability and size affect the capital structure of European high-tech SMEs? Do capital structure choices affect the financial performance of the firms? Does innovation through future growth opportunities and patents influence the capital structure and performance of these businesses? What impact has human capital and financing have on the exports of European high-tech SMEs? The data comprises of the Orbis panel data, the fixed effect model is implemented primarily in this analysis, and these results are discussed within the chapter. The dynamic panel model analysis and instrumental variable analysis results are presented in the appendix. The dynamic panel data technique is implemented using the GMM approach as the robustness of the results, since it controls for unobserved heterogeneous firm-specific effects, with endogenous explanatory variables used. While the TSLS regression analysis, implementing instrumental variables is also undertaken on all of the topics discussed and investigated within the chapter. Additional test results, which include the Hausman test, Phillips-Perron test and Dicker-Fuller test are also accessible in Appendix E. The first models implemented are used to test the influence of 4 separate external sources of finance, comprising of 3 debt categories and 1 equity, on the financial performance of high-tech SMEs, which entails 6 separate measurements. The next part of the analysis investigates the determinants of capital sources implemented by high-tech SMEs, encompassing both the values and gearing percentages in the individual analysis. The final analysis section within this chapter examines the relationship between innovation, capital sources and firm characteristics with high-tech SME exports. Analysis and discussion of the results encompass previous literature, theories and the rejection or acceptance of the relevant proposed hypotheses produced in Chapter 4.

6.2 Data Overview

The data has been discussed in detail in Chapter 5 and as mentioned a key issue regarding research in the SME sector is obtaining reliable, up-to-date and useful data. Issues relating to many databases both in Europe and the USA concern the unavailability of certain data results for a variety of distinct details. Indeed, limited information regarding revenue and expenses are provided and often in a broad-spectrum approach by many databases. The Orbis database used in this analysis consists of firm-level data of both private and public European businesses. The database, produced by Bureau van Dijk, contains information on businesses encompassing key criteria such as balance sheet, profit and loss accounts and other firm information on an annual period. The data spans multiple countries and industries and has been utilised in the previous analysis of capital structure (Brounen et al., 2006; Santos, Moreira, & Vieira, 2014; Grilli & Murtinu, 2014; Goddard, Tavakoli, & Wilson, 2005; Psillaki & Daskalakis, 2009; Mac an Bhaird & Lucey, 2014). This research addresses important topics not abundantly examined, particularly for European high-tech SMEs. The inclusion of key statistics and figures will provide a greater insight towards the financial performance and capital structure of European high-tech SMEs over a 10-year period; 2007-2016. A figurative breakdown of the data is provided from Figure 6.1 to Figure 6.4 and illustrates the values of long-term debt and cash flow for these firms.

Table 6.1: Breakdown of the data regarding the number and percentages of high-tech SMEs from the European countries under analysis

Country	Number of Firms	Percentage of Total
Belgium	69	0.94
Bosnia	67	0.92
Bulgaria	2	0.03
Croatia	806	11.04
Czech Republic	137	1.88
Estonia	103	1.41
Finland	153	2.1
France	69	0.94
Greece	11	0.15
Hungary	408	5.59
Italy	2074	28.4
Latvia	243	3.33
Lithuania	7	0.10
Portugal	455	6.23
Serbia	5	0.07
Slovakia	434	5.94
Slovenia	324	4.44
Spain	69	0.94
Sweden	1764	24.15
United Kingdom	103	1.41
Total	7303	100.00

Notes: This table provides information on the breakdown of the high-tech SMEs under analysis from the Orbis database. The first column represents the country where the firm is based. The second column provides the number of firms under analysis that correspond to the country. The third column provides the representation of the firms in the second column as a percentage of the total amount of high-tech SMEs under analysis. The total values illustrate the total sample size and that it totals 100 percent.

6.2.1 Analysis Models

The independent and dependent variables used to test the hypotheses are discussed in Chapter 4, and the econometric models are provided in Chapter 5. The Hausman test was undertaken for the majority of the models, and the fixed effects model was found to be best suited for the analysis, providing the most statistically adequate results. However, the models analysing export revenue utilise random effects as a patent is a time inherent variable and thus would be removed in a fixed effects model despite being a key part of the analysis. Regarding the inclusion of time-fixed effects, the Wald test is undertaken to test and the time fixed effects test was produced regarding the financial performance models. The unit root tests consisted of both the Dickey-Fuller Test and the Phillips-Perron Test to provide robustness and, no unit root exists in the analysis. Additional robustness and misspecification tests that include the Ramsey RESET test, Wooldridge test, Modified Wald test, AIC and BIC analysis examine the models regarding the analysis on the financial performance and determinants of capital structure. The Breusch and Pagan LM Test analyses the models about the determinants of capital structures and effects on domestic and international sales. The results for all tests are found in Appendix E and show that no issues exist and the analysis undertaken is appropriate.

IV regression analysis implementing the TSLS approach is undertaken as a secondary robustness check. The instrumental variables regressions demonstrated that the majority of the findings declared that endogeneity was not apparent and thus the OLS regressions undertaken with fixed effects and random effects would suffice. All of the models possessed valid instruments, apart from the analysis on exports which could not produce such a result and thus the IV analysis into that topic was insignificant. The results for all of the instrumental regression analysis are provided in Appendix C. The dynamic panel model provides useful findings, and the autocorrelation test showed that correlation was not an issue. Subsequently, the use of the fixed effects and random effects models are demonstrated and analysed when investigating the capital structure of high-tech SMEs. The findings for dynamic panel model analysis, through the Arellano–Bover/Blundell–Bond analysis, are provided in Appendix D and allow another insight into such novel topics discussed in Chapter 5.8.1. It is key to note that two-year lags are implemented for the most relevant independent variables, while a one-year lag for the dependent variables is provided in the model. The investigation focuses on the same topics as those produced in the chapter that implement the panel fixed effects and panel random effects models and so additional analysis and robustness regarding the results are produced.

6.3 Results and Discussion

6.3.1 Insights and Overview

Figure 6.1 illustrates the issues affecting European high-tech SMEs, which demonstrates how older high-tech SMEs tend to generate the greatest cash flows and this trend is one that can affect younger firms such as NTBFs. This is an expected result as older firms would tend to be larger and would need to generate more cash flow in order to survive and grow. The results for each country within the sample all follow a similar trend, whereby age has a positive relationship with cash flow.

Figure 6.2 demonstrates the cash flow and the mean cash flow for high-tech SMEs categorised into their origin country. The mean value is close to €0, and the values presented in the figures are in €'000s. The countries with the largest deviations in their values consist of Belgium, Croatia, France, Italy, Sweden and the UK. These deviations can be both larger and smaller than the mean value, demonstrating the issues of high-tech SMEs in utilising internal finance, as some firms can generate substantially larger cash flows than other such businesses. While, high-tech SMEs based in Bulgaria, Czech Republic, Latvia and Slovakia tend to have cash flows that remain close to the mean value.

Figure 6.3 provides a prediction of the relationship between long-term debt and cash flow for high-tech SMEs based in European countries. Under this figure, the results illustrate that the majority of the firms that have larger values of long-term debt tend to generate lower cash flows. Interestingly, the figure does not provide support to Brander & Lewis (1986) who state that when firms take on debt, it is often perceived that they will generate a strong cash flow. The figure depicts that firms with larger cash flows utilise less debt; some support for the pecking order theory is provided, since this can be used as internal finance. The pecking order theory states that firms should use retained earnings and internal finance as the primary source of finance and then when they are no longer available, firms prefer the use of debt instead of equity, when external finance is needed (Myers & Majluf, 1984). However, it may suggest that the modified high-tech pecking order theory is supported since in this theory high-tech SMEs tend to employ equity finance over debt finance (Hogan & Hutson, 2005). A further detailed investigation into the capital structure and financial performance of high-tech SMEs is undertaken within this chapter.

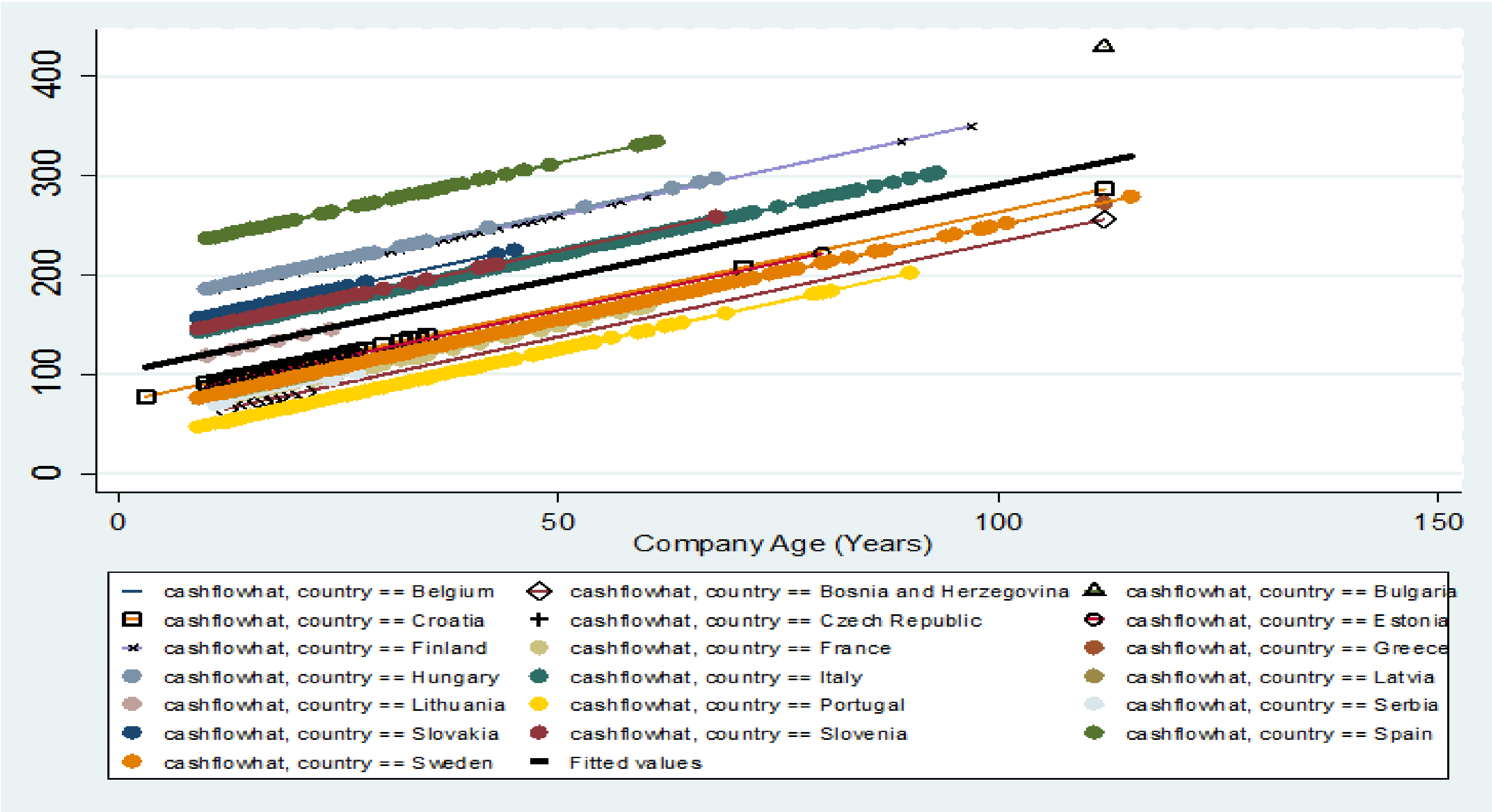


Figure 6.1: Cash flow prediction of European high-tech SMEs using regression analysis with years, illustrated for each country.

Notes: This figure provides an insight into the relationship of cash flow and age for high-tech SMEs presented in each country. Company age is presented in years, and cash flow is presented in €,000s.

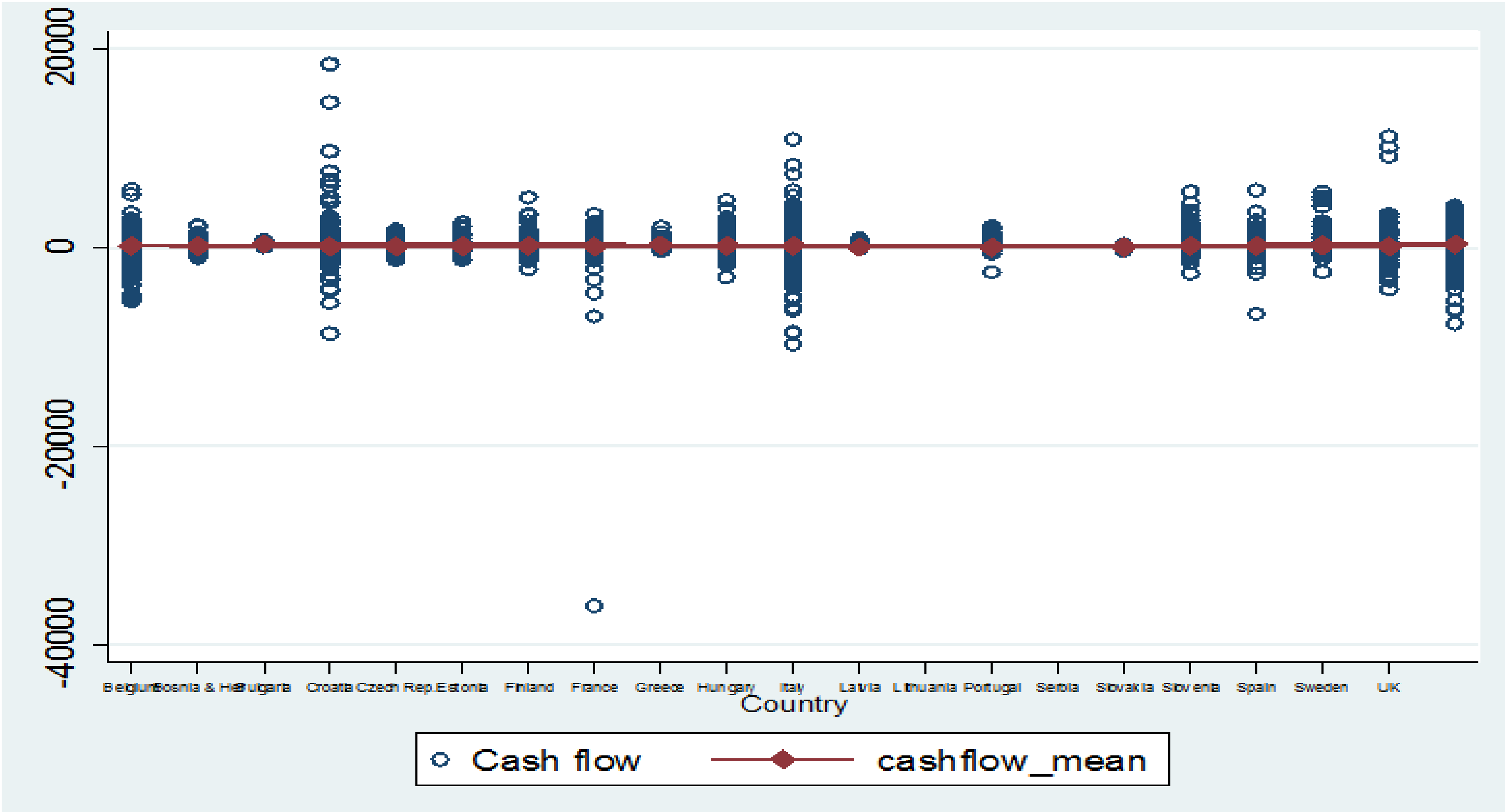


Figure 6.2: Cash flow means of European high-tech SMEs regarding individual countries

Notes: The figure illustrates the cash flow of high-tech SMEs based in each European country under analysis, while also providing the cash flow mean, which is quite close to €0 for the majority of the samples. The cash flow values are in €'000s.

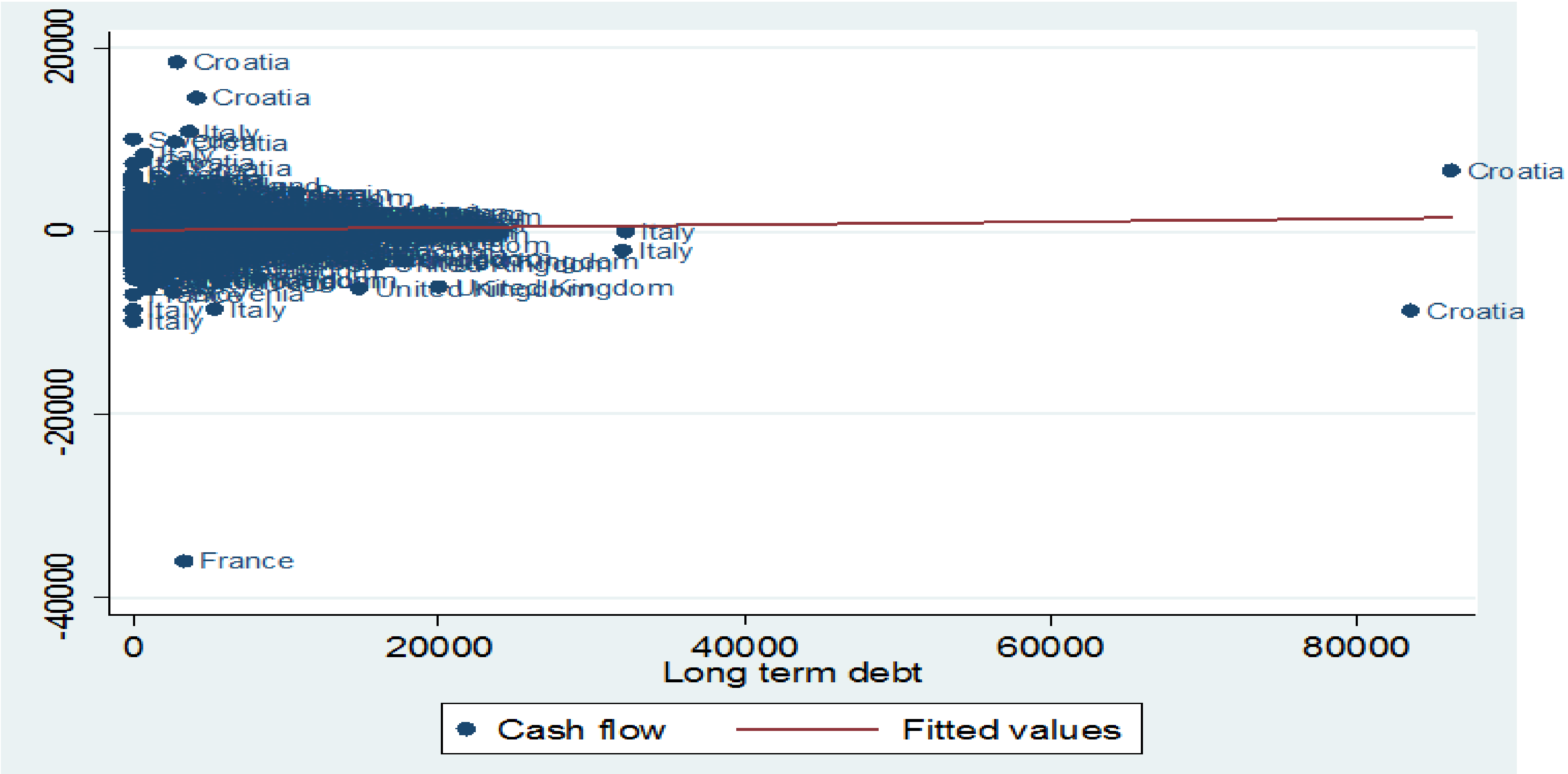


Figure 6.3: Cash flow prediction regression results using long-term debt, for European high-tech SMEs illustrated through individual countries

Notes: The figure illustrates the cash flow of high-tech SMEs based in each European country under analysis; these values are on the vertical line. The long-term values are provided on the horizontal line. The cash flow and long term debt values are both in €'000s. The plots on the figure represent high-tech SMEs that are denoted by their country of operations.

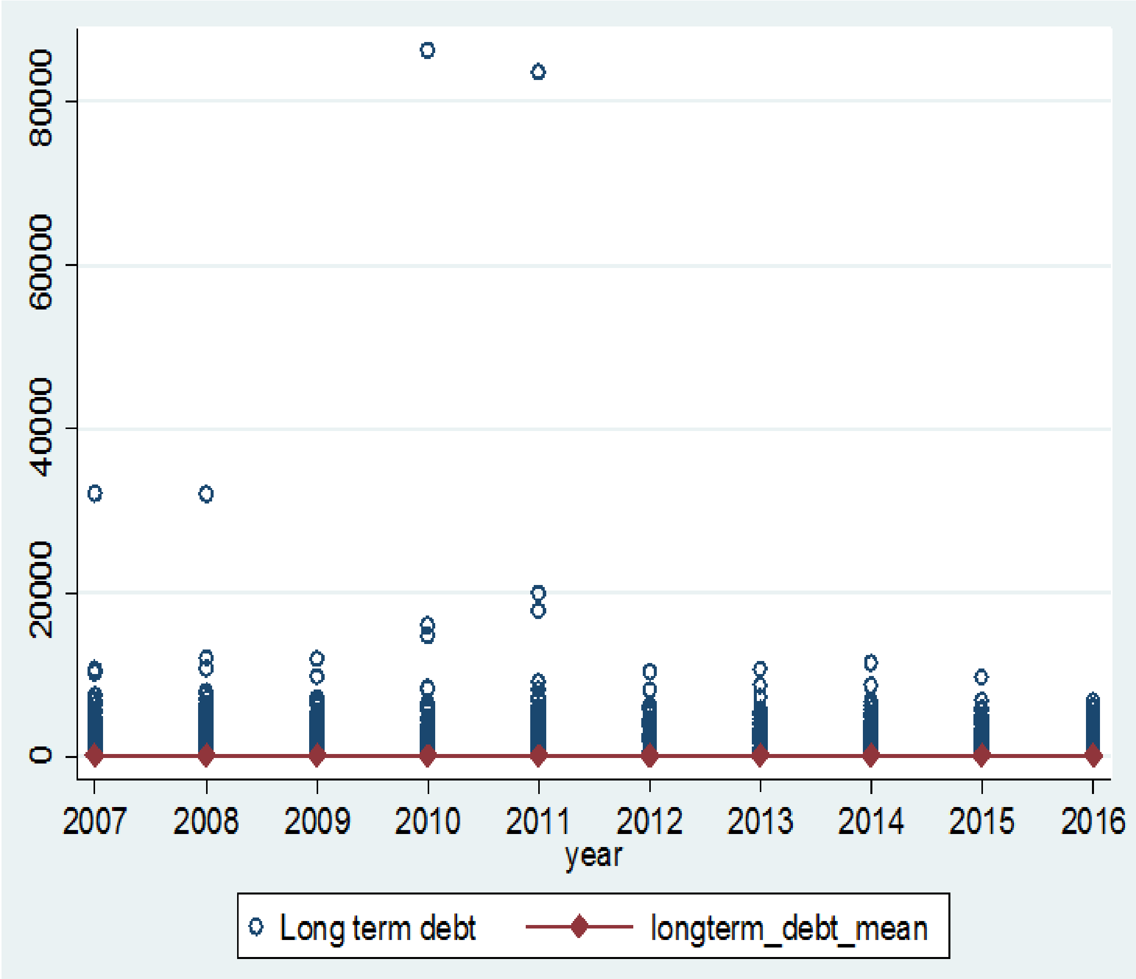


Figure 6.4: Annual long-term debt values compared to long-term debt mean values for European high-tech SMEs, 2007–2016
Notes: The figure provides the long-term value of debt in comparison to the mean value of long-term for high-tech SME on an annual basis from 2007 to 2016. The mean of long-term debt is quite low, while the use of long-term debt is relatively stable throughout the lifespan of the analysis. Values are presented in €'000s.

Figure 6.4 demonstrates a critical issue that high-tech SMEs face regarding external financing. It does not provide a breakdown for each country but instead demonstrates the differences of the years throughout the sample. The mean value for long-term debt finance is low throughout the entire period, while the long-term debt value that high-tech SMEs could acquire is between €0 and €1million. This value remains consistent throughout the entire time-period between 2007 and 2016, with only some individual high-tech SMEs gaining long-term debt finance above this range, where maybe the largest deviation value is about €3.2million in 2007 and 2008.

Financial performance is measured through six individual variables used in unique models for the fixed effects linear model, which utilise panel data. Each of these 6 models were analysed using four exclusive financing ratios, which comprise of total debt, long-term debt, short-term debt and external equity to total assets. All three measures of debt leverage; long term, short term and total debt ratios were utilised in the previous analysis regarding SMEs' capital structure, leverage analysis and financial policies (Michaelas, Chittenden, & Poutziouris, 1999; Sheikh & Wang, 2013; Sogorb-Mira, 2005). The equity ratio has been used in prior studies and proved a suitable variable with similarities to corresponding gearing values (Goddard, Tavakoli, & Wilson, 2005). Subsequently, the results are robust given the multitude of models and sources under analysis combined with the 10-year time range and 7,300 firms that produce a reliable combination for database researching high-tech SMEs capital structure.

6.3.2 Influence of Capital Structure and Determinants on Financial Performance

Table 6.2: Panel Data Fixed Effects regression coefficients employing the total debt ratio as an independent variable upon the analysis of 6 individual financial performance measures.

	(1) ROA using Net income %	(2) ROA using P/L before tax %	(3) ROE using Net income %	(4) ROE using P/L before tax %	(5) Profit margin %	(6) EBITDA margin %
Total Debt Ratio	-0.038*** (0.003)	-0.057*** (0.003)	0.056*** (0.016)	0.053** (0.020)	-0.033*** (0.002)	0.004 (0.002)
Employees	-0.612*** (0.101)	-0.409** (0.127)	-2.686*** (0.609)	-3.728*** (0.730)	-2.097*** (0.101)	-2.937*** (0.098)
Cash flow	6.705*** (0.039)	7.588*** (0.049)	18.940*** (0.236)	20.190*** (0.282)	5.121*** (0.039)	5.189*** (0.038)
Future Growth Opportunities	-0.083*** (0.009)	-0.114*** (0.012)	-0.487*** (0.053)	-0.637*** (0.064)	-0.093*** (0.009)	0.020* (0.009)
Sales Growth	0.002*** (0.000)	0.002*** (0.000)	0.007*** (0.001)	0.011*** (0.001)	0.001* (0.000)	-0.001** (0.000)
Size: Total Assets	-5.517*** (0.105)	-6.252*** (0.132)	-15.61*** (0.637)	-17.22*** (0.764)	-0.636*** (0.104)	-0.462*** (0.101)
Constant	18.080*** (0.636)	21.200*** (0.800)	49.140*** (3.872)	64.990*** (4.643)	-5.623*** (0.636)	-1.285* (0.616)
Observations	43730	43691	42978	42966	43721	43743
R^2	0.456	0.409	0.156	0.129	0.347	0.359
Adjusted R^2	0.358	0.303	0.003	-0.028	0.230	0.244
Rmse	5.048	6.335	29.79	35.71	5.053	4.908

Notes: This table represents 6 separate models that explain the relationship between capital structure and firm characteristics with the financial performance measures of high-tech SMEs. Given the results of the Hausman test, the fixed effects panel data analysis is used to produce the results, and primary focus is on the effect of the total debt ratio on each of the individual financial performance measures. The standard errors are reported in parentheses. ***, **, and * represent significance at the 0.1%, 1% and 5% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables.

Table 6.3: Panel Data Fixed Effects regression coefficients employing the long-term debt ratio as an independent variable upon the analysis of 6 individual financial performance measures.

	(1) ROA using Net income %	(2) ROA using P/L before tax %	(3) ROE using Net income %	(4) ROE using P/L before tax %	(5) Profit margin %	(6) EBITDA margin %
Long -Term Debt Ratio	-0.040***	-0.059***	0.083***	0.024	-0.043***	0.002
	(0.003)	(0.004)	(0.020)	(0.024)	(0.003)	(0.003)
Employees	-0.612***	-0.418***	-2.510***	-3.632***	-2.125***	-2.942***
	(0.101)	(0.127)	(0.608)	(0.729)	(0.101)	(0.098)
Cash flow	6.737***	7.636***	18.900***	20.110***	5.144***	5.190***
	(0.039)	(0.0487)	(0.234)	(0.280)	(0.039)	(0.038)
Future Growth Opportunities	-0.085***	-0.118***	-0.484***	-0.630***	-0.095***	0.021*
	(0.009)	(0.011)	(0.053)	(0.064)	(0.009)	(0.009)
Sales Growth	0.002***	0.003***	0.008***	0.011***	0.001*	-0.001**
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
Size: Total Assets	-5.562***	-6.317***	-15.820***	-17.30***	-0.630***	-0.472***
	(0.104)	(0.131)	(0.634)	(0.760)	(0.104)	(0.101)
Constant	18.020***	21.110***	50.43***	66.08***	-5.826***	-1.165
	(0.633)	(0.795)	(3.859)	(4.626)	(0.631)	(0.612)
Observations	44072	44033	43318	43306	44063	44085
R^2	0.455	0.408	0.155	0.129	0.348	0.359
Adjusted R^2	0.358	0.303	0.003	-0.028	0.231	0.245
Rmse	5.042	6.327	29.81	35.72	5.041	4.901

Notes: This table represents 6 separate models that explain the relationship between capital structure and firm characteristics with the financial performance measures of high-tech SMEs. Given the results of the Hausman test, the fixed effects panel data analysis is used to produce the results, and the primary focus is on the effect of the long-term debt ratio on each of the individual financial performance measures. The standard errors are reported in parentheses. ***, **, and * represent significance at the 0.1%, 1% and 5% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables.

Table 6.4: Panel Data Fixed Effects regression coefficients employing the short-term debt ratio as an independent variable upon the analysis of 6 individual financial performance measures.

	(1) ROA using Net income %	(2) ROA using P/L before tax %	(3) ROE using Net income %	(4) ROE using P/L before tax %	(5) Profit margin %	(6) EBITDA margin %
Short-Term Debt Ratio	-0.025***	-0.039***	0.030	0.094***	-0.012***	0.010**
	(0.004)	(0.005)	(0.023)	(0.028)	(0.003)	(0.003)
Employees	-0.771***	-0.566***	-2.804***	-3.828***	-2.448***	-3.197***
	(0.099)	(0.122)	(0.572)	(0.675)	(0.097)	(0.094)
Cash flow	7.285***	8.222***	19.080***	20.400***	5.407***	5.305***
	(0.038)	(0.046)	(0.215)	(0.254)	(0.0364)	(0.036)
Future Growth Opportunities	-0.092***	-0.125***	-0.449***	-0.601***	-0.105***	0.019*
	(0.009)	(0.011)	(0.050)	(0.059)	(0.009)	(0.008)
Sales Growth	0.001***	0.002***	0.004***	0.005***	0.000	-0.000
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Size: Total Assets	-5.933***	-6.760***	-16.140***	-17.580***	-0.508***	-0.298**
	(0.010)	(0.123)	(0.578)	(0.682)	(0.097)	(0.095)
Constant	18.790***	22.150***	53.060***	66.400***	-6.861***	-2.172***
	(0.600)	(0.740)	(3.481)	(4.110)	(0.581)	(0.568)
Observations	50394	50350	49592	49576	50367	50404
R^2	0.471	0.429	0.158	0.135	0.361	0.362
Adjusted R^2	0.388	0.339	0.025	-0.002	0.261	0.262
Rmse	5.350	6.595	30.26	35.71	5.198	5.093

Notes: This table represents 6 separate models that explain the relationship between capital structure and firm characteristics with the financial performance measures of high-tech SMEs. Given the results of the Hausman test, the fixed effects panel data analysis is used to produce the results, and the primary focus is on the effect of the short-term debt ratio on each of the individual financial performance measures. The standard errors are reported in parentheses. ***, **, and * represent significance at the 0.1%, 1% and 5% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables.

Table 6.5: Panel Data Fixed Effects regression coefficients employing the equity ratio as an independent variable upon the analysis of 6 individual financial performance measures.

	(1) ROA using Net income %	(2) ROA using P/L before tax %	(3) ROE using Net income %	(4) ROE using P/L before tax %	(5) Profit margin %	(6) EBITDA margin %
Total Equity Ratio	0.032***	0.047***	-0.467***	-0.582***	0.026***	0.010***
	(0.002)	(0.002)	(0.013)	(0.016)	(0.001)	(0.001)
Employees	-0.754***	-0.556***	-2.772***	-3.731***	-2.456***	-3.189***
	(0.098)	(0.121)	(0.561)	(0.660)	(0.096)	(0.094)
Cash flow	7.241***	8.157***	20.200***	21.760***	5.371***	5.290***
	(0.037)	(0.046)	(0.214)	(0.251)	(0.036)	(0.035)
Future Growth Opportunities	-0.091***	-0.124***	-0.468***	-0.618***	-0.102***	0.020*
	(0.009)	(0.011)	(0.049)	(0.058)	(0.008)	(0.008)
Sales Growth	0.001***	0.002***	0.002***	0.004***	0.001*	-0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
Size: Total Assets	-5.911***	-6.719***	-19.080***	-21.200***	-0.523***	-0.325***
	(0.099)	(0.122)	(0.571)	(0.672)	(0.096)	(0.094)
Constant	17.170***	19.750***	90.140***	112.60***	-7.828***	-2.308***
	(0.600)	(0.740)	(3.558)	(4.187)	(0.577)	(0.566)
Observations	50936	50892	50132	50116	50909	50946
R^2	0.474	0.434	0.181	0.162	0.367	0.364
Adjusted R^2	0.393	0.346	0.053	0.030	0.268	0.265
Rmse	5.326	6.558	29.850	35.120	5.176	5.086

Notes: This table represents 6 separate models that explain the relationship between capital structure and firm characteristics with the financial performance measures of high-tech SMEs. Given the results of the Hausman test, the fixed effects panel data analysis is used to produce the results, and the primary focus is on the effect of the total equity ratio on each of the individual financial performance measures. The standard errors are reported in parentheses. ***, **, and * represent significance at the 0.1%, 1% and 5% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables.

6.3.2.1 Total Debt Ratio

The first range of models under review analyses the influence of the total debt ratio on the differing financial performance measures, with the results presented in Table 6.2. An increase of 1 percent in total debt to total assets, the total debt ratio, can alter the strength of these performance measures. When analysing the influence of total debt on both the return on assets (ROA) it is important to note that a similar result occurs on both measures, thus proving the robustness of the results. For a 1 percent increase in the total debt ratio, statistically, significant decreases exist for ROA of -0.038 percent and -0.057 percent for net income and profit and loss before tax, respectively when all other variables are held constant. This finding supports the previous analysis that debt possesses a negative influence on financial performance (Margaritis & Psillaki, 2010; Titman & Wessels, 1988). According to the results shown in Table 6.2, when high-tech SMEs use additional debt, this has a negative impact on the return on assets for firms. This is a financial measure that both management and external finance providers view in high regard when analysing financial performance. Indeed, while the influence may seem small, this is not the case when related to the mean values previously discussed.

While the return on assets may be one measure of financial performance, to produce robustness it is significant to analyse other values that provide useful information regarding the high-tech SMEs. Subsequently, analysis of return on equity (ROE) is also examined using both net income and profit and loss before tax, as per the ROA values. Contrary to the previous results portrayed in Table 8.2 it is suggested that a positive relationship exists between the total debt ratio and ROE, with a 1 percent increase resulting in values of 0.056 percent and 0.053 percent respectively when one extra unit of the total debt ratio is added. This result rejects recent analysis in which debt is portrayed as a hindrance to financial performance (Claudiu, 2013). Instead, this result further strengthens the finding that leverage has a positive relationship with shareholder value (Wippern, 1966). Therefore, an increase of total debt ratio is found to support the findings of Modigliani & Miller (1963) whereby debt has tax advantages and should be implemented by the firm to produce optimal performance.

The final two financial measures that are used in the analysis consist of the profit margin and EBITDA margin, which examine the overall financial position of the firm in relation to operating revenue. Once again, a 1-unit increase in the total debt ratio has a negatively impacts profit margin with -0.033 percent. This finding provides further support to Fama & French (1998) who state that debt is a signal of poor financial performance value. The EBITDA margin results are not statistically significant. While the previous 4 measurements were based upon total assets, the use of these two measurements and a differing base value can provide a valuable financial measurement tool. These are values that financial managers seek to improve, as they portray the financial strength and position of the firm. Subsequently, given the poor peformance results that an increase in the total debt variable produces, it illustrates the negative impact which debt has on the financial performance of high-tech SMEs. The prior analysis that relates to this denotes that if firms cannot repay their loans there is a substantial threat of liquidation and so this can stop firms obtaining their cash flows (Diamond, 1991). This finding in the tables supports the previous work of Goddard, Tavakoli, & Wilson (2005) and suggests that high-tech SMEs are similar to firms in other sectors regarding the negative influence of debt on financial performance. Therefore, this supports *hypothesis 14: Total debt has a negative relationship with the financial performance of high-tech SMEs*, and further strengthens the findings of Titman & Wessels (1988) and Rajan & Zingales (1995).

The future growth opportunity is a variable that utilises the perceived value of intangible assets amongst the high-tech SMEs and thus can provide an engaging analysis concerning the financial performance valuations. Future growth opportunities represent the importance of this variable for the high-tech SMEs and have statistically significant results on all 6 financial performance measures, per Table 6.2. The influence on the corresponding values have similar results when a 1 percent increase occurs, with the negative impact of -0.083 and -0.114 percent on the ROA dependent variables and a more substantial negative influence of -0.487 and -0.637 percent on the ROE dependent variables, respectively. These negative findings provide some support to Myers (1984), whereby intangible assets are more likely to lose their value in financial difficulties which increases the bankruptcy costs. Intangible assets and growth opportunities are difficult to value correctly or transfer, compared to tangible assets such as vehicles or land (Revest & Sapio, 2012). This may relate to the decrease in financial performance figures in the analysis, since they may be valued incorrectly and thus a more considerable amount may result in adverse financial outcomes. The profit margin also decreases by 0.093 percent, while the EBITDA margin increases by 0.020 percent when there is a 1 percent increase. Regarding the EBITDA margin, it supports the belief that intangible assets can produce future sustainable returns as they can become successful competitive advantages for firms (Hitt et al., 2001). However, the results for the remaining 5 financial performance variables reject this conclusion.

The number of employees has statistically significant influences on all 6 of the financial performance variables, whereby a percentage increase in employees results in a negative influence. On the other hand, the effect of sales growth is shown to have a small but statistically significant positive impact on the financial performance measures apart from the EBITDA margin and profit margin that are both statistically insignificant. All of the influences are negative values when compared to previous findings. The somewhat differing results of the total debt ratio on financial performance measures can relate to the trade-off theory, since it has an important role to play in the financing of firms and that these firms can benefit by balancing debt (Myers, 1984).

6.3.2.2 Long-Term Debt Ratio

When analysing the impact of long-term debt, the long-term debt ratio is utilised for the analysis of the financial performance measurement variables. Long-term debt has a negative impact on ROA for both perspectives as per Table 6.3 whereby a one percent unit increase, results in a deficiency of -0.040 percent and -0.059 percent thus proving the robustness of the model given the similar results. This supports previous research that a negative relationship exists between future earnings and the maturity level of debt (Flannery, 1986). It further sustains the finding that financial performance and debt use are negatively related (Margaritis & Psillaki, 2010). Long-term debt has a lengthy and intriguing history about the financial performance of businesses, but little research has examined it regarding high-tech SMEs. Therefore, the results portray an image of long-term debt, like total debt, actually positively affecting the ROE variables with an increase of 0.083 percent, while the ROE that implements profits before taxes has a statistically insignificant result. The statistically significant result, however, negates the finding of Drobetz & Fix (2005) who illustrate that low leverage will relate to stronger financial performance. This positive value should be addressed when deciding upon the capital structure of such firms. The result further strengthens the finding that under favourable market conditions, debt use can lead to higher net profits (Norvaisiene, 2012). Often both ROE and ROA are key components for the financial analysis of businesses when banks and external investors are concerned.

Previous research has discovered that high-tech SMEs do not have the option to take on additional long-term debt, it can relate to the issues of bankruptcy such leveraged firms are expected to possess strong cash flow (Brander & Lewis, 1986). The relationship between financial performance and such relevant assets for firms is something that must be noted as overall the effect is more relevant for ROE. The profit margin and EBITDA margin follow the same trend as ROA for these assets, although the EBITDA margin is statistically insignificant. Given that of the 4 statistically significant results, 3 of the financial measures are negatively affected by an increase in the long-term debt ratio, *hypothesis 15: The use of long-term debt has a negative relationship with the financial performance of high-tech SMEs,* is accepted. This supports previous findings relating to debt's negative impact on financial performance (M. Harris & Raviv, 1991; Smith & Watts, 1992). It is an engaging concept to consider that extra capital will allow such firms to expand and take on further projects, but can also have a detrimental influence on their financial performance. The finding provides some support to the modified high-tech pecking order theory, given that debt finance would not be utilised by such firms seeking to perform strongly, whereby internal finance is used primarily with debt as a last resort (Minola, Cassia, & Criaco, 2013).

It is important to note that an increase in future growth opportunities results in a greater adverse outcome compared to long-term debt in all performance measures shown. This is significant as the majority of assets of high-tech SMEs often consist of a higher proportion of intangible assets when compared to other industries. Interestingly, intangible assets tend to have a negative relationship with debt (Brealey & Myers, 2000; Barclay, Smith Jr., & Morrellec, 2006).

6.3.2.3 Short-Term Debt Ratio

Often short-term debt is more accessible to obtain, due to its low time period of less than one year involved. Long-term debt as a source of finance can be obtained after scrutiny and research from both the firm and the debt provider, but a short-term loan is not scrutinised in such detail. Indeed, short-term debt has previously been found to possess a robust positive correlation with firm performance (Abor, 2005). It is worthwhile to investigate whether the short-term debt has similar results when examining its impact on the financial performance of high-tech SMEs, to verify whether the type of debt has an important role. As per the previous analysis of both total and long-term debt, when there is an increase in the short-term debt ratio, a similar negative impact on both ROA measures with a -0.025 percent and -0.039 percent change occurs. Often short-term debt and long-term debt consist of distinct categories when discussing financial performance, but from this analysis, short-term debt has a similar effect, such that poor performing quality firms often cannot obtain and sustain multiple short-term debt policies (Stohs & Mauer, 1996). The results are contrary to previous analysis regarding short-term debt and financial performance, which demonstrate a positive relationship (Salawu & Awolowo, 2009). However, the positive influence apparent on both ROE: profit and loss and also the EBITDA margin, provide support that quality businesses issue short-term debt to signal and account for their undervaluation as debt maturity and future earnings have an inverse relationship (Flannery, 1986). Given the overall inconclusive results, *hypothesis 16: The use of short-term debt has a positive impact on the financial performance of high-tech SME, is* rejected as short-term debt overall has a negative influence upon financial performance measures. It does, however, provide additional support to the modified high-tech pecking order theory since this likely negative debt usage resonates with the issue of technological uncertainty, market uncertainty and information asymmetry (Serrasqueiro et al., 2014).

Furthermore, the remaining variables such as employees, future growth opportunities and sales growth possess similar effects as their counterparts, in Table 6.2 and Table 6.3, on the key dependent variables when all other variables are held constant. It provides further evidence particularly of the role future growth opportunities can have on the financial performance of high-tech SMEs, given the previous discussion regarding the importance of intangible assets. Their importance can be the crux of success or failure for many firms in the future (Clarysse et al., 2003). However, the results do not support the previous finding that intangible assets can be am essential component of positive business performance (Barney, 1991).

6.3.2.4 Total Equity Ratio

The final analysis investigates how the financial performance of high-tech SMEs is affected by equity finance and not debt, which was an independent variable in the previous regression analysis. While short-term, long-term and total debt were found to have a substantially negative effect on the majority of the dependent variables, it is interesting to compare such findings with that of equity as illustrated in Table 6.5. Nawaz, Ali, & Naseem (2011) discuss how a high debt to equity ratio improves financial performance, thus larger amounts of equity will inhibit this. Contrary to previous findings, a positive relationship exists between total equity ratio and both measures of ROA, profit margin and EBITDA margin with a 1 percent increase resulting in 0.032, 0.047, 0.026 and 0.010 percent improvements, respectively. These findings do not support the belief that firms will utilise equity to dilute the expected losses due to poor performance for the original shareholders (Schmid Klein, O'Brien, & Peters, 2002). It is also important to note that remaining independent variables also follow a similar impact on financial performance as the models, which implemented debt ratios in Table 6.2, Table 6.3 and Table 6.4. The results of equity, support the discovery that technology-based firms have been shown to have a capital structure which consisted more of equity than debt (Hogan & Hutson, 2005). The ROE measures have a negative relationship, which supports the signalling theories that an increase in equity signals a decrease in firm value (Ross, 1977; Leland & Pyle, 1977).

Given the findings, *hypothesis 17: The use of equity finance signals the negative relationship with the financial performance of high-tech SMEs*, is rejected, since a positive relationship exists. The results are very engaging given that equity has been viewed as a last resort amongst US businesses (Cotei & Farhat, 2009). The results illustrate the importance of implementing an adequate capital structure for high-tech SMEs. The positive result gives credence to a belief that a modified version of the pecking order theory is supported by high-tech start-ups which favour equity use (Minola, Cassia, & Criaco, 2013). Equity has a significant positive relationship with financial performance in European high-tech SMEs and is a result for the future capital structure decisions.

6.3.2.5 Financial Performance Analysis Conclusion

When combining the overall results of the 4 tables, this analysis provides a strong capacity high-tech SMEs may indeed utilise a modified high-tech pecking order theory. Given the negative relationship debt has with financial performance measures and the positive impact equity produces, the results also provide credence to the finding that younger and unprofitable technology-based firms often seek to obtain venture capital financing (Minola & Giorgino, 2011). Such firms would not be able to afford to take on debt due to the threat of bankruptcy. A key reason why such firms may implement this theory is to disassociate them from the threat of bankruptcy and instead use equity even given the issues involving information asymmetry (Minola, Cassia, & Criaco, 2013). The findings in the 4 tables demonstrate support for the modified high-tech pecking order theory which relates to the result that NTBFs obtain six times less debt than equity, suggesting that an issue of credit rationing exists (Colombo & Grilli, 2007).

6.3.3 The Influence of Future Growth Opportunities, Size and Profitability on High-Tech SME Capital Structure

Now that the influence of debt and equity on financial performance measures has been analysed and discussed, it is of interest to see whether particular variables can affect the use of these financing sources for the high-tech SME capital structure. The first method to be discussed is the determinants which impact the gearing figures within high-tech SMEs, whereby three distinct measures are analysed as shown in Table 6.6. The Hausman test found that fixed effects are the most relevant for this undertaking and so the fixed effects model is used in the analysis. The primary dependent measure as illustrated in the model (1) relates to gearing as the combination of short-term and non-current liabilities, divided by the total amount of equity. The use of three separate dependent variables will provide robustness to the analysis.

Table 6.6: Results of the separate regression analysis that implement the panel fixed effects model investigating the determinants of gearing values

	(1) Gearing: Total Debt to Equity	(2) Gearing: Total Debt to Assets	(3) Gearing: Total Debt to Capital
Size: Sales	-10.160***	-1.190***	2.946
	(1.343)	(0.217)	(1.963)
Current Ratio	-0.065	-0.093***	-0.155
	(0.142)	(0.027)	(0.242)
Tangible Fixed Assets	12.160***	2.121***	4.651***
	(0.631)	(0.108)	(0.975)
Profitability	-1.044***	-0.188***	-0.192***
	(0.037)	(0.005)	(0.041)
Future Growth	1.356***	0.130***	0.152
Opportunities	(0.138)	(0.022)	(0.201)
Employees	-1.810	-1.434***	-2.547
	(1.601)	(0.263)	(2.369)
Constant	120.300***	18.850***	-7.780
	(8.150)	(1.335)	(12.08)
Observations	60092	57659	57546
R^2	0.077	0.082	0.004
Adjusted R^2	0.076	0.082	0.004
Rmse	95.410	15.800	142.300

Notes: This table represents three separate models that explain the relationship between firm characteristics and debt for high-tech SMEs. Debt is represented by 3 individual measures of gearing ratios: total debt to equity in model 1, total debt to assets in model 2 and total debt to capital in model 3. Given the results of the Hausman test, the fixed effects panel data analysis is used to produce the results and primary focus is on the effect of future growth opportunities, size and the tangible fixed assets on each of the individual gearing measures. The standard errors are reported in parentheses. ***, **, and * represent significance at the 0.1%, 1% and 5% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables.

Table 6.6 is distinct from the analysis in that both profitability and future growth opportunities possess a substantial impact on the amount of gearing which encompasses both short and long-term debt. Indeed, when there is a 1 percent increase in profitability, this results in a decrease of gearing by -1.044 percent, -0.188 percent and -0.192 percent respectively in regressions (1), (2) and (3). The results support the previous research with similar findings relating to this negative relationship between profitability and gearing (Cole, 2013; Tsuji, 2013). The findings illustrate how high-tech SMEs will tend to decrease and not utilise debt finance when their profitability is increasing. Primarily the results are similar amongst the regressions and provide ample support to results. The results offer support that as a determinant of capital structure, profitability displays a negative relationship with leverage (Booth et al., 2001). Given the discrepancies between the constant values, overall there is a similar change when profitability increases with all other variables being held constant. Due to the results, *hypothesis 6: Profitability has a negative effect on total debt use in high-tech SMEs,* is supported. It provides support to prior findings that a negative relationship between debt and profitability exists, as the most profitable firms possess low levels of debt (Titman & Wessels, 1988; Rajan & Zingales, 1995). The finding is substantial as it provides further evidence to the previous analysis that examined the influence of debt and equity upon the financial performance measures.

The next determinant under discussion is the future growth opportunities. When this variable increases by 1 percent, the change in gearing values substantially increases by the corresponding percentage value of 1.356, 1.130 and 0.152 respectively. However, due to the associated p-values, only the findings in the regression models (1) and (2) are statistically significant. This helps sustain the finding that, debt finance is not always negatively associated with growth opportunities, as small innovative firms were discovered to possess greater debt levels (Acs & Isberg, 1996). This does not support the view that intangible assets hinder firms in obtaining debt since tangible assets can be used as collateral they will have a positive correlation with debt finance (Fan et al., 2012). This provides evidence that high-tech SMEs with intangible assets are open to taking on extra gearing and is supported by prior research relating to high-tech SMEs by Schäfer et al. (2004). It is a relevant finding and relates to others in the field, where innovative high-tech SMEs often do not obtain sufficient capital from banks, especially younger firms (Gompers & Lerner, 2001). It portrays how there is an almost exact or increased correlation with a 1 percent increase in both independent variables total debt to equity gearing value. *Hypothesis 9: A negative relationship exists between future growth opportunities and the total debt in high-tech SMEs,* is thus rejected. However, it offers further strength to the finding that a positive relationship between leverage and growth opportunities exists (Bayrakdaroglu, Ege, & Yazici, 2013).

Size, as defined by the log of sales, demonstrates a negative relationship with the gearing values in regressions (1) and (2), while a positive but statistically insignificant relationship occurs in regression (3). This finding is contrary to Harris & Raviv (1991) and Rajan & Zingales (1995), who find a positive correlation exists with the size of the business and as firms grow in size, they will utilise larger debt amounts. However, the finding in which a one unit increase in size decreases the gearing value by -10.160 percent and -1.190 percent respectively, is supported by Chen (2004). The results provide some partial support that firm size is a crucial influence on capital structure (Titman & Wessels, 1988). Furthermore, the result can maintain that the pecking order theory is actually more reliable when used by larger businesses (Helwege & Liang, 1996), and so while not conclusive, do suggest that *hypothesis 1: The firm size of high-tech SMEs is positively related to internal finance,* may be correct but additional analysis is required.

Overall, the findings in Table 6.6 support Titman & Wessels (1988) who declare that capital structure is influenced by determinants that include variables such as firm size, growth, profitability, volatility of earnings and industry type. The results further emphasise the findings that growth opportunities, liquidity and profitability and firm size are key determinants of capital structure and debt usage amongst firms (Ozkan, 2001). Practically and theoretically, the findings discussed so far in the chapter complement each other and make logical sense. They provide further evidence of the relationship between capital structure and high-tech SMEs, even when different analysis variables are used. Debt has a negative impact on financial measures, while profitability has a negative correlation with the use of debt via gearing. In order to emphasise and reinforce these findings, an examination regarding the total values of both equity and debt types will prove insightful. This is researched and discussed in the following section.

6.3.4 Debt and Equity Value Determinants

An examination of the determinants of long-term debt, short-term debt, total debt and equity monetary values is undertaken as a robust comparison check to the gearing determinants previously discussed and analysed. A key component of this analysis compared to that of gearing is that it utilises other variables such as profitability, the EBITDA margin and size measured by the log of total assets. This will provide another insight into what effect such values can have on these four sources of financing. Given this econometric panel data model, the Hausman test prescribed the use of fixed effects. The results shed further light onto the characteristics of capital structure within the high-tech SMEs of Europe and the influences of both debt and equity. The relationship between the dependent and independent variables relate to a semi-log (lnX) model.

The first determinant of note, as illustrated in Table 6.7, consists of the future growth opportunity that has an extremely positive, statistically significant influence on all three types of debt. In essence, this equates to a substantial change when a 1 percent increase occurs for future growth opportunities, with an increase of €57.46 for total debt, € 35.09 for long-term debt and finally, €24.06 for the short-term debt due to the semi-log model. The results offer no support to the previous belief that such assets limit debt use, as they cannot be used as collateral due to their intangible characteristics and result in strong difficulty in obtaining any debt (Titman & Wessels, 1988; Rajan & Zingales, 1995). Given this finding, h*ypothesis 9: A negative relationship exists between future growth opportunities and the total debt in high-tech SMEs,* is rejected. Furthermore, it does provide an interesting finding given that intangible assets are often highly disassociated with gaining debt finance, due to the issue of evolving valuations within the high-tech sector. However, the findings in Table 6.7 support Sogorb-Mira (2005) who disseminates that growth opportunities attract particularly long-term assets, thus the debt maturity is similar. Given that there is no statistically significant relationship between future growth opportunities and equity, *hypothesis 10: A negative relationship exists amongst future growth opportunities and equity in high-tech SMEs*, is rejected.

Table 6.7: Individual panel fixed effects regression analysis investigating the determinants of debt and equity values

	(1) Long Term Debt Value	(2) Short Term Debt Value	(3) Total Debt Value	(4) Equity Value
Employees	-41.430***	23.890***	-12.470	1.861
	(9.102)	(4.561)	(10.590)	(10.550)
Current Ratio	1.147	-4.224***	-3.742**	18.440***
	(0.979)	(0.458)	(1.158)	(1.034)
EBITDA margin %	0.272	-0.217	0.167	2.929***
	(0.367)	(0.178)	(0.427)	(0.413)
Future Growth Opportunities	3.509***	2.406***	5.746***	0.765
	(0.790)	(0.399)	(0.919)	(0.919)
Size: Total Assets	253.000***	135.500***	404.200***	631.200***
	(8.960)	(4.394)	(10.440)	(10.150)
Profitability	-1.728***	-1.031***	-2.927***	0.588*
	(0.226)	(0.109)	(0.263)	(0.253)
Constant	-1460.600***	-772.700***	-2351.400***	-3495.500***
	(55.780)	(27.000)	(65.000)	(62.330)
Observations	57296	65383	56895	66034
R^2	0.072	0.108	0.159	0.316
Adjusted R^2	0.072	0.108	0.159	0.316
Rmse	576.600	312.500	669.100	726.100

Notes: This table represents 4 separate models that examine the relationship between firm characteristics and capital structure for high-tech SMEs. Capital structure is represented by 3 versions of debt: long-term debt, short-term debt and total debt, while the remaining capital structure dependent variable is equity. The models are presented in numbers 1 to 4 respectively. The econometric model is produced as a semi-log (lnX) model since the determinants are in log or percentage, but the dependent variables are in standard values. The results for this are interpreted by dividing the coefficient effect by 100. The values of each dependent are in €'000s. Given the results of the Hausman test, the fixed effects panel data analysis is used to produce the results, and the primary focus is on the effect of future growth opportunities, size and profitability on each of the individual capital structure measures. The standard errors are reported in parentheses. ***, **, and * represent significance at the 0.1%, 1% and 5% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables.

Innovation is closely related to future growth opportunities and the perceived positive relationship with debt may be due to ensuring innovation can take place within high-tech SMEs. Previous research notes that innovative businesses are less likely to receive external finance (Freel, 2007; C. Mason & Brown, 2013). However, innovative businesses should obtain external capital to reach full potential in the commercial market (Beck & Demirguc-Kunt, 2006). Furthermore, if the growth opportunity does prove hugely successful, then the owners and management of high-tech SMEs would be wary of underselling their stock and prefer to obtain debt, rather than give up ownership. Considering the findings in both Table 6.6 and Table 6.7, as previously discussed, *hypothesis 9: A negative relationship exists between future growth opportunities and the total debt in high-tech SMEs,* is rejected.

Firm size has a significant influence on the capital structure of high-tech SMEs where there is a substantial positive relationship amongst all 4-capital options under analysis. A 1 percent increase in size accounts for a minimum increase of €1,355 in short-term debt, €2,530 in long-term debt and €4,042 in total debt, which follows the belief that larger businesses are more open to utilising debt (Cassar, 2004). These results support prior research that an increase in size is positively correlated to enlargement in debt (Harris & Raviv, 1991; Rajan & Zingales, 1995). Most substantially, there is an addition of €6,312 in equity finance accounts for each unit increase in size. The findings for debt are in complete contrast to that of Cole (2013) but can sustain the increase in equity results. The findings of size differ greatly when both the independent and dependent variables are altered, as happened with the results in Table 6.6 and Table 6.7. When size is measured by the log of total assets, *hypothesis 2: Firm size has a positive relationship with the ability to obtain adequate future capital for high-tech SMEs,* is accepted. The relationship with the firm supports previous research that suggests larger SMEs amend their capital structure through different financial sources (Newman et al., 2012). Given the findings in Table 6.7, it further cements that firm size is a major influence on the capital structure (Titman & Wessels, 1988). This positive correlation with all capital structure options illustrates that as high-tech SMEs become larger it is a necessity to obtain external sources of capital. Without such capital availability, many businesses will suffer financially and may not fulfil their potential due to limited financial resources. Therefore, the results shown in Table 6.7 provide a keen insight into this approach and corroborate prior literature that external finance is more highly sought for high-tech SMEs as they grow in size. This finding supports previous results whereby larger firms find it easier to access external capital than smaller firms (Newman et al., 2012). In essence, smaller high-tech SMEs have a harder time gaining capital from lenders and investors.

The number of employees can be used as a descriptor of size. It possesses a statistically significant relevant positive impact on short-term debt, whereby one percent increase in employees correlates to an increase of €238.90. Due to the other financing sources portraying a negative association with an increase in employees, it is an interesting insight. The results suggest that when high-tech SMEs employ extra staff, there is an additional need for capital. Subsequently, the short-term debt can cover the costs associated with this. Indeed, SMEs are more likely to have financing difficulties with more extensive levels of uncertainty and risk existing for smaller new firms (Engel & Stiebale, 2013; Rosenbusch et al., 2013). There is a less substantial need regarding long-term debt since a decrease of -€414.30 occurs. Many high-tech SMEs have small staff numbers, as discussed in Chapter 2 and so often a new employee joining the business could account for a 5 to 10 percent increase in the number of staff.

The outcome of the impact of profitability and results for all three types of debt and equity will be discussed in further detail, with the results demonstrating that all coefficients are statistically significant. The influence of profitability on the debt is negative and the results are opposite to those of future growth opportunities, with the strength of the impact limited. This follows previous similar research whereby the leverage of business is negatively correlated with their profits (Fama & French, 2002; Frank & Goyal, 2003). However, they are similar to the impact upon the gearing values previously discussed in Table 6.6. When profitability increases by one unit, the corresponding decrease in short-term debt relate to -€10.31. This may occur because retained earnings could financially support the firm for the near future. It upholds the belief that the least profitable firms are funded through debt (Margaritis & Psillaki, 2010). However, this relationship with short-term debt is contrary to other findings, whereby it is positively correlated with profitability (Abor, 2005; Salawu & Awolowo, 2009). Indeed, reducing such loans can allow a firm to gain some financial freedom from legal debt obligations. This demonstrates that when such firms are in a stronger economic condition, they may favour retained earnings over debt, thus providing support to the pecking order theory. To further analyse this correlation, it is crucial to view the impact upon long-term and total debt when influenced by 1 percent increase in profitability, with a negative impact of -€17.28 and -€29.27 respectively. The reduction in both short term and long term debt and thus total debt is supported amongst profitable SMEs (Sogorb-Mira 2005). Given the findings, *hypothesis 6: Profitability has a negative effect on total debt use in high-tech SMEs,* is accepted. An enlargement of one percentage within profitability correlates to the substantial decrease in all debt measures, which further emphasises the result of Tsuji (2013) who found that in large, listed firms profitability is negatively related to the leverage ratio.

The effect of profitability has a small but positive relationship of €5.88 on equity for each percentage increase. This result rejects a proposition of signalling that if the business is expected to generate losses in the future, it will seek to gain new shareholders so that the losses are diluted for the current owner (Schmid Klein, O'Brien, Peters, 2002). This finding in Table 6.7 combined with that of debt negates the suggestion that only higher quality businesses can use a substantial proportion of debt due to the threat of bankruptcy (Foster & Young, 2013). It does, however, sustain that the use of debt is a signal of poor performance and lower value overall (Fama & French, 1998). The finding does reject that the issuance of new shares can be perceived as negative as the manager could have learnt some damaging information (Myers & Majluf, 1984). Contrary to this, the results suggest that an increase in profitability will result in an increase in equity use within the capital structure and so *hypothesis 7: Profitability has a positive effect on equity use in high-tech SMEs,* is accepted.

As per Table 6.6 and Table 6.7, the combined findings of the impact of profitability support the previously made position that a negative relationship between debt and profitability exists, as the most profitable firms possess low levels of debt (Titman & Wessels, 1988; Rajan & Zingales, 1995). Subsequently, this provides further support to accept *hypothesis 6: Profitability has a negative effect on total debt use in high-tech SMEs.* The results for both profitability on debt and equity values in both tables reinforce the finding of Titman & Wessels (1988) that profitability is a critical component of the pecking order theory since profitable firms generate higher revenue which results in a larger amount of retained earnings for investments. Additional support regarding high-tech SMEs implementing a modified version of the pecking order theory also gains traction from these results, whereby equity is chosen as the second source of capital, rather than debt (Minola, Cassia, & Criaco, 2013). The effect of profitability has the opposite impact of future growth opportunity, as there is a substantial uptake in short-term, long-term and total debt. The overall findings maintain that variables such as age, size, profitability, growth, asset structure and the industry are established key determinants that can affect the capital structure of SMEs (Hall, Hutchinson, & Michaelas, 2000). Indeed, the findings in Table 6.7 demonstrate that firm size, growth opportunity and profitability are some of the critical influencers of debt usage similar to the results of Deesomsak et al. (2004).

6.3.5 Capital Structure and Exports

Before discussing the results in detail, the model used revolves around random effects, as due to the stationarity of the patents variable, it is critical to ensure such a determinant can provide an insight into the exports of high-tech SMEs. The Breusch-Pagan Lagrange multiplier test, which analyses the variance, was undertaken to ensure a random-effects regression model would suffice instead of OLS regression analysis and the result valued the model satisfactory for both dependent variables. An engaging concept regarding this model is that it includes debt values, equity and size to provide an insight into what encourages SMEs in this sector to export,

Table 6.8: Results of the separate regression analysis that implements the random fixed effects model investigating the influencers of exports

	(1) Export Revenue	(2) Export revenue / Operating revenue %
Equity	0.119***	0.940**
	(0.033)	(0.331)
Total Debt	0.033	0.637***
	(0.017)	(0.183)
Size: Total Assets	0.315***	0.317
	(0.059)	(0.599)
Employees	0.759***	3.550***
	(0.047)	(0.489)
Patent=1 YES	0.550**	9.139**
	(0.211)	(3.320)
Age	-0.132	-3.576
	(0.144)	(2.053)
Constant	-0.059	11.910
	(0.481)	(6.514)
Observations	4575	6927
R^2	0.407	0.128
Adjusted R^2	0.406	0.127
Rmse	0.920	11.600

Notes: This table represents 2 separate models that investigate the relationship the capital structure and firm characteristics of high-tech SMEs with exporting. SMEs. For robustness, exporting is represented by 2 distinct measures, in model 1: export revenue and in model 2: export revenue divided by operating revenue. Given the results of the Breusch-Pagan Lagrange multiplier test, the random effects panel data analysis is used to produce the result, and the primary focus is on the effects of equity, total debt and whether the firm has a patent on each of the individual export measures. The standard errors are reported in parentheses. ***, **, and * represent significance at the 0.1%, 1% and 5% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables.

The impact of total debt on exports will be examined first, per illustrated in Table 6.8. A percentage increase in total debt has a statistically significant positive change in export revenue as a percentage of operating revenue by 0.637 percent. However, this does not support previous findings which suggest that banks often reject loan applications from young SMEs that implement an exporting growth strategy as the plan for strong returns (Riding et al., 2012). This result does, however, maintain that firms that export utilise greater amounts of debt to meet the sunk costs involved (Greenaway et al., 2007). The result provides some support for *hypothesis 30: Debt has a positive relationship with exports in high-tech SMEs.*

The increase in equity has a limited impact on export revenue, with a positive influence of 0.119 percent and 0.994 percent increases respectively in models 1 and 2 building upon the finding of debt. Regarding equity, it supports the finding that only the financially strong will tend to export, given the capital investment needed to support the sale of products in foreign markets (Chaney, 2016). Indeed, sunk costs have a significant influence on whether a firm exports (Roberts & Tybout, 1997). Often firms that sell shares will seek to generate considerable revenue streams, but given the size of the firms and the markets involved, focusing on the home market can prove less risky and improve investor relations. The results provide support to *hypothesis 31: Equity has a positive relationship with exports in high-tech SMEs.* It further strengthens the finding that young firms with growth expectations prefer to implement equity finance when exporting (Riding et al., 2012).

The number of employees has a significant relationship with exports, illustrated in Table 6.8 for both models. This positive effect results in a 1 percent increase that corresponds to a 0.759 percent increase in export revenue for SMEs in this sector. This is a substantial amount and relates to the physical size. Given previous research, it would be worthwhile to find if a distinct employee type, such as in sales or R&D can improve the export value greater. The finding supports previous SME research, whereby such firms that strategise international market sales through the improvement of staff technical abilities can advance international markets (Maranto-Vargas & Gómez-Tagle Rangel, 2007). The exporting compared to overall operating revenue percentage will improve by 3.55 percent with every additional percentage increase in employees, which corresponds with the findings of model 1 but to a stronger degree. This finding further strengthens the belief that human resource issues are a critical issue which can hinder NTBFs from exporting (Cahen et al., 2016). Concerning employees, *hypothesis 29: Firm size has a positive relationship with exports in high-tech SMEs,* is accepted. As SMEs grow, a critical strategy for their progression is to undertake businesses in different countries (Barringer & Greening, 1998). The expansion is often signposted by an increased level of staff working at the firm, and foreign markets can prove to be critically important if the export strategy is successfully implemented. The results from this research provide further support to this belief and can be a useful indicator for would-be investors or capital suppliers interested in high-tech SMEs that export. Furthermore, the additional employees play a more significant role, since the age of the firm has no statistically relevant influence on exports.

To compound this result, the size of the firm has only a minor positive effect on export revenue in comparison to employees with an increase of 0.315 percent, yet previous literature has disseminated that firms that export are often strongly positively correlated with size (Bonaccorsi, 1992). This is both a practical and a central theoretical finding as the perceived age of the firm would be positively correlated with exports. Given the findings relating to employees and the increase it can have, some further support is provided to hypothesis *29: Firm size has a positive relationship with exports in high-tech SMEs.* In the high-tech sector, the results portray that age has no statistically significant influence on exports and revenue generation. Subsequently, the findings rely strongly on an implication that European high-tech SMEs do not view age as a precursor to specific criteria for exporting. As the results in Table 6.8 have demonstrated, more controllable variables such as the capital structure, patents and the firm's profitability are of most importance when analysing exports.

Patents have a distinctly positive, statistically significant outcome upon both export measures as demonstrated in Table 6.8. This is contrary to the lack of a statistically significant influence of age. The analysis implements whether a firm has obtained a patent or not. The results provided determine that if high-tech SMEs attain a patent, it results in the exports to operating revenue considerably intensifying by 9.139 percent, while the export revenue also increases by 0.550 percent. This finding is similar to MacGarvie (2006) whereby a strong positive relationship exists between patent application and exports. The scale of the increase perhaps is represented by the hard work, time and cost involved in the attainment of patents, which provides legal rights to such firms who often rely heavily upon intangible growth advantages which can be altered or copied by competitors. It supports previous research which shows firms with world-leading technology and innovation will export and possess a strong, positive association with patents (Salomon & Jin, 2010). Given the value increase associated with each patent and the substantial export percentage increase of 9.139 percent, as illustrated in Table 6.8, this finding is apparent for European high-tech SMEs. Support is offered for the findings of Hsu & Ziedonis (2013), in which patents are a signal of quality and such firms that obtain patents will have trade improvements Subsequently *hypothesis 35: Patents have a positive relationship with the exports of high-tech SMEs,* is accepted. Patents are viewed as a signal that firms can take an innovative idea and generate a useful technology (Levitas & McFaydan, 2009). This is often a reason why high-tech SMEs have information asymmetry with would-be lenders or investors, as they do not wish to provide too much detail regarding any of their future projects relating to intangible assets. Therefore, such a high valuation placed on an increase in patents is justified, in particular for exporting, as patents have demonstrated the opportunity to generate sales from new customers (Holgersson, 2013). To summarise this point, the inclusion of patents for high-tech SMEs is an aspect of significant importance that such firms should seek to acquire when attempting to generate revenue from exports. However, it can be quite expensive to undertake and depends on the situation in which each firm finds itself, that is; whether to submit a patent application (Blackburn, 2003).

6.4 Conclusion

This chapter implements some of the hypotheses produced in Chapter 4 into the models produced in Chapter 5 and discusses the findings of the statistical tests. The results consist of 3 different topics, with first results examining the influence of capital structure and firm characteristics on the financial performance of high-tech SMEs. The total debt ratio negatively affects the financial performance of the firms, meaning that an increase in debt would hamper their ability to perform. This may relate to the legal constraints associated with debt and the threat of bankruptcy. Further analysis finds that the long-term debt ratio also has a negative relationship on the financial performance of the firms. These two findings support both proposed *hypothesis 14 and hypothesis 15*, produced in Chapter 4. Regarding the analysis of the short-term debt ratio, given the previous literature discussed, a positive relationship would exist; however, an adverse effect exists, and so *hypothesis 16* is rejected. The analysis then implemented an equity ratio instead of debt, whereby a positive relationship exists; meaning the rejection of *hypothesis 17*. The findings suggest that a modified high-tech pecking order theory may best improve the financial performance of high-tech SMEs given that equity increases performance, while all 3 of the debt measures hinder it. The finding provides some support to the modified high-tech pecking order theory, given that debt finance would not be utilised and only as a last resort by such firms seeking to perform strongly, whereby internal finance is used primarily with debt (Minola et al. 2013). The modified high-tech pecking order theory may be undertaken since this likely negative debt usage resonates with the issue of technological uncertainty, market uncertainty and information asymmetry (Serrasqueiro et al. 2014). These findings will be further analysed in the next chapters, implementing primary survey data in order to provide a unique insight into the topic with data that covers topics not available through secondary datasets.

The chapter also investigates the determinants of the capital structure of high-tech SMEs. The firm size as measured using the log of total assets has a positive relationship with obtaining both debt and equity, providing support to *hypothesis 2.* High-tech SMEs that increased their profitability have a negative relationship with the use of debt finance, while it improves the equity use within their capital structure. Subsequently, both *hypothesis 6* and *hypothesis 7* are accepted, respectively. It also provides some additional support to a modified high-tech pecking order theory, according to Minola et al. (2013) whereby high-tech start-ups prefer equity finance. The relationship between firm size and internal size, garners some support and so *hypothesis 1* is tentatively accepted. In relation to the future growth opportunities, a negative relationship was expected to exist with both debt and equity; however, the influence on debt is positive, while there is no statistically significant result for the influence on equity. Both of these findings result in the rejection of *hypothesis 9* and *hypothesis 10*.

The final set of analysis examines the effects of capital structure, firm characteristics and patents on the exporting of these firms. When implementing both the number of employees and the total assets as measures of firm size, within high-tech SMEs they both have a positive relationship with the exports. Therefore, *hypothesis 29* is accepted. The results for both debt and equity finance have a positive effect on exports, and thus *hypothesis 30* and *hypothesis 31* are accepted. This can relate to the impact of sunk costs which severely hinders firms exporting as they act as a barrier to international markets for businesses that have insufficient finance available (Chaney, 2016). Finally, while the application for patents can be costly regarding time, staff and monetary assets, the increase in export revenue are substantial for high-tech SMEs that possess a patent. A patent can also be a signal to possible investors and lenders regarding the firm's strong position and should be viewed as a potential client. Given the findings *hypothesis 35* is accepted. It is particularly important to note this because high-tech SMEs and SMEs alike, often have difficulty in obtaining external capital. It is an area, which many firms should investigate if struggling to gain new financial sources. This will be further investigated in Chapter 8.

In the following chapters, hypotheses produced in Chapter 4 are further tested and examined through the implementation of the primary survey data produced through a questionnaire of high-level participants within high-tech SMEs. The analysis will further delve into the topics mentioned and examine other areas not available through secondary datasets.

Chapter 7. The Financial Performance and Background of Capital Sources

7.1 Introduction

This chapter utilises the primary dataset produced from the questionnaire discussed previously in Chapter 4 and Chapter 5. The benefit of utilising such a dataset revolves around the unique insights and detailed responses that are not available in secondary datasets. The results will further build upon the analysis of Chapter 6, while producing further findings that will be used to test the produced hypotheses. This chapter addresses the background, breakdown and determinants of the financing sources implemented by high-tech SMEs and the effect of capital structure and firm characteristics on financial performance. The chapter aims to provide insight regarding the following topics: What financing options are used by high-tech SMEs and at what value? How has the financing of these firms changed from their original capital structure to their present one? What is the range of intangible assets that account for the overall percentage of total assets? How have banks' understanding of the high-tech sector and their lending to the high-tech SMEs altered in the past few years? The models described in Chapter 5 and the variables defined in Chapter 4 are used in investigation. The analysis first examines the determinants that have the most significant impact on the capital structure of high-tech SMEs. The next section of the analysis investigates the influences on financial performance, including the effect of incubators and accelerators, perceived risk and a target debt ratio. The final part of the analysis examines whether different financing options can increase or decrease the likelihood of high-tech SMEs becoming profitable. The entire questionnaire and responses are available in Appendix A and this data is cleaned to produce the dataset which tests the relevant proposed hypotheses and produces the findings for discussion and analysis.

7.2 Data Overview

Business success is strongly related to the correct finance mix; if debt finance is not implemented correctly, it can lead to bankruptcy (Thomas, 2013). While many entrepreneurs may have brilliant ideas, without adequate and appropriate finance to support them, they will never become tangible. Thus for firms to operate and perform to their potential, it is crucial that the appropriate amount of capital is available to them (Cassar, 2004). A total of 100 high-tech SMEs comprised the sample size for analysis, with a 10 percent response rate achieved which is similar to typical survey response rates (Curran & Blackburn 2001). The incorporated questions utilised ranges for answers as opposed to unique values, to allow a better grasp of the high-tech sector in Ireland. These are provided in the appendix. Questions that revolve around revenue, profits and growth are answered using bands of values, as the revenue of the firm positively correlates to the owner's income (Ang, 1992). The mean values for each individual band from relevant questions were created and used for the regression analysis. The discussion of the questionnaire data is provided in Chapter 5.

Table 7.1: The age of businesses compared to their respective number of employees

	Micro		Small		Medium	
(Years)	**1**	**2 to 9**	**10 to 20**	**21 to 49**	**50 to 249**	**Total**
Up to 2years	0	16	2	0	0	18
2 to 4years	4	14	3	1	1	23
5 to 10years	3	8	3	4	3	21
11years+	1	8	7	13	9	38
Total	8	46	15	18	13	100

Pearson chi2 (12)	= 39.556	Pr = 0.000
Likelihood-ratio chi2 (12)	= 45.793	Pr = 0.000
Fisher's exact	= 0.000	

Notes: The table represents a breakdown of the high-tech SMEs into the 3 distinct SME types: Micro, Small and Medium. The table illustrates the number of employees within the firm and the corresponding age of the firm. Additional descriptive information about the data such as the mean values is provided. Tests are provided to prove the validity of the results, such as Fisher's exact test

Table 7.1 illustrates the number of employees working in the firm as well as the years the business has been in operation. Theses SMEs can be broken down further into three distinct types based on the number of employees, be they, micro, small or medium using the European Union's definitions, which also incorporates turnover (European Commission, 2012). Subsequently, the analysis consists of 54 micro firms, 33 small firms and 13 medium firms, which provides a good spread of firm types. The age of businesses is also broken down into a similar scale, and interestingly, given the high amount of micro firms, the highest proportion of businesses are 11 years or older and the majority of these employ less than 50 employees. 41 percent of the businesses are less than 5 years old, which shows that they were founded during one of the worst economic climates Ireland and the world have seen in recent decades. Furthermore, when combing the results, 62 percent of the businesses are 10 years old or younger. This has strong similarity but at a lower value than 81 percent of 117 software firms in analysis undertaken by Hogan & Hutson (2005). One final point to note is that just under half of the firms employ less than 10 people, showing how some of these firms are quite small.

The pecking order theory, proposed by Myers & Majluf (1984) in their seminal paper, is used as the foundation for the types of finance variables used for the regression analysis.

This is due to the valid responses that met the criteria. Subsequently, the sources of finance examined in regression analysis are internal finance, external debt and external equity, and they are discussed further in Table 7.1, which analyses current financing of the high-tech firms. The variables involved in the econometric investigation are described previously in Table 4.4 and Table 4.5, and the models are available in section 5.8.2. Robustness tests and sensitivity analysis that include the propensity score matching, Rosenbaum-Bounds analysis, Mantel-Haenszel Bounds analysis and the Heckman two-step analysis are used to examine the econometric models for both the analysis on the effects on financial performance, revenue location and determinants of capital structure. The results are available in Appendix F and illustrate that no issues exist and the analysis undertaken is suitable.

7.3 Findings and Discussion

It was of utmost importance that key individuals who possess a wealth of knowledge regarding their firms were surveyed to ensure robust findings. While this may have limited the number of completed surveys, the data collected is of the highest quality. This is supported by the fact that 91 percent of those surveyed are the CEO, managing director or founder of the business. The responses, therefore, are expected to be extremely relevant to the businesses and provide a strong extremely positive relationship to the business itself.

7.3.1 Descriptive Findings

Table 7.2: Spearman correlation matrix amongst the key independent variables

	Employees	Age	R&D Investment	Experience	ROI	Firm Size
Age	0.505*					
R&D Investment	-0.160	-0.424*				
Experience	0.068	-0.053	0.062			
ROI	0.114	-0.056	0.162	0.084		
Firm Size	0.813*	0.617*	-0.243*	0.035	0.132	
Intangible Assets	-0.240*	-0.375*	0.226*	0.041	0.212*	-0.206*

Notes: The table represents the Spearman correlation matrix amongst the key independent variables used in the regression analysis undertaken within this chapter. The Spearman correlation is used to account for some of the variables that are measured on an ordinal scale within the questionnaire. The research is undertaken to ascertain the correlation between the variables and as expected the most highly correlated consists of the firm size, firm age and number of employees.* Correlation is statistically significant at the 95% confidence level.

Investment in R&D has been previously used as a means to denote growth opportunities of a firm and thus has been included along with other variables which are more easily understood (Michaelas, Chittenden, & Poutziouris, 1999). Some variables were measured on an ordinal scale as part of the survey. Consequently. a Spearman correlation was undertaken to provide the level and magnitude of correlation amongst them (Croux & Dehon, 2010). As shown in Table 7.2 a relatively strong correlation between a number of key variables exists, such as the number of employees and years in existence. A strong positive relationship also exists between the size of the firm and the number of employees, as well the finding that older firms also have a strong negative correlation with R&D investment. The number of businesses the participant has previously been involved in setting up has a fragile relationship with all the other variables and from this can conclude that experience has little influence on the current predicament in which these high-tech firms find themselves. Given the correlation amongst some of these variables are a confidence level of 95 percent; therefore the null hypothesis that no relationship exists should be rejected. The likelihood of collinearity is examined further through the variance inflation factor (VIF) and tolerance statistic. These findings once again illustrate the distinct issues facing high-tech firms that will now be discussed and examined in more detail.

Table 7.3: Initial and current financing sources compared to business age

Finance Type	Up to 2 Years	2 to 4years	5 to 10years	11 Years Plus	Total
Initial Stage					
Internal	41.03%	44.23%	44.19%	56.16%	47.83%
External: Debt	5.13%	9.62%	9.30%	8.22%	8.21%
External: Equity	25.64%	28.85%	27.91%	16.44%	23.67%
Other	28.21%	17.31%	18.60%	19.18%	20.29%
Total	100%	100%	100%	100%	100%
Current Stage					
Internal	39.53%	42.55%	41.18%	57.35%	46.41%
External: Debt	11.63%	17.02%	9.80%	17.65%	14.35%
External: Equity	18.60%	19.15%	31.37%	10.29%	19.14%
Other	20.93%	10.64%	11.76%	11.76%	13.40%
Total	100%	100%	100%	100%	100%

Notes: The table represents the breakdown of high-tech SMEs financing sources from different times, the first period: the initial stage, concerns the financing when the firm first started. The second period is the current stage, so the financing which they are implementing now. The table provides this information by the firm age so that if the firm age were 5 to 10 years, the minimum initial stage financing for this section would be 5 years ago. The results are produced in overall percentage values for each of 5 different age groups and a total overall value concerning all of the firms. Additional information regarding this breakdown is available in the appendix.

As illustrated in Table 7.3, internal funding remains constant over time, at 47.8 percent and 46.4 percent for initial capital and current capital respectively. This confirms previous findings of NTBF's relying heavily on internal financing (Brito & Mello, 1995). An interesting finding is that external equity decreased from 23.67 percent in firms using it as the initial source of capital, to 19.14 percent implementing it currently. Most intriguing is the drop from 31.37 percent of 5 to 10-year-old firms using equity to just 10.29 percent of firms which are 11 years and older. This may relate to Rosenbusch, Brinckmann, & Müller (2013) who discover that the high-quality venture capital (VC) firms will choose to invest in a business with high growth opportunities and the capabilities of reaching high levels. This is often at its maximum level when firms are younger. When VC firms obtain more information, they can make less accurate predictions about firm performance due to the vast amounts of available data (Zacharakis & Shepherd, 2001a). This further emphasises how equity finance is used more at the initial start-up stage for high-tech SMEs than as they become older.

In relation to debt finance, the opposite is true, as its use has almost doubled between the respective 2 age groups, as firms get older. This finding somewhat supports the belief that there is a strong positive correlation between larger firms and greater debt amounts (Rajan & Zingales, 1995). Furthermore, this loosely supports the finding that external equity is less crucial for older firms in comparison to other financing sources for high-tech SMEs (Hogan, Hutson, & Drnevich, 2017). In a previous study, 50 percent of businesses under one-year-old have been found to possess zero debt (Barclay & Smith, 1995). Internal sources of revenue for innovative firms are often not enough to be financially successful (Schneider & Veugelers, 2010).

As proposed by Frank & Goyal (2004) internal sources of finance are often not sufficient to ensure the pecking order theory covers all the financing needs of a firm. Here, the findings suggest that the the majority of young high-tech SMEs do not utilise the pecking order theory and traditional financing beliefs may not hold for this sector. However, for older firms the pecking order theory does seem to hold true. These results are contrary to the findings of Berger & Udell (1998) and their growth cycle capital structure as there is no pattern which is supported throughout the growing age of the firms as displayed in Table 7.3. Thus, we can interpolate that given this data, high-tech SMEs do not support the life cycle model. These findings will be investigated further in the analysis, examining what effect the sources used and how the distinct capital options can influence the financial performance of high-tech SMEs.

7.3.2 Perception of Banks and the Influence of Intangible Assets

High-tech firms are different from most other companies as often many of their values are comprised of intangible assets, such as patents, so when it comes to bank lending, it is hard to provide adequate security for loans. As previously mentioned, intangible assets can play a significant role in the financing of high-tech firms. Intangible assets are complicated to price correctly, but for TBSFs the majority of their value is derived from growth opportunities and intangible assets which are not easy to transfer or sell (Revest & Sapio, 2012). This can lead to problems of gaining loans through security and selling equity at a fair value. Subsequently, the higher the percentage of intangible assets; the more likely financing difficulties will occur (Brierley, 2001).

Table 7.4: Percentage of intangible assets from total assets for high-tech SMEs

Intangible Assets	Amount	Accumulation
0 to 15percent	34	34
15 to 25percent	9	43
25 to 40percent	9	52
40 to 55percent	3	55
55 to 70percent	10	65
70 to 85percent	11	76
85 to 100percent	24	100
Total	100	100

Notes: The table represents the breakdown of high-tech SMEs' percentage of intangible assets as a value of the total assets. An interesting finding notes that 24 percent of the firms note that intangible assets account for 85 to 100 percent of their total assets

The results in Table 7.4 are somewhat contrasting as 34 percent declare that intangible assets consist of 0 to 15 percent of the total assets, while 24 percent of the firms have intangible assets worth 85 to 100 percent. Further emphasising the contrasting results, 52 percent of businesses value intangible assets as worth between 0 to 40 percent of the total assets, this is compared to 45 percent of the firms, which possess intangible assets worth at least 55 percent. Overall this provides a mean value of 45 percent for intangible assets, which is high but less than the 59 percent as reported by Minola, Cassia, & Criaco (2013) when analysing NTBFs. This may be down to multiple factors, such as the business' inability to correctly value intangible assets or the business has purchased a substantial or even insignificant amount of tangible assets. It is interesting as often high-tech firms are associated with possessing a majority of intangible assets but as shown, it is not always the case. However, when compared to previous findings it demonstrates how high-tech firms comprise strongly of intangible assets such as the Nouveau Marche which consists of mainly French high growth firms which on average had just 2.8 percent of total assets as intangible (Bottazzi & Rin, 2002). The significant difference between high-tech firms and other businesses is further illustrated.

Table 7.5: How banks' understanding of high-tech firms and the funding environment for high-tech firms has changed in the last few years

	Banks' Understanding	Banks' Lending Environment
Significantly Improved	5.26	5.26
Slightly Improved	23.16	28.42
Neither Better nor Worse	49.47	45.26
Slightly Worse	15.79	14.74
Significantly Worse	6.32	6.32
Total	100.00	100.00

Notes: The table represents the breakdown of 2 specific results taken from the primary questionnaire data for high-tech SMEs. The first finding notes that these firms are asked to describe how they deemed banks' understanding of the high-tech sector has improved in the past 2 to 3 years. The second finding relates to another question whereby the high-tech SMEs were asked to comment on the change in the bank lending environment in the past 2 to 3 years. Please refer to Appenix A for additional details of the questionnaire results.

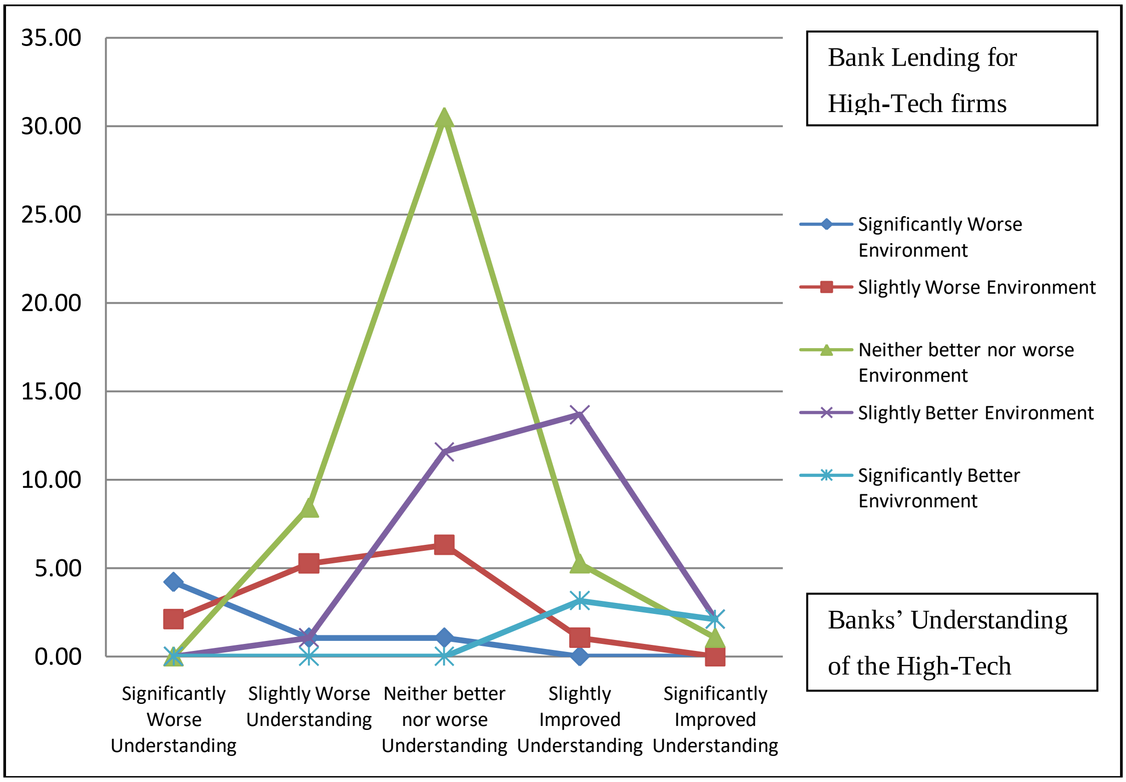


Figure 7.1: Improvement of the banks' understanding of the high-tech sector compared to the change in the banking environment for high-tech SMEs

Notes: This figure illustrates the findings of Table 7.5 representing the banks understanding of the high-tech sector, according to the high-tech SMEs, on the horizontal axis. Furthermore, the outcomes for the change in the bank lending environment for high-tech SMEs are plotted against the banks understanding to provide a keen insight into the topic for high-tech SMEs. Please refer to the appendix for additional details of the questionnaire results.

High-tech firms have faced the problem that banks do not understand the business model or products and this is an ongoing problem for many years for them. Therefore, it is an interesting topic to analyse, particularly when comparing the change over the past 2 to 3 years. The results are presented in Table 7.5 and illustrated in Figure 7.1. The banks understanding of high-tech firms shows that overall there has been an improvement of 28.5 percent of firms, which is a noteworthy difference compared to 22.1 percent who deem the understanding to have gotten worse. Hogan, Hutson, & Drnevich (2017) using older data, discover that high-tech firms will utilise considerable amounts of external equity when information asymmetries amongst the bank lenders exist. This analysis offers further support to earlier results whereby external debt finance is the third favourite option as a lack of improvement by banks in lending and understanding high-tech SMEs would be a key influence.

However, what is perhaps most worrying is that 45.26 percent of firms do not see any change in the lending environment, be it good or bad. Considering banks have struggled to deal with high-tech firms over the years, this is a considerable challenge that will have to be met, to ensure adequate lending can be provided to high-tech firms. Furthermore, an active engagement with understanding and learning about the businesses will improve the likelihood of more firms applying for loans in the coming years. The inability of key financial firms to gain knowledge regarding the products and services of high-tech firms and their business models has been staggered in Europe (Dosi, Llerena, & Labini, 2006). This can explain why high-tech firms are not provided with adequate capital to ensure they can become successful in the future due to their amount of intangible assets.

7.4 Regression Analysis Findings

7.4.1 Choice of Finance

Table 7.6 illustrates the analysis of the financing mix. To ensure collinearity amongst the variables was not a problem, the variance inflation factor (VIF) and tolerance were both used. The tolerance value solely focuses on each variable's unique predictive ability on the dependent (Hair et al., 2006). When analysing the results, a VIF value of less than 10 and a tolerance value as close to 1 as possible, indicates that an independent variable is not affected by the others. According to the results in Table 7.6, collinearity is not a significant issue in the dataset, and the analysis is undertaken.

A 1 percent increase in firm size, which is measured using the log of total assets, results in effecting internal finance by an increase in 7.894 percent. SMEs often face financing difficulties with larger levels of uncertainty and risk existing for smaller new firms (Engel & Stiebale, 2013). The findings in Table 7.6 offers support for the implementation of the pecking order theory becoming more reliable when used by larger businesses (Helwege & Liang, 1996). Given the finresukts, the following hypothesis is accepte; *hypothesis 1: The firm size of high-tech SMEs is positively related to internal finance.* It is an important result since firm size has been a contentious issue in relation to determining the capital structure. Indeed, a large amount of uncertainty regarding the risk involved with new firms compared to those which are older and larger (Rosenbusch, Brinckmann, & Müller, 2013).

Table 7.6: Determinant variables of finance use within high-tech smes through OLS regression analysis and the collinearity statistics tests provided

	(1) Internal Finance	(2) External: Debt Finance	(3) External: Equity	Collinearity Statistics: VIF	Collinearity Statistics: Tolerance
Employees	-10.480**	0.699	6.085***	3.610	0.277
	(3.937)	(2.062)	(3.033)		
Firm Age	7.088	-2.928	-5.216	2.330	0.571
	(4.359)	(2.461)	(3.628)		
R&D Investment	-0.335*	-0.031	0.127	1.360	0.263
	(0.131)	(0.055)	(0.116)		
Experience	1.728	-0.020	3.598	1.100	0.911
	(4.481)	(1.498)	(3.655)		
Return on Investment	-0.988*	0.051	1.084**	1.220	0.182
	(0.482)	(0.153)	(0.369)		
Size: Sales	7.894**	-0.784	-5.096	4.790	0.791
	(3.554)	(2.141)	(3.434)		
Intangible Assets	0.250***	-0.027	-0.105	1.330	0.754
	(0.093)	(0.532)	(0.073)		
Constant	-11.52	-0.974	54.980		
	(41.380)	(19.580)	(37.650)		
Observations	75	90	90		
R^2	0.285	0.031	0.198		
RMSE	26.709	12.513	25.706		

Notes: This table represents three separate models that explain the relationship between firm characteristics and capital structure for high-tech SMEs. Capital structure is represented by internal finance in model, debt finance in model 2 and equity finance in model 3 OLS regression analysis is implemented, utilising the specific survey modelling approach of the analysis, which is implemented through Stata using the prefix svy, which provide for the generation of robust results, given the low number of observations. The primary focus is on the effect of intangible assets, employees and size for each of the individual dependent variables The VIF and Tolerance tests are used to test for strong collinearity, which is not apparent in this model. The standard errors are reported in parentheses. ***, **, and * represent significance at the 0.1%, 1% and 5% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables,

According to the results in Table 7.6, the number of employees has a substantial negative relationship with internal finance, whereby a 1 percent increase in the number of employees results in a -10.480 percent decrease in internal finance. This may occur due to the wages and the training expenses that high-tech SMEs must account for when increasing their employee numbers. This follows the finding that SMEs are often found to possess limited resources such as capital and knowledge and are more susceptible to damaging changes in the market (Buckley, 1989). A 1 percent increase in employees increases the amount of equity finance by 6.085 percent, which accounts towards the decrease in internal finance. Some credence to the results of Minola, Cassia, & Criaco (2013) is supported as they declare that start-up high-tech firms implement the modified pecking order theory, with internal capital primarily, then equity as the second source over debt finance. Given the issues with these firms in sustaining themselves throughout internal finance alone, SMEs are depicted as facing a litany of challenges such as inadequate access to finance (Lange, Ottens, & Taylor, 2000), the findings in Table 7.6 are noteworthy.

There is a strong positive relationship between internal finance and the age of the business, but it is statistically insignificant, which rejects previous findings of a longitudinal sample of international SME's (Ciaran Mac an Bhaird & Lucey, 2014). Previous findings have suggested that often younger firms possess a strong dependence on internal finance, but, as discussed, the SME high-tech firms have a different relationship with financing options compared to other sectors (Hyytinen & Pajarinen, 2005). There is also a negative relationship between the firms' age and debt finance and equity finance; however, the results again are statistically insignificant. Given these findings, *hypothesis 5: The age of high-tech SMEs has a positive relationship with internal finance,* and *hypothesis 6: The age of high-tech SMEs has a negative relationship with debt,* are both rejected in this study. Subsequently, no support is offered to older businesses utilising their retained earnings, resulting in a negative relationship between debt and age under the pecking order theory (Berger & Udell, 1998; López-Gracia & Sogorb-Mira, 2008). *Hypothesis 3: Age has a positive influence on the ability to obtain adequate future capital for high-tech SMEs,* can also not be supported.

R&D investment can be a proxy variable to determine the future growth opportunities of a firm because if little were invested in the area the firm would likely stagnate in the high-tech sector. According to this analysis; when high-tech SMEs increase their investment in R&D by 1 percent this results in the decrease of internal finance by -0.335 percent **a**nd this is substantiated by previous analysis of SMEs by Mac an Bhaird & Lucey (2010). R&D entails many various expenses, and so retained earnings may not suffice in financially covering the costs involved. It has been shown to become an issue with firms if the retained earnings are not strong enough to support the investment (Westhead & Storey, 1997). On the other hand, there is an inverse relationship between leverage and growth opportunities (Barclay Smith Jr., & Morrellec, 2006; Rajan & Zingales, 1995). No support exists within the results, but it illustrates the many issues high-tech SMEs face in order to maximise their potential. Furthermore, from a business perspective, high-tech SMEs seek to often differentiate by providing better substitute products than currently on the market and so with less available money for R&D, this can have a severe effect on the firms. This finding is somewhat supported by Bougheas (2004) as the equity value is not statistically significant to provide full support, but a negative relationship with internal finance holds accurate. Subsequently, *hypothesis 11: R&D expenditure has a negative relationship with internal finance in high-tech SMEs,* is accepted.

Large information asymmetries tend to exist for SMEs, but their most significant influence regards high-tech SMEs, given their relationship with intangible assets and future growth opportunities. (Berger & Udell, 1998). The positive relationship between intangible assets and internal finance found in Table 7.6 is a key finding and re-emphasises this point regarding intangible assets. A 1 percent increase in intangible assets results in the improvement of internal finance by 0.250 percent, emphasising previous research that young high-tech firms are found to rely on personal financing (Bollingtoft et al., 2003). Furthermore, SMEs which are smaller, and also those that possess a large proportion of intangible assets, are not leveraged highly (Frank & Goyal, 2009). With limited other financing options, preceding literature supports the results regarding the use of internal finance. This result reinforces the theory that intangible assets can prove to be a burden for high-tech SMEs when obtaining external finance (Brierley, 2001). Therefore, it is often deemed a safe option for high-tech firm that possess a large percentage of intangible assets to use retained earnings, even if they could be detrimental to the business' growth prospects in the future as illustrated in Table 7.4. Given the result and analysis, *hypothesis 12: Intangible assets have a positive relationship with internal finance in high-tech SMEs,* is accepted. To account for information asymmetry, the pecking order theory states that internal sources should be utilised and equity is only used as the least preferred option (Myers & Majluf, 1984). The result provides an insight that high-tech SMEs implement the pecking order theory. It further strengthens that the modified high-tech pecking order may be used, as discussed in the analysis in Chapter 6. This is of particular importance since previous research finds that firms only use debt with a high proportion of tangible assets as part of the trade-off theory (Rajan & Zingales, 1995).

A statistically significant and robust positive relationship exists between ROI and equity finance exits with a 1 percent increase in ROI affecting equity finance by 1.084 percent. This result suggests that in the business world outside investors seek a high return on their investments and so, in theory, this result is strongly supported. Previous analysis state that the annual rates of return for a start-up business are often double that of reputable firms and the finding supports this belief (Mason & Harrison, 1999). On the opposite scale, there is a negative relationship between return on investments and the use of internal finance with a decrease of -0.988 percent, which further strengthens the finding on equity. Results such as this paint an illustrative picture of the high-tech sector's relationship with equity. It is further emphasised by the finding that VC firms seek more substantial returns from high-tech firms than any other type of projects and the findings support this standing (Murray, Lott, & Have, 1995). However, economic growth can have an important role, as Paik & Woo (2014) illustrate how a decrease in the economy can instigate VC firms to prioritise investing in older stage traditional businesses This is accurate when combined with the previously discussed variables particularly that of experience which along with high return rates tend to favour the use of equity financing. The results also provide support that new equity owners often seek higher rates of return as compensation for information asymmetries which may exist (Cassar, 2004). Subsequently, the may relate to why equity finance is used more at the initial stage for high-tech SMEs, as discussed in Table 7.3, since firms may provide more information in their infancy thus limiting the costs.

A solid, but statistically insignificant relationship exists between the experience regarding the number of businesses with which the respondent has been involved at the initial stage and the use of equity finance and internal finance. Zhang (2011) finds that the use of venture capital funding relates closely to previous experience in start-ups. Interestingly another piece of research suggests that when investors possess substantial experience and skills to evaluate new projects, the inclusion of equity finance can be a sign of a superior business (Garmaise, 2001). Referring to this as a type of human capital, since the people employed have an important role regarding the ownership of the business, it can add value to the firm. The findings in Table 7.6 do not support previous literature which identifies human capital including experience, as an important factor for any business to be successful (Burt, 1992) and can impact on the types of finance a new SME wishes to obtain (Atherton, 2009). Therefore, *hypothesis 8: Previous start-up experience has a positive relationship with external equity finance in high-tech SMEs,* is rejected.

7.4.2 The Impact of Capital Structure Sources on EBITDA

Table 7.7 illustrates the relationship between financing options and other variables on the financial performance of firms. The analysis implements variables that are often specifically available through primary research which include, whether the firm has a target debt ratio, the risk-return profile of the firm and the previous experience in an incubator or accelerator program. The investigation will provide some engaging insights relating to an area of the capital structure topic not previously researched. 3 separate models previously discussed in Chapter 5.8 are presented, and it builds from model 1 as the original and then implements an additional categorical variable in both model 2 and again in model 3.

Table 7.7: The impact of the three main financing sources and characteristics on EBITDA

	(1) EBITDA	(2) EBITDA	(3) EBITDA
Internal Finance	0.010**	0.007	0.009**
	(0.005)	(0.005)	(0.005)
External: Debt Finance	0.012	0.009	0.011
	(0.010)	(0.010)	(0.010)
External: Equity Finance	-0.001	-0.001	-0.000
	(0.005)	(0.005)	(0.005)
Target Debt Ratio: Yes	0.694	0.778**	0.709*
	(0.417)	(0.346)	(0.369)
Incubator or Accelerator: Yes		-0.787***	-0.822***
		(0.211)	(0.206)
Risk Preference: Adequately Valued Intangible Assets			0.533*
			(0.299)
Risk Preference: Possible Higher Valued Intangible Assets			0.431*
			(0.250)
Constant	11.360***	11.950***	11.430***
	(0.422)	(0.431)	(0.485)
Observations	83	83	83
R^2	0.136	0.258	0.288
Rmse	1.043	0.973	0.966

Notes: This table represents three separate models that explain the relationship between capital structure, firm characteristics and risk with EBITDA for high-tech SMEs. The total debt ratio is a binary value with no as the comparison result. Incubator or accelerator is a binary variable with no as the comparison result. RISKPREF is a categorical variable that utilises three options of different assets to derive a perceived risk level for the firm. The options available consist of; low worth tangible assets valued correctly (no risk), medium worth intangible assets valued adequately (some risk) or high worth intangible assets that may have been incorrectly valued (risky). In this analysis the outcomes compare to the low worth correctly valued tangible assets. The model 2 builds on from model 1, includes the incubator or accelerator variable, and then model 3 builds upon model 2 and integrates the risk variable. 3 OLS regression analysis is implemented, utilising the specific survey modelling approach of the analysis, which is implemented through Stata using the prefix svy, which provide for the generation of robust results, given the low number of observations. The primary focus is on the effect of target debt ratio, incubator or accelerator and the risk outcomes. The standard errors are reported in parentheses. ***, **, and * represent significance at the 0.1%, 1% and 5% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables.

In relation to model 1, a percentage increase in internal finance results in a small positive increase in EBITDA by 0.010 percent. This finding rejects the theories of both Modigliani & Miller (1963) and the trade-off theory discussed by Miller (1977) whereby both theories utilise debt finance to generate benefits for the firm. Instead, the finding provides further emphasises of the importance of a type of pecking order theory for high-tech SMEs seeking to generate EBITDA. This may relate to information asymmetries, whereby the owners of businesses hold more information about their firm than external stakeholders (Leland & Pyle, 1977; Ross, 1977). This result synergises with the findings in Chapter 6, to some degree. The finding also emphasises that the signalling theory could be implemented, given the similar pattern of using internally generated capital which is viewed by the market as a positive signal of strong future investments (Giudici & Paleari, 2000). Furthermore, the result in model 3 of Table 7.7 supports this finding with a positive increase of 0.009. This provides additional support for the signalling theory which suggests that owners will utilise their internal capital for high return investments (Leland & Pyle, 1977). Subsequently, h*ypothesis 13: Internal finance signals a positive relationship with the financial performance of high-tech SMEs*, is accepted.

Regarding the outcomes in model 2 and model 3, the target debt ratio produces a statistically significant result. For high-tech SMEs possessing a target debt ratio demonstrates a strong positive impact on revenue with a 0.778 percent increase and 0.709 percent increase, respectively. This rejects previous research that claims the debt ratio of business is negatively correlated with profits (Fama & French, 2002; Frank & Goyal, 2003). Further analysis finds that large firms will attempt to obtain a targeted debt which supports the static trade-off theory (Brounen et al., 2006). Given the findings in Table 7.7, h*ypothesis 18: Possessing a target debt ratio will have a negative relationship with the financial performance of high-tech SMEs,* is rejected. However, the findings do sustain more recent analysis that suggests large start-ups implement debt supporting the trade-off theory, meaning it is not solely for older firms (Coleman, Cotei, & Farhat, 2014). An important finding to note is that the debt target capacity can change as per differing theories, the pecking order theory and trade-off theory are both mutually beneficial and co-exist (Leary & Roberts, 2010). This is illustrated by Alti (2006) where a target debt level, via a modified version of the trade-off theory, is found to exist in combination with a short-term market timing effect which influences the debt level in the short term in a strongly performing market. Therefore, the findings in Table 7.7 may suggest additional support to a modified high-tech pecking order theory. Results in the appendix note that the majority of high-tech SMEs within the questionnaire dataset possess a target debt ratio of just 20 percent or lower, thus creating a mean value of just 8 percent. In a previous study, it was suggested that a low debt ratio is often associated with larger, profitable firms (Graham, 2000). The influence of the trade-off theory on SMEs is supported and reinforces the result by Lopez-Gracia & Mestre-Barbera (2015) that finds the majority aim for a debt target throughout a 10-year period.

The use of external debt has a positive relationship with the amount of revenue within high-tech SMEs, but the results in each of the 3 models are statistically insignificant. The findings are not supportive of a relationship between debt and EBITDA and do not sustain Drobetz & Fix (2005) who state that debt levels are strongly associated with the volatility of a company's potential earnings; thus profitable firms tend to possess low leverage. Furthermore, the finding by Norvaisiene (2012) that in favourable market conditions, debt can lead to higher net profits, is also rejected and so *hypothesis 14: Total debt has a negative relationship with the financial performance of high-tech SMEs,* is not supported under this analysis. An additional point from this finding relates to Table 7.3 where debt is the least used finance source at the initial stage, and currently the second most implemented capital source for the oldest high-tech SMEs. Subsequently, with the low level of debt finance currently utilised by high-tech SMEs combined with the negative banking section of Figure 7.1, there is scope to improve for younger firms at the initial stage to utilise it more. Equity finance appears to have a negative relationship with revenue in all 3 models, but all 3 results are statistically insignificant. Therefore, no support is provided to the signalling theory that share issuances are viewed as bad news (Myers & Majluf, 1984). Unlike in the previous chapter's findings where a statistically significant positive relationship was found to exist, *hypothesis 17: The use of equity finance signals the negative relationship with the financial performance of high-tech SMEs*, cannot be accepted in this analysis.

The second model introduces an analysis of incubator and accelerator programmes. Such programmes are often shown to be paths for many high-tech SMEs before going into the market. Research has shown that the use of incubators by a firm can signal strong firm quality to outside investors and customers (Colombo & Grilli, 2006). Furthermore, acquired knowledge which can relate to the use of incubator and accelerator programmes and start-up experience can have a considerable positive influence on a firm's performance (Bandura, 1986; Davidsson, Low, & Wright, 2001). According to Table 7.7, the use of incubators and accelerators has a negative relationship with EBITDA in both model 2 and model 3 with -0.787 and -0.822 results, respectively. Due to the negative relationship, h*ypothesis 19: Experience in an incubator or accelerator program will have a positive relationship with the revenue and profitability of high-tech SMEs,* is rejected. It is a result which previous literature does not predict, given that incubators can assist firms in gaining essential capital (Revest & Sapio, 2012) and firm growth and performance is influenced by the founder's acquired entrepreneurial knowledge (Colombo & Grilli, 2005). The sample under analysis is appropriate given that 46 percent of the high-tech SMEs within the dataset have used such services as demonstrated in the appendix. In a previous study of high-tech firms, start-ups benefited from public support programmes for networking and future research, which could lead to higher revenues, but they had no impact on academic start-ups (Colombo et al., 2012). The finding in Table7.7 suggests that the use of accelerator and incubator programmes is not beneficial, as the time and effort taken up could be better used elsewhere by the high-tech SMEs.

The final version of this research as shown in model 3, implements the asset preference and risk profile of the high-tech SMEs where choosing a guaranteed value against a higher, but not guaranteed, valuation can have an impact on the generation of revenue. In essence, it measures a risk and reward theory with a simple, practical method regarding the benefits of obtaining guaranteed valuation, particularly given the previous discussion about intangible assets. Including a risk preference variable provides greater insight into the people running and behind the business, which can have a decisive impact on the future of the firm, regardless of any other variables. Subsequently, given that possessing substantial tangible assets is believed to be more beneficial, the model examines the behavioural component of a business. Previous research notes that innovative small businesses undertake the majority of investments through assets that are unsuitable for collateral (Demirel & Parris, 2015). This unsuitability as collateral is due to the intangible knowledge which is difficult to value meaning they struggle to signal their lower risk profile due to the assets (Demirel & Parris, 2015).

The results in Table 7.7 confirm that a preference for higher value intangible assets has a positive impact on EBITDA compared to tangible assets. In relation to tangible assets with a medium risk profile, as the medium worth intangible assets with a 0.533 increase compared to lower worth tangible assets. This finding is imperative due to the financing issues associated with intangible assets, since they offer limited value for collateral or none at all for many high-tech firms (Berger & Udell, 1998). The impact of a preference for higher risk profile, deemed through the high worth intangible assets has a less favourable increase on the EBITDA by 0.431 in comparison to the lower worth tangible assets. Initial asymmetric information creates a moral hazard selection problem for banks where they charge high rates initially and reduce rates in later periods after the borrower types are revealed (Petersen & Rajan, 1994). Previous findings suggest that tangible assets can be valued appropriately and used in a more useful manner for high-tech SMEs. Although the findings in Table 7.7 demonstrate the benefits of selecting riskier intangible assets to improve EBITDA to a degree, tangible assets have additional benefits such as collateral (Fan et al., 2012). The results reinforce the financing difficulties that exist for NTBFs that are exacerbated by the information asymmetry issues associated with technology businesses (Carpenter & Petersen, 2002). Quintessentially this risk and reward strategy reverts to the human capital and how it can influence the capital structure of a firm (Atherton, 2009). It suggests that smaller firms seek such advantages, while firms with more disposable capital can take on additional risks, such as venture capitalists firms that accept higher risk if the returns are substantial (Berger & Udell, 1998).

7.4.3 Impact of Financing and Incubator Programmes on Profitability

Finally, logistic regression analysis is undertaken whereby if the dependent variable is equal to 1 it is represented as profitable. The odds ratio is implemented in order to comprehend the results of an event happening, in this case the high-tech SME being profitable or unprofitable. It is important to note that the odds ratios are constant. The odd ratio results in Table 7.8 represents the odds of the dependent variable being profitable occurring whereby when the odds ratio is greater than 1 the odds increase and if the result is less than 1 the odds of the dependent variable occurring decreases. To emphasise this analysis and best capture the impact of accelerator and incubator programmes regarding the odds of being profitable, the regression was undertaken twice with slight alterations. The first model illustrates the impact on profitability for high-tech SMEs that have used such services, while the second model provides an insight into the results when firms have not. This method has produced substantial results that support the findings from the previous revenue analysis in Table 7.7 and illustrates how these services can have a significant influence on the dependent variable.

The first statistically significant result with a 1 percent increase of equity finance results in a minor yet negative impact on high-tech SMEs being profitable with an odds ratio of 0.973. This can be further interpreted as a constant effect of the odds of being profitable decreasing by 1.7 percent with each percentage increase in equity finance when all other variables are held constant. This result reinforces the approach that businesses do not issue new shares when the firm is in a strong position and so selling new shares could prove to be a signal of bad news (Myers & Majluf, 1984). The negative result is an engaging finding and illustrates some support for the signalling theory, whereby firms use external equity sources when the return for investments are not as strong or weak, given the risk (Leland & Pyle, 1977). The decrease in profitability produces some support for *hypothesis 17: The use of equity finance signals the negative relationship with the financial performance of high-tech SMEs.* This finding reinforces the belief that signalling occurs throughout businesses since equity is not provided to external investors, when current shareholders have information that the business' investments will provide strong profits in the future (Norvaisiene, 2012). The result in Table 7.8 reaffirms this position and that of Myers & Majluf (1984) who declare that any action undertaken by the business should be viewed as signals by investors, given the information asymmetries that exist with the managers regarding the future growth of the firms and asset valuations.

Table 7.8: Logistic regression odds ratio results on whether the high-tech SMEs are profitable using two different base answers for the categorical incubator or accelerator variable

	(1) Profitable Odds ratio	(2) Profitable Odds ratio
Internal Finance	1.018	1.005
	(0.012)	(0.012)
External: Debt Finance	0.983	0.983
	(0.017)	(0.017)
External: Equity Finance	0.973**	0.973**
	(0.014)	(0.014)
Debt Ratio- Yes	1.016	1.017
	(0.026)	(0.029)
Incubator or Accelerator = No		3.384**
		(1.623)
Incubator or Accelerator = Yes	0.296**	
	(0.142)	
Constant	3.134	0.926
	(3.073)	(0.927)
Observations	84	84
Pseudo R^2	0.172	0.172

Notes: This table represents a logistic regression model that demonstrates the 2 specific outcomes, regarding whether high-tech SMEs have used incubator or accelerator programmes and the effect on being profitable. The analysis within the model explains the relationship between capital structure elements and being profitable. The results are produced as odds ratios to allow a clearer interpretation of the findings and effects on the dependent variables. Logistic regression analysis is implemented, utilising the specific survey modelling approach of the analysis, which is implemented through Stata using the prefix svy, which provide for the generation of robust results, given the low number of observations. The primary focus is on the effect of equity and the incubator or accelerator binary variable. The t statistics are reported in parentheses. ***, **, and * represent significance at the 1%, 5% and 10% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables

Regarding the effect of the firm having experience in an incubator or accelerator, the odds of being profitable for firms that have not used incubators or accelerators is 3.384 times that of those high-tech SMEs that used such programmes. It does not support previous findings that high-growth firms are more likely to implement incubator experience to help improve performance compared to low-growth firms (Feeser & Willard 1990). The result is engaging and further strengthens the finding in Table 7.7 whereby such programmes decrease the financial performance of high-tech SMEs. Previous research notes that accelerator programmes can prove beneficial to SMEs by opening up additional channels of finance and providing opportunities to increase their cash flow and liquidity (Love & Roper, 2015). The other perspective from the finding in Table 7.8 portrays that when high-tech SMEs utilise such programmes, the odds ratio of being profitable is over 3 times less than if they did not get involved. It does not support previous research that incubators provide an opportunity for start-ups to grow since these firms have the use of assets at a cheaper rate than the market (Revest & Sapio, 2012). This reduction in costs should help improve the firm becoming profitable. Furthermore, for start-ups based within university incubators, the office rent was below market value (Ciarán Mac an Bhaird & Lynn, 2015). This finding further emphasises the importance of the result in Table 7.8. Subsequently, additional support is provided towards a negative relationship, and so *hypothesis 19: Experience in an incubator or accelerator program will have a positive relationship with the financial performance and profitability of high-tech SMEs,* is rejected. The finding provides no support to the theory that incubator use can signal the quality of a firm to outside stakeholders (Colombo & Grilli, 2006). This result is engaging and there are various expenses, such as time, employees and monetary involved with such programmes, but not with expected financial benefits as an outcome according to the analysis.

7.5 Conclusion

This chapter investigated the breakdown of financing options within high-tech SMEs, the determinants of the financing sources implemented and the effect of capital structure and firm characteristics on financial performance and profitability. The use of internal funding remains constant over time for high-tech SMEs when comparing their initial capital and current capital values as a percentage of the overall capital used with 47.8 percent and 46.4 percent, respectively. This finding provides strong support that NTBFs rely heavily on internal financing (Brito & Mello, 1995). Internal sources of revenue for innovative firms are often not enough to be financially successful (Schneider & Veugelers, 2010). An interesting finding is that external equity decreased from 23.67 percent in firms using it as the initial source of capital, to 19.14 percent currently. A large drop in the current use of equity is apparent between 5 to 10-year-olds and those firms that are 11 years and older, with the values accounting for 31.37 percent and dropping to just 10.29 percent, respectively. This may occur due to VC funding being implemented at an early start-up stage but as the firms grow older, equity is hard to obtain. This relates to the previous analysis that notes how venture capital firms are willing to accept higher risk if the returns are substantial through the provision of capital to such firms (Berger & Udell, 1998). Interestingly, as VC funds receive more information, they can make less accurate firm performance predictions as too much information overcomplicates the process (Zacharakis & Shepherd, 2001a). In relation to the debt, its use has almost doubled between the respective 2 age groups. This finding to some extent supports the belief that a strong positive correlation exists between larger firms and greater debt amounts (Rajan

& Zingales, 1995). In a previous study, 50 percent of businesses under one-year-old were found to possess zero debt (Barclay & Smith, 1995).

When examining the total percent of assets that are intangible for these high-tech SMEs: 34 percent of the firms declare that intangible assets consist of 0 to 15 percent of the total assets, while 24 percent of the firms have intangible assets worth 85 to 100 percent. The engaging results demonstrate that 52 percent of high-tech SMEs state that intangible assets encompass 0 to 40 percent of their total assets, while 45 percent of the firms declare that intangible assets comprise 55 to 100 percent of their total assets. Further analysis produces a mean value of 45 percent for intangible assets, which is substantial but less than the value of 59 percent reported by Minola, Cassia, & Criaco (2013) when analysing NTBFs. The banks understanding of high-tech firms shows that overall there has been an improvement of 28.5 percent of firms, which is a noteworthy difference compared to 22.1 percent who deem the understanding to have gotten worse. Hogan, Hutson, & Drnevich (2017) using older data, discover that high-tech firms will utilise larger amounts of external equity when information asymmetries amongst the bank lenders exist. The finding most perturbing is that 45.26 percent of firms do not see any change in the lending environment, be it good or bad, given the previous discussion of the current financing landscape in both Europe and Ireland in Chapter 2.

Results of the regression analysis first examine the determinants that have the most significant impact on the capital structure of high-tech SMEs and tests some of the previously produced hypotheses. Firm size, using the log of total assets, has a positive relationship with internal finance within high-tech SMEs, supporting *hypothesis 1.* The findings propose that R&D expenditure has a negative relationship with internal finance, resulting in the acceptance of *hypothesis 11.* The result sheds some insight regarding the expenses involved in R&D and how internal finance may not be sufficient for high-tech SMEs and the need for the external source may be apparent given the finite amount of internal finance available. Intangible assets are found to have a positive relationship with internal finance, with *hypothesis 12* being accepted, and this may relate to the issue of adequately valuing intangible assets given that they offer limited or no value for collateral, which particularly effects high-tech firms (Berger & Udell, 1998). The age of the high-tech SME reports no statistically significant results on their relationship with internal finance or debt meaning neither *hypothesis 4* nor *hypothesis 5* can be accepted.

The next analysis section investigates the influences on financial performance, including the effect of incubators and accelerators, perceived risk and a target debt ratio. OLS regression analysis, logistic regression analysis and the odds ratios are implemented.

Internal finance demonstrates a positive effect on the financial performance of high-tech SMEs, resulting in the acceptance of *hypothesis 13.* The result further strengthens the outcome from chapter 6, which found that a modified pecking order theory might best help firms financially perform to their optimum level. For high-tech SMEs that sought to obtain a target debt ratio, this has a positive relationship between revenue, resulting in the rejection of *hypothesis 18.* However, the findings do sustain more recent analysis that suggests large start-ups implement debt supporting the trade-off theory, meaning it is not solely for older firms (Coleman et al., 2014). Some support toward the pecking order theory is apparent given the limited internal finance high-tech SMEs have at their disposal. Equity financing has a small negative effect on the profitability of the firms, resulting in the partial acceptance of *hypothesis 17.*

It is discovered that high-tech SMEs that favour higher valued but riskier intangible assets instead of lower valued tangible assets will improve their EBITDA. Under this risk and reward analysis, a greater positive effect on EBITDA occurs when high-tech SMEs prefer a higher risk and reward for both intangible asset risk options. The results for both intangible options are in comparison to the stable lower valued tangible assets. The option with the most substantial risk involved in the valuation of intangible assets had a less positive impact demonstrating how intangible assets are difficult to manage effectively. This finding further emphasises the financing difficulties that exist for NTBFs intensified by the information asymmetry issues associated with technology businesses (Carpenter & Petersen, 2002). Experience in an incubator or accelerator has a negative relationship with the financial performance and profitability of high-tech SMEs, which results in the rejection of *hypothesis 19.* The result demonstrates that firms that commence such programmes do not ensure strong financial performance, but an adverse effect on the firm's financial performance can occur. This also rejects the finding that is beneficial to SMEs by providing opportunities to increase their cash flow and liquidity (Love & Roper, 2015).

The next chapter will further expand on the performance of high-tech SMEs by investigating the influence of capital structure and firm characteristics on a not previously researched topic regarding the objectives and challenges. Additional research is undertaken on the topic of exports to provide new insights and findings on this infant topic through the implementation of the primary survey data. The research is produced given the unique insights and findings not available from secondary datasets.

Chapter 8. The Relationship of Capital Structure with Objectives, Challenges and Exports

8.1 Introduction

Chapter 8 focuses on 2 specific areas of performance relating to the capital structure of high-tech SMEs. The first topic analyses the effects of capital structure on the objectives and challenges that high-tech SMEs are facing and will meet in the future. The analysis then focuses on further examining the relationship between the capital structure and exports, implementing additional tests and variables from the survey dataset. The dataset is discussed in Chapter 5 and was obtained from the questionnaire completed by high-level participants within high-tech SMEs. The first section of this chapter provides descriptive analysis regarding the firms relating to their largest shareholders, profitability, structure and strength of financing sources used in their capital structure in percentage form. The discussion also examines the preferred sources of alternative finance that the high-tech SMEs are willing to utilise. The first descriptive figure presented illustrates the relationship between the age and number of employees, while the second figure presents the revenue levels in comparison to different employee sizes. Finally, the long-term objectives and top 3 challenges for high-tech SMEs are examined.

The second part of the chapter addresses the hypotheses and models relevant to the objectives and challenges of high-tech SMEs produced in Chapter 4 and Chapter 5. Multinomial logistic regression analysis is used to produce the most valid and engaging results that are discussed using the relative risk ratio (RRR). The analysis aims to test the relevant hypotheses in order to examine the effect of capital structure components in relation to meeting expenses, the ability to obtain future capital and employ and retain future staff members. The next multinomial regression analysis examines the effect of capital structure and firm characteristics on objectives such as selling the business, completing a merger or the likelihood of an IPO. The results are presented and discussed using the relative risk ratio. The export section first researches the effects of capital structure and firm characteristics on domestic sales, exports and a breakdown of different global regions. The analysis then examines a logistic regression on the determinants of high-tech SMEs which export. The results are provided in both log odds and the odds ratio. The research then further expands upon the relationship between applying for debt from a bank and the effect on high-tech SMEs to export. The results are conveyed through execution of predicted probability, log odds and odds. Finally, the analysis examines the predicted probability that high-tech SMEs will export given differing levels of debt within the capital structure.

8.2 Descriptive Findings

8.2.1 Background of Shareholders, Profitability and Financing Sources

According to the results in Table 8.1, just 54 percent of the high-tech SMEs within the sample dataset are profitable. Previous research discovers that the most profitable firms possess low levels of debt (Rajan & Zingales, 1995; Titman & Wessels, 1988). This can have a telling impact on the future objectives and challenges of the firms. If neither adequate financing nor the ability to generate profits exists, many firms eventually find it unsustainable to remain in business. For the majority of the analysed firms, 41 percent are less than five years in business, and 53 percent have less than 10 employees, thus illustrating how a large proportion of these businesses would be highly susceptible to changes in the economy. In order to mitigate this risk, SMEs should expand into international markets, since having an advantage due to their quick adaptation can improve firm growth internationally, higher profits and subsequent retained earnings (Autio et al., 2000). Exporting is now a vital cog in the acceleration of internationalisation for SMEs due to the data and the capabilities to interact with all stakeholders (Mathews & Healy, 2008). The profitability of these firms is of crucial importance given the results in Table 8.1, and it is imperative to ensure debt is used suitably, since it can diminish profits (Thomas, 2013). Furthermore, debt can signal poor performance and lower firm value (Fama & French, 1998).

Table 8.1: The breakdown of shareholders within the high-tech SMEs and whether the business is profitable

Largest Shareholder	Profitable	Not Profitable	Total
Business Angels	0	2	2
CEO	22	16	38
CTO	0	1	1
Family & Friends	2	0	2
Founders	0	3	3
Management	1	0	1
Other: Businesses	1	0	1
Other: Owners	22	19	41
Various Shareholders	3	0	3
Venture Capitalists	3	5	8
Total	54	46	100

Notes: The table represents a breakdown of the high-tech SMEs into whether they are profitable or not profitable. The corresponding data portrays the largest shareholder of the firms, which provides an insight into the type of shareholder and profitability associated. An example of this information relates to the finding that VC firms have majority ownership of 8 percent of the total high-tech SME sample, but just 3 of them are profitable. Additional information is available in the appendix

The results in Table 8.1 illustrate how the other shareholders categorised into owners is the strongest selection with 41 percent. This response option is for unsure participants regarding who possesses the most substantial shareholding in the business, which can occur given that certain participants would not have such information at hand. Interestingly, it shows that high-tech SMEs are not always single owner equity holding businesses and they can have numerous shareholders. However, the exact amount of shares available was not asked to ensure completion of the survey and so the term “largest shareholder” could vary considerably. Of this 41 percent, just 22 percent are profitable, thus illustrating that even though the firms can be quite small and not making returns, there is scope to sell equity. The structure of ownership is one of the key influences on the capital structure of SMEs (Ciarán Mac an Bhaird & Lucey, 2010). An engaging result is that these firms possess no problems with using equity finance, and given the limited profitability, can support the signalling theory. For the current owners, when maximising shareholder value, firms will only seek to sell equity when it is overvalued (Myers & Majluf, 1984). This may address the sale of shares given profitability of the sample with 54 percent. However, if current shareholders have information regarding the firm's strong future growth and profits, they will stop any issuance of new shares to maintain their level of returns (Norvaisiene, 2012). Therefore, it may go against the pecking order theory, in which equity should be used as the preferred final source of finance (Myers & Majluf, 1984).

Interestingly, this provides credence to the likelihood of a modified pecking order theory, where unprofitable technology firms seek to obtain venture capital financing (Minola & Giorgino, 2011) and since NTBFs implement equity finance instead of debt due to issues in obtaining debt finance (Cosh et al., 2009b). However, contrary to that finding, 38 percent of businesses have the CEO as the largest shareholder. Of this 22 percent are profitable, and 16 percent are currently not profitable which shows that there is a loyalty to these firms. This illustrates how the high-tech sector is a microcosm of a variety of different industries around the world, as there are no set rules that they should follow. Indeed, NTBFs tend to have limited tangible assets and resources to supplement the provider's risk (Minola & Giorgino, 2011). This lack of tangible assets, and how firms view this, their perspective on risk and their future objectives, can have a significant impact on how firms finance themselves for future growth. The collateral prerequisite can strongly influence SMEs' capital structures (Ciarán Mac an Bhaird & Lucey, 2010).

Where venture capitalists and business angels have a majority shareholding, 70 percent of these firms are not profitable. This finding offers some support that VC finance is sought by younger and unprofitable firms (Minola & Giorgino, 2011). Interestingly, NTBFs with VC investment increases their probability of obtaining external finance, and so they may not utilise such finance alone. VC firms invest in innovative firms which are often close to launch date of their products and so within a small period they seek to gain a return (Mazzucato, 2013). An interesting finding from the appendix is that none of those firms are less than two years old and the majority are between five to ten years in business. High-tech firms have a strong association with intangible assets, and often their value stems from them (Revest & Sapio, 2012). This may explain why such a high proportion of the firms which have gained external financing are not currently generating profits. Furthermore, younger firms may not be profitable since they have only entered the market recently.

Unfortunately for high-tech firms, it is difficult to put a relative measure of value on these assets and can often prove to be an issue when seeking external capital due to information asymmetries (Clarysse et al., 2003). This illustrates how intangible assets can have a value which can prove to be complicated even for institutions such as private investors, and profitability is not always guaranteed. It would also be a major determinant for the previously mentioned CEOs to remain the largest shareholders even though 40 percent of these firms are not making a profit. However the use of equity may relate to firms which are expected to generate losses, and they will aim to gain new shareholders so that the losses are diluted for the current owners (Schmid Klein, O'Brien, Peters, 2002).

8.2.2 Financing

The findings in Table 8.2 provide a snapshot of the current financing sources used by high-tech firms including the percentage makeup of the total capital amongst each firm. It is important to note that SMEs have different financing inclinations compared to larger firms, as their growth opportunities and internal resources affect their capital structure (López-Gracia & Sogorb-Mira, 2008). Internal sources of finance are currently the most utilised as they account for over 46 percent of the total individual sources, with a key finding that almost 14 percent of the firms utilise retained earnings as 80 to 100 percent of total capital. During the early stage of TBSFs' lifecycle, internal finance is of critical importance to ensure the firms remain financially viable (Ullah & Talyor, 2005). Personal savings are shown to have a stronger influence concerning the smaller amount of total finance, with 7 percent of firms using this financing source as 1 to 20 percent of their overall capital sources. In theory, this makes sense, as often personal savings are used initially before the business would begin to generate profits and use retained earnings. Indeed, often younger technology firms find it better to use internal sources rather than external options (Akerlof, 1970). Retained earnings are the most used source as it accounts for 70 percent of the total 80 to 100 percent capital sources and 60 percent of 70 to 80 percent capital sources respectively. Even large listed firms may still utilise retained earnings for the majority of their financing needs (Carpenter & Petersen, 2002). These findings offer support to a version of the pecking order theory since it is such a large amount of the firms' capital structure.

Table 8.2: Breakdown of the current financing sources used by high-tech SMEs and the ranges in which they account for their overall financing

Current Finance	1 to 20 percent	20 to 40 percent	40 to 60 percent	60 to 80 percent	80 to 100 percent	Total
Personal Savings	7.18	2.39	2.87	0.48	2.87	15.79
Retained Earnings	4.31	2.87	3.83	5.74	13.88	30.62
Total: Internal	11.49	5.26	6.70	6.22	16.75	46.41
Family & Friends Loans	1.91	0.48	0.96	0.00	0.00	3.35
Bank Borrowings	8.61	1.91	0.48	0.00	0.00	11.00
External: Debt	10.52	2.39	1.44	0.00	0.00	14.35
Family & Friends Equity	4.31	0.96	0.48	0.96	0.00	6.70
Angel Finance Equity	1.91	5.74	0.96	0.48	0.48	9.57
Venture Capital Equity	3.35	2.39	2.39	0.48	0.96	9.57
External: Equity	9.57	9.09	3.83	1.92	1.44	25.84
Other	5.26	2.39	2.87	1.44	1.44	13.40
Total	36.84	19.14	14.83	9.57	19.62	100.00

Notes: The table represents the breakdown of high-tech SMEs current financing sources in specific details regarding the used components of the internal finance, debt finance and equity finance: table provides this information relating to the magnitude of the source that is selected in ranges of 20 percent starting from 1 to 20 percent up to 80 to 100 percent. The other finance option may consist of options such as crowdfunding or peer to peer lending. The results for 0 percent are not included in the table as the findings are not relevant. The results are provided in percentage form, with a total of 100 percent. Additional information regarding this breakdown is available in the appendix.

When examining the individual capital sources that entail 60 percent or greater of the current finance sources, retained earnings account for nearly 67 percent of the amount, illustrating the dominance of internal finance amongst the firms. This relates to previous findings relating to start-up software firms which show how their features can influence the opportunities to gain finance (Hogan & Hutson, 2005). Although a high dependence on internal sources exists, businesses in the technology sector must use external capital for a chance to reach their objectives and become commercially successful (Beck & Demirguc-Kunt, 2006). Support for this is reinforced by Michaelas, Chittenden, & Poutziouris (1999) who find that small firms with strong growth will often need additional sources rather than internal finance to satisfy the need for capital. However, the issue of information asymmetry is often a key reason why firms cannot access adequate external capital sources. This is supported by Stiglitz & Weiss (1981) who portray that the risk for the external capital provider is often significant enough to deter financial investment in these firms.

The least used sources are loans from friends and family and equity from friends and family with a maximum total of 10 percent of firms using these options. Angel finance and VC firms have provided capital with a maximum of 19 percent usage amongst the firms. This is spread out amongst the ranges, but the most active presence is in the 20 to 40 percent bracket, particularly angel finance. The results reinforce the belief that VC firms and angel financers have considerable difficulty in adequately evaluating NTBFS and so this limits the capital that they provide (Brierley, 2001). Given the results in Table 8.2, this seems adequate. Total external equity accounts for 25.84 percent of all the sources used and is second to internal sources. This offers support to the modified high-tech pecking order theory for NTBFs that find it more accessible to implement equity finance instead of debt finance due to its limited availability (Cosh et al., 2009b). Interestingly, the information and results from Table 8.2 offer support for Hogan & Hutson (2005) who note that high-tech SMEs follow a modified pecking order theory due to the information asymmetries existing with banks and to a lesser degree with VC firms that purchase equity. Subsequently, external debt has a much smaller total amount of uses with just 14.35 percent, and this illustrates the lack of support for debt amongst the firms. An issue for high-tech SMEs concerning debt, given their high amount of intangible assets, is that often banks seek collateral before they provide loans (Thorne, 1989). This is further emphasised by the finding that any firm does not use debt if it encompasses over 60 percent of the total capital. This supports the hypothesis that start-up technology firms use internal sources as their major, initial capital and then, if extra capital is needed, they utilise equity over debt resulting in a modified version of the pecking order theory (Minola, Cassia, & Criaco, 2013).

When discussing the capital structure of the high-tech SMEs, it would be correct in stating that the utilisation of retained earnings is indeed following the pecking order theory (Myers & Majluf, 1984). However, there seems to be a more substantial first preference for equity financing over debt. It is not without reason considering the impact which debt finance can have on any firm, but principally an SME within the high-tech sector. One bad year and low revenue could result in financial distress for a firm, and it is something that many CEOs and founders do not want to deal with. When asked whether the firms had a targeted debt range as part of the overall capital, 87 percent said they did not, as presented in the appendix. Once again this reverts to the initial problem where TBSFs have difficulty obtaining capital and thus cannot be meticulous regarding leverage.

Table 8.3: The alternative sources of finance which high-tech SMEs would prefer to utilise

Alternative Sources of Finance	Preference Percentage
Peer-to-Peer	35.7
Crowd Funding	23.8
Angel Finance & Venture Capital	11.9
Grants	7.1
Private Equity	7.1
Unsure	7.1
Other	7.1
Total	100.0

Notes: The table represents the breakdown of high-tech SMEs preferred sources of alternative finance that they would utilise, presented in percentage form. An interesting finding notes that just 7.1 percent would choose grants such government and public money, while 35.7 percent of the firms would implement peer-to-peer financing

Brierley (2001) has previously found that NTBFs can have significant problems gaining adequate finance and so this finding is supported. In essence, if the firms do not take on any capital, they will likely have to stop operations meaning the risk of high leverage is diluted, if available. Subsequently, while the sale of equity does relinquish some of the control which owners hold, it can be viewed as a safer and less risky option than debt particularly with little information asymmetries. Alternative sources of finance, such as crowdfunding among others, have stronger support for highly preferred types of finance than bank loans, with 23 percent. Analysing this further shows that while these sources are not yet favourable as the most preferred and sole type of financing, there is scope for them to be included in a capital structure of high-tech firms.

Regarding the use of alternative sources of finance over the next 2 to 5 years, according to the results in Appendix A, just 48 percent of the firms stated that it is a source which would interest them. This is interesting since crowdsourcing and venture capital are becoming more common financing sources, predominately when discussing high-tech firms. The two most highly selected sources were peer to peer and crowdfunding, which accounted for almost 60 percent of the total sources. It can often put the future of the business in unknown hands, as opposed to government agencies or venture capitalists. Public finance can have a crucial effect regarding the performance of high-tech firms in their early years, but mainly for firms that have a high probability of becoming successful (Lach, 2002). With just 7.1 percent favouring government grants, this supports previous findings where overall just 5.67 percent of NTBFs received government subsidies. NTBFs tend to be the most viable firms; thus it is not an option for the majority of innovative SMEs seeking to close a financing gap with limited choices (Colombo et al., 2012). A reason for this may be due to the bureaucracy involved with such funding, and so the firms view the top two sources as more open and less encroaching for the business. The majority of firms that are successful in obtaining public finance and grants are often less innovative businesses (Schneider & Veugelers, 2010). Consequently, innovative firms waste scarce resources, such as time and human resources, unsuccessfully searching for and applying for such capital (Schneider & Veugelers, 2010). This is an issue which Governments must address, particularly given the discussion in Chapter 2 relating to Government initiatives to help high-tech SMEs access adequate funding. If implemented correctly public finance can fix funding gaps, provide capital to high-tech SMEs, remove the dependence on internal finance and thus provide for these firms to capture their growth opportunities (Colombo et al., 2012; Czarnitzki, 2006).

However as shown previously, some firms have utilised the services of angel finance and venture capital and this correlates with the findings where 11.9 percent of those firms would use such sources. This disseminates an interesting perspective regarding the mindset of high-tech SMEs; only 7 percent are unsure if they would seek alternative sources which contrast with the previous outcomes that illustrate a significant dependence on internal financing. Alternative financing is also gaining importance due to the failure of governments to act accordingly regarding financing issues (Schneider & Veugelers, 2010). Private equity also has a small preference, perhaps given the nature of these firms that seek to make a considerable profit often in a short period. This finding emphasises the lack of interest by high-tech SMEs that public equity is cheaper than private equity for the respective firms due to information asymmetries and control issues (Brav, 2009).

Figure 8.1 and Figure 8.2 provide a background to the SMEs under analysis, reviewing the employees, revenue and years in business. The smallest category in the survey sample was medium sized businesses with 14, while micro firms make up the majority with 53. When examining the age of the businesses the biggest proportion is actually at 11 years and older with 38 percent, which is expected given that research on Irish software firms by Hogan & Hutson (2005) had a figure of 19 percent. Figure 8.1 also provides an engaging insight for the firms within the sample since data portrays an evenly dispersed proportion of firms about both the firm age and number of employees. Figure 8.2 illustrates a breakdown on revenue, where over half of the firms have revenue of €1million or less, while interestingly high-tech SMEs which have a minimum of 10 employees make at least this amount. Furthermore, the firms which have the largest amount of employees unsurprisingly have the highest revenue amounts and the same applies to smaller firms which have lesser sales values. Both of these figures provide an interesting breakdown of the firms analysed and the current characteristics of high-tech SMEs, which will provide foundations for further analysis within the chapter.

Figure 8.1: The number of employees in comparison to the age of high-tech SMEs

Notes: This figure represents the high-tech SMEs relationship between the age profile and the number of employees. The number of employees is based on the horizontal x-axis, with the percentage of total firms shown on the vertical y-axis. The age values are categorised into 4 separate entities, and make plots on the graph in regards to the range of revenue with the specific number of employees. The plot line increases depending on the amount of high-tech SMEs in a similar position, with the overall percent of firms accounted for by the y-axis values.

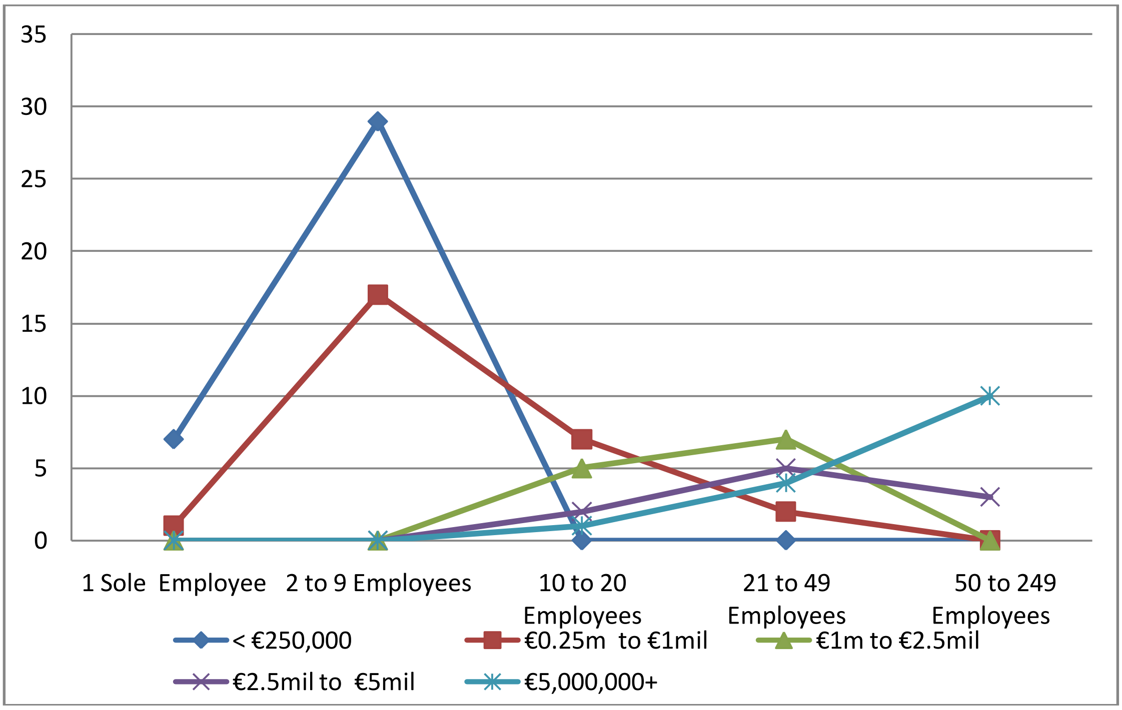


Figure 8.2: Revenue ranges in comparison to the number of employees within high-tech SMEs

Notes: This figure represents the relationship between the annual revenue generated by high-tech SMEs compared to the number of employees. The number of employees is based on the horizontal x-axis, with the percentage of total firms shown on the vertical y-axis. The revenue values are categorised into 5 separate entities, and make plots on the graph in regards the revenue associated with the specific number of employees. The plotline increases depending on the amount if high-tech SMEs in a similar position with the overall percent of firms accounted for by the y-axis values.

8.2.3 Challenges

When businesses have objectives, there will always be challenges that must be navigated and overcome to reach their end target successfully. Such challenges are not always financially orientated and often consist of ensuring the business runs efficiently and hits maximum performance. With this in mind, the survey included these challenges as regulations, such as, employing and retaining skilled personnel who are responsible for either the technical or business sections of the firm. Technical staff consists of engineers, software developers and key data analytics, while business includes sales, marketing and management aspects of the firm. Both departments would be expected to engage in an equally critical role within high-tech SMEs.

Table 8.4: Upcoming challenges high-tech smes will face (shown in percentage value)

Challenges	First Biggest Challenge	Second Biggest Challenge	Third Biggest Challenge	Average Importance
Access Adequate Capital	23	11	14	16
Gaining Customers	30	20	10	20
Regulations	5	4	8	6
Skilled Technical Employees	16	14	14	15
Skilled Business Employees	8	19	14	13
Competition	7	19	18	15
Increasing Costs	7	12	19	13
Other Challenges	4	1	2	2
Total	100	100	100	100

Notes: The table represents the breakdown of the high-tech SMEs biggest challenges, broken into 4 distinct categories: first biggest challenge, second biggest challenge, third biggest challenge than the average importance, which takes the average of the 3 values for each of the challenges. The challenges consist of 8seperate issues and they are ranked out of 100 percent for each of the importance levels by the firms. The results provide a ranking for each of the three challenges, which are then used to produce the average importance ranking. Additional information regarding this and the questionnaire is available in the appendix.

The biggest challenge facing the high-tech SMEs in the medium term was found to be gaining customers, as displayed in Table 8.4. This will prove to be an adequate base model for the multinomial logistic regression model that implements the relative risk ratio, further on in this paper. The challenge of gaining customers is one which many SMEs would strive towards and amongst the three largest challenges it has the highest average highest importance, with 20 percent, and the largest main challenge, with 30 percent. Patents can have a significant benefit for SMEs involved in R&D as the signals they provide helps gain customers, due to their legal protection (Holgersson, 2013). Ensuring that the business has skilled technical and business employees compliments gaining customers, and this correlation is shown in the results. Gaining and retaining skilled technical employees in the coming years is the third main challenge, with 16 percent, and illustrates the significant impact that human capital can have on high-tech SMEs.

The implementation of innovation primarily adheres to adequately providing for resources such as expenses, staff and time. Only when these are catered for can businesses create the products and generate revenue (Brophy & Shulman 1993). Often, skilled labour may seek to work for larger, more established firms which can offer greater security and benefits and the findings support this. Along with innovation, a sustainable competitive advantage can be produced by SMEs which strategise international market sales through the improvement of staff technical abilities, that advances firms in international markets (Maranto-Vargas & Gómez-Tagle Rangel, 2007).

The access to adequate capital is the second largest primary challenge with 23 percent, which high-tech SMEs will face in the medium term future and signifies the failure of banks and investors to realise the potential of many of these firms. It supports previous research that SMEs are more likely to have financing difficulties and limited access to external financing sources (Ang 1991; Engel & Stiebale 2013). Indeed, this finding is similar to that of the SAFE report, whereby it is the most significant issue for European SMEs which needs to be addressed (European Commission, 2014). It is an issue discussed in depth within the literature review, but without a capital supply, businesses can never reach their full potential and can often cease to exist. Therefore, this finding is encouraging as it portrays that firms realise it is an issue, with a total of 48 percent of the firms deeming it to be one of the top three challenges that must be dealt with. SMEs are depicted as facing a litany of challenges with insufficient access to finance a significant issue (Lange et al., 2000). Access to adequate capital is not only the second biggest main challenge but also the second biggest top three challenges to high-tech SMEs. This further supports the findings that SMEs, and particularly those within the high-tech sector which have a large proportion of intangible assets, can struggle from a financial resource matter. North, Baldock, & Ullah (2013) support this and declare that prior to the global financial crisis small high-tech firms struggled with financing, and since the crisis, the issue has worsened for firms.

8.2.4 Long-Term Objectives

When discussing business performance and the future, often the conversation can centre on the revenue, costs and profits and the likelihood for future growth. However, while profit generation should be a key criteriion for businesses, it is not the only objective. Some SMEs may view it as their primary objective, but many firms have other agendas whereby increasing profits is a necessary step. This is of particular importance concerning high-tech firms as these are businesses which cancreate products or services that change the way we interact with ourselves and the world. These businesses such as

PayPal, Facebook and Microsoft have transformed the lives of billions of people. In a globalised world where technology can transcend through cultures and countries, it is interesting to investigate the objectives and challenges of high-tech SMEs concerning their capital structure. The results will provide an insight into a topic not previously researched and demonstrate whether the capital structure affects the firms' primary objectives.

Table 8.5: Top two and the average long-term objectives for high-tech SMEs (in percentages)

Objective	First Long-Term Objective	Second Long-Term Objective	Average Importance of Objective
Initial Public Offering	5.22	7.19	6.21
Generate High Profits	46.09	20.14	33.12
Sold Within 5 Years	23.48	15.83	19.65
Sold After 5 Years	8.70	20.86	14.78
Merge with Firm	6.96	17.27	12.11
Acquire Other Firm	4.35	13.67	9.01
Other Objectives	5.22	5.04	5.13
Total	100.00	100.00	100.00

Notes: The table represents the breakdown of high-tech SMEs top 2 long-term objectives, broken into 3 distinct categories: first long-term objective, second long-term objective and then the average importance, which takes the average of the 2 values for each of the objectives. The objectives consist of 7 separate goals, and they are ranked out of 100 percent for each of the importance caegories. The results provide a ranking for each of the 2 long-term objectives, which are then used to produce the average importance ranking. Additional information regarding this and the questionnaire is available in the appendix.

While the importance of short term and medium term objectives are not to be underestimated, the most intriguing aspect to consider is what exactly these firms see as the two most important long-term objectives. All firms should have long-term objectives, as without them the business has little structure and can be destroyed by focused and resolute competitors who work to achieve their objectives. They are critical for high-tech firms as although the dream for some is to be the next billion-dollar company, this is not the case for the majority of the firms. Without realistic long-term objectives, the business will suffer, morale will drop and crucial staff will eventually leave, menaing it is interesting to see what exactly these high-tech firms aim to achieve long-term.

The main objectives of high-tech SMEs are presented in Table 8.5 and the primary long-term objective with 46 percent of firms aiming to generate high profits. It accounts for 33 percent of the overall two main objectives. Indeed, this is an important long-term objective for such firms, particularly when noted that 46 percent of the high-tech firms are not profitable as illustrated in Table 8.2. Without profits, firms will unlikely be in business for too long and so while not an unexpected finding it is one which is extremely important. This supports the signalling theory by Akerlof (1970) that a firm's objective is to maximise profits. Perhaps the aim of generating high profits is to reach the second main objective of being bought out within five years which has an robust 23.48 percent, while the total overall importance is just fewer than 20 percent. The finding that maximising the profit should be the sole objective for firms (Friedman, 1970), can be altered to ensure it is in a strong position to be sold. This can occur by adjusting the primary objective to maximise the shareholders' wealth (Tudose, 2012). This provides an insight into the psyche of the people in charge of high-tech SMEs; while they may believe in the product, selling the firm within a relatively short time frame is paramount objective. When this is combined with the objective to sell after five years, almost one-third of the firms choose to sell the business as the primary long-term objective. This finding ties in with the generation of high profits, since firms will only seek to sell equity when it is overvalued and when debt finance is not available (Myers & Majluf, 1984). This will maximising shareholder value and one method to produce an overvaluation is to generate profits constantly.

The theory of market timing has been stated as a real strategy used by managers when investors believe the markets are positive and therefore optimistic about future earnings, so firms should sell shares (Baker & Wurgler, 2002). This is reinforced when the second long-term objectives are examined which are even more conclusive than the primary. Selling the business within five years has decreased to just less than 16 percent, while the objective of selling the business after five years has increased substantially to just fewer than 21 percent. Therefore, over 36.5 percent of the firms view selling the business as a crucial long term objective, thus supporting the findings for the primary objective. A critical piece of research undertaken by Graham & Harvey (2001) finds that 66 percent of CFOs are open to capitalise on such market timing events due to share over-valuations. The maximisation of profits can also assist in over-valuing the shares, as per the main primary objective of high-tech SMEs. The combined objectives of merging with firms and acquiring firms account for 11 percent of the high-tech SMEs' main objectives. Concerning the second objectives, this increases significantly to 31 percent, thus emphasising that secondary objectives can have a distinct role in the firms' future. The impact of the capital structure upon these objectives are analysed through regression analysis within this chapter and the results are examined in detail through the testing of the previously developed hypotheses.

8.3 Analysis Overview

This research addresses important areas previously not investigated regarding the capital structure of high-tech SMEs. A key rationale for this chapter was to provide a novel contribution to current cross-topic literature which envelops SMEs, the high-tech sector, capital structure, objectives, challenges and exports. To undertake such an approach it was essential to gain primary data which can allow for greater in-depth questioning while covering a broad range of such topics. However, the generation of primary data through the use of a questionnaire can expand a significant amount of time and effort. A crucial reason for their use is that a novel dataset and secondary research databases can often ignore areas which would present enlightening and informative finding. For the proposed research, it was deemed that such secondary data alone would not suffice due to the topics under review. The overall quantity of firms participating in the survey provides strong confidence in the high-quality of the data. The independent and dependent variables used throughout this chapter are displayed in Chapter 4, while the econometric models implemented to test the previously proposed hypotheses are provide and discussed in Chapter 5.

The goodness of fit analysis shows how the model used is sufficient for the task at hand. Multinomial logistic regression analysis is used to reveal the influences on both the challenges and objectives of the high-tech SMEs about their capital structure and other key variables. To ensure the results can present accurate conclusions, they are configured as an output which illustrates the relative risk ratio (RRR) of the various objectives and challenges in comparison to a separate unique outcome. There are two unique analyses which individually examine the goals and challenges of high-tech SMEs and show the importance and influence capital structure has upon these decisions and results. Indeed, does the pecking order theory, which recommends using all internal sources and then favours debt before equity, holds through; or does the use of debt hinder these firms and not allow them to reach maximum potential (Myers & Majluf, 1984)?

The next part of the analysis will research the determinants of exporting for high-tech SMEs. Questionnaire participants were asked to provide a breakdown of total revenue from a geographic perspective using percentages of total sales for each given region. Ireland was provided as the domestic sales location and the finding supports that all firms have their headquarters in the country. Exports were broken into four distinct parts; The United Kingdom (UK), remaining Europe, the Middle East and Africa (EMEA), The United States of America (USA) and finally the rest of the world (ROW). For the logistic regression in the analysis, a dummy variable was produced which provided an insight into whether the firms had 100 percent of sales within the domestic market or if they generated revenue from other markets via exports. A similar method was established by Hair et al. (1979) who classified ventures as international or domestic, whereby sales which had at least 5 percent in international markets were deemed as international while firms which has full sales within the home market were deemed to be domestic. Subsequently, this method is implemented as it provides simple clarity regarding its interpretation. R&D investment is often used to characterise growth opportunities for a firm and so has been included in the regression analysis (Michaelas, Chittenden, & Poutziouris, 1999). The data has been cleaned to ensure maximum benefit from any analysis, meaning the results should prove robust. To provide an engaging insight into this topic OLS regression analysis and logistic regression analysis are used with both log odds and odds ratios reported, given that often odds ratios can be easily misinterpreted. Robustness tests and sensitivity analysis that include the propensity score matching, Rosenbaum-Bounds analysis, Mantel-Haenszel Bounds analysis and the Heckman two-step analysis are used to examine the econometric models analysing the effects on domestic and international sales. The results are available in Appendix F and illustrate that no issues exist and the analysis undertaken is appropriate. The analysis of predicted probabilities allows for clear dissemination of the strength of changes within certain variables, and so this analysis is also produced.

8.4 Regression Analysis: Challenges

The challenges these firms will deal with in the medium term are illustrated in Table 8.6 using gaining and retaining customers as the base outcome. Gaining customers is chosen as the most frequent issue by the high-tech SMEs, with 33 percent. This information is provided as part of the questionnaire results in Appendix A. It is a base which is easier to comprehend given that customer attraction, and retention is a critical business element. Gaining customers is a fundamental challenge which any firm must deal with in order to grow both figuratively and monetarily. Therefore, gaining customers is used as the comparison group from which the relative risk ratio, for the remaining challenges that the high-tech SMEs may face, is determined. When analysing the independent variables from the data, it must be noted that the other outcomes in the model are held constant. Subsequently, within the analysis, it will be discussed which elements of capital structure influence the challenges of these businesses.

Table 8.6: Relative Risk Ratio regarding the Impact of the key financing options, age and employees on the main challenges high-tech SMEs will face within the next 3 years

	Adequate Capital	Competition	Expenses	Regulatory	Business Staff	Technical Staff	Other
Internal Finance	1.010	1.024	1.047*	1.022	1.033	1.057*	1.328
	(0.197)	(0.035)	(0.025)	(0.033)	(0.029)	(0.026)	(0.267)
Debt Finance	1.135*	1.117	1.111	1.114	1.149*	1.150*	0.217***
	(0.073)	(0.076)	(0.075)	(0.074)	(0.074)	(0.075)	(0.032)
Equity Finance	1.028	1.056	0.205***	0.207***	1.025	1.022	0.445
	(0.231)	(0.033)	(0.017)	(0.016)	(0.037)	(0.039)	(0.199)
Firm Age	0.269**	1.479	0.308	0.537	0.260	0.959	10.46***
	(0.120)	(1.368)	(0.202)	(0.288)	(0.181)	(0.606)	(5.150)
Employees	1.802	1.045	1.270	1.252	0.577	2.123**	0.893
	(0.597)	(0.938)	(0.393)	(0.294)	(0.218)	(0.587)	(0.691)
Constant	0.357	0.003	0.019*	0.054	0.305	0.000***	0.000***
	(0.654)	(0.009)	(0.037)	(0.163)	(0.781)	(0.000)	(0.068)
Observations	83	83	83	83	83	83	83
Population Size	1,328	1,328	1,328	1,328	1,328	1,328	1,328
Pseudo R^2	0.227	0.227	0.227	0.227	0.227	0.227	0.227

Notes: This table represents a multinomial logistic regression model that demonstrates the 7 specific outcomes associated with challenges with the base challenge of gaining customers used as a comparison base in the analysis. The analysis tests the relationship between financing options and firm characteristics on the challenges that high-tech SMEs will face. The analysis within the model explains the relationship the influence of the independent variable through the use of relative risk ratio (RRR) which compares the outcome to the table values is X the times the risk of gaining customers, given the value X on the corresponding point on the table. The results provide a clearer interpretation of the findings and effects on the dependent variables given the complicated manner of the model. The multinomial logistic regression analysis is implemented utilising the specific survey modelling approach of the analysis, which is processed through Stata using the prefix; svy. This provides for the generation of robust results, given the low number of observations associated with survey data. The primary focus is on the effect of equity and debt finance. The standard errors are reported in parentheses. ***, **, and * represent significance at the 5%, 1% and 0.1% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables

8.4.1 Adequate Capital

When external debt increases by one percent within the overall capital structure, the relative risk for securing adequate capital is 1.135 times the risk of gaining customers. This results in the larger the amount of debt used, the more likely that securing adequate capital becomes the main challenge. The result offers reinforcement towards the finding that while additional debt is used to signal confidence and reduce information asymmetries, it increases the likelihood of bankruptcy and the costs involved (Fairchild, 2005). Debt appears to be a stop gap but not what firms want, and this relates to previous literature discussing the issues firms have with debt due to intangible assets and to obligations which debt carries. Fama & French (1998) find that the use of debt is essentially a signal of poor performance and lower value overall. Support is given to the SAFE report published in 2016 which notes that although there is an improvement since 2009, European SMEs still view access to capital as major challenges (European Commission, 2016).

Furthermore, this result provides a greater understanding of how high-tech SMEs view debt as a possible option for some firms but illustrates that the high-tech SMEs do not fully support debt. It is an interesting finding; given that debt would be expected to reduce the issue of obtaining adequate capital. Subsequently, *hypothesis 21: The use of external finance has a positive influence on the ability to gain adequate future capital for high-tech SMEs,* is rejected for debt since the risk to obtain such finance becomes higher. This further reinforces the belief that a modified pecking order theory should be implemented by high-tech SMEs (Minola, Cassia, & Criaco, 2013; Colombo & Grilli 2007), given the negative impact illustrated in Table 8.6 that debt provides. Further insight demonstrates that debt use results in higher leverage, where a negative relationship exists between leverage and the concentrated number of owners according to the signalling and agency theories (Deesomsak, Paudyal, & Pescetto, 2004). In relation to equity finance, the result is not statistically significant and *hypothesis 21* is not accepted.

As firms become older and larger, they may change their capital structure compared to their initial capital structure due to different circumstances, as small high-growth businesses tend to support the use of the pecking order theory (Frank & Goyal, 2003). However, as firms grow and mature they tend to have a positive correlation to debt, offering support to the trade-off theory (Frank & Goyal, 2003). It is worth investigating whether an increase in age provides an insight into a progression with sufficient capital amongst these firms. With a unit increase in firm age, adequate capital has 73.1 percent less the risk than gaining customers when the remaining variables are constant. This can be synthesised down to old firms will deem gaining customers as a more significant challenge than obtaining adequate capital. This is supported by previous results, which show that young high-tech SMEs often cannot gain sufficient adequate capital, particularly if undertaking research (Brierley, 2001; Demirel & Parris, 2015). The result supports that for older firms, banks are more willing to provide debt, and that leverage has a positive relationship with firm size (Petersen & Rajan, 1994). It is an interesting finding and further strengthens the issues regarding a lack of finance for younger firms, particularly high-tech SMEs. These findings are of crucial interest as previous research has illustrated how innovative firms have more difficulty in gaining finance (Freel, 2007; Canepa & Stoneman, 2008). Obtaining such finance is proposed to become less of a challenge as the firms become older; however, without adequate finance these businesses may not survive to this point.

8.4.2 Business and Technical Staff

Both the challenges of obtaining and retaining business and technical staff can be negated in comparison to gaining customers or ensuring the firm is sufficiently financed. However, human capital can be critical for business success especially in the medium term. Consequently, ensuring high-tech SMEs have relevant staff from both aspects of a business is crucial and so analysing this in comparison to the challenge of gaining customers provides some relevant results. The use of debt influences both the challenge of acquiring adequate business staff to grow the business and the relevant technical staff to develop products and services. Debt can provide information concerning the ability of a firm to make their loan repayments and also their revenue and expenses management (Harris & Raviv, 1990). When all other variables are held constant, an increase in external debt finance means high-tech SMEs are 1.149 and 1.150 times as likely to have issues in obtaining business and technical staff respectively, than gaining customers. Previous analysis has shown that an over-demand for loans can happen when a firm possesses stronger human capital (Grilli, 2005). In this regard the findings note that firms which use debt finance may find it more challenging to gain staff. Whereas in this respect, when high-tech SMEs use an extra value of the external debt, they are likely to deem gaining and retaining adequate and qualified staff for the business as a more substanial challenge than the similar objectives for customers. When a firm implements debt, it can signal firm strength since the firm must deal with the repayments associated with additional debt (Masulis, 1983). However, these loan repayments may hamper the amount of capital available to gain and retain staff members. Given the findings, *hypothesis 22: debt has a negative relationship with obtaining future staff for high-tech SMEs,* is accepted.

Understanding the comprehension of these figures is crucial, and it shows how debt can influence the behaviour of firms since it must be repaid. The capital structure of high-tech SMEs is influenced by matters regarding information asymmetry, technological uncertainty and market uncertainty (Serrasqueiro et al., 2014). The owners of these TBSFs must understand the requirement for highly qualified staff to ensure long-term success as opposed to merely the challenge of gaining customers. The 2016 SAFE report finds that 20 percent of the SMEs view skilled and experienced staff and managers as the major problem for firms (European Commission, 2016). Furthermore, the issue of staffing can be critical as barriers for NTBFs, when exporting, were found to resonate around human resource issues (Cahen et al., 2016)**.**

8.4.3 Regulations and Expenses

An increase of external equity within the capital structure is demonstrated to have a significant influence on just 0.205 and 0.207 times the risk of gaining customers for expenses and regulations respectively. Furthermore, this can be interpreted as 79.5 percent and 79.3 percent less risk relating to the difficulties in meeting expense and regulatory challenges when compared to the issue of gaining customers, due to the increase in equity. It is an engaging finding as the assumption of selling equity is that it raises a large amount of capital for the high-tech SMEs, which can assist in the payment of expenses and professionals regarding regulatory concerns. The result demonstrates that equity can reduce such issues of expenses for high-tech SMEs. This is of note since R&D expenses can place considerable financial burdens on high-tech SMEs due to their substantial fixed costs (Symeonidis, 1996). Subsequently, the challenge of gaining customers is crucial to overcoming if high-tech SMEs are to utilise equity finance.

Firms that increase their internal finance have 1.047 times the risk of meeting expenses than gaining customers. This finding supports prior literature, that due to innovation internal sources of finance are fully capable of sustaining the expenses of SMEs and these firms must obtain external capital to grow (Beck & Demirguc-Kunt, 2006). The result in Table 8.6 further emphasises that high-tech SMEs need to utilise external sources of finance or else they will not reach their potential. The result reemphasises that insufficient access to finance can be a severe challenge for SMEs that want to improve and grow (Lange et al., 2000). *Hypothesis 20: Internal finance has a negative relationship with the ability to meet expenses for high-tech SMEs,* is therefore accepted. The result also offers some support to previous literature whereby SMEs are more vulnerable to adverse market changes as they have limited capital resources (Buckley, 1989). Furthermore, controlling expenses is a challenge which does not dissipate when compared to an improvement in equity financing. Overall, these findings illustrate how capital structure not only relates to financing, new projects and costing issues. Although certain challenges may seem dissimilar compared to the general topic of finance, they are all important in the successful outcome of SMEs. These results of financing high-tech SMEs can influence how management and owners view the future issues for the firm. A plan to influence the business challenges through the use of different sources can provide another layer to the capital structure corundum of what is the optimal financing level. The objectives for the high-tech SMEs are now examined and results will demonstrate whether the capital structure has such an influence as has been illustrated for the challenges.

8.5 Regression Analysis: Objectives

In order for the multinomial logistic regression to work correctly and produce interpretative RRR results, a similar outcome must be selected, which in Table 8.7 is chosen as strong profits. Firms often seek to achieve strong profits although from a long-term economic standpoint this is not a single objective to follow; it is one which many firms seek to achieve. It is the highest ranked long-term primary objective with 47 percent of the high-tech SMEs selecting it, as per the results in Table 8.5. It is also in tandem with the base outcome of the multinomial regression analysis that investigated the challenges. This base outcome of attaining an adequate number of customers is sufficient as for most businesses they cannot produce strong profits without gaining and retaining customers. When discussing the ability to raise internal and external finance, while the business plan and ideas are imperative, the entrepreneurs human capital is also of critical significance (Chandler & Hanks, 1998; Watson, Hogarth-Scott, & Wilson, 1998). Therefore, start-up experience is used as an independent variable, to help decipher what, if any, affect it has on the differing objectives. It is of the utmost importance to allow for different interpretations of a firm's performance due to the various manners and methods in which performance can be evaluated (Delios & Beamish, 2001).

Table 8.7: Relative Risk Ratio regarding the long term primary objectives and the influence of capital structure and business start-up experience

	IPO	Acquire Firms	Sold > 5yrs	Sold < 5yrs	Merge	Other
Internal Finance	1.055*	0.991	1.161	0.993	1.021	0.904**
	(0.028)	(0.027)	(0.135)	(0.014)	(0.028)	(0.029)
Debt Finance	1.050	1.045	1.107	1.017	0.982	0.106***
	(0.051)	(0.048)	(0.097)	(0.032)	(0.050)	(0.024)
Equity Finance	0.409*	0.993	1.156	1.020	0.203***	0.222***
	(0.187)	(0.041)	(0.107)	(0.017)	(0.022)	(0.031)
Experience	94.003	0.918	0.000***	0.777	1.936	1.036
	(244.007)	(0.833)	(0.000)	(0.351)	(1.456)	(0.722)
Constant	0.000*	0.126	0.000	0.541	0.019	344.923*
	(0.000)	(0.314)	(0.000)	(0.667)	(0.050)	(779.927)
Observations	75	75	75	75	75	75
Population Size	1,200	1,200	1,200	1,200	1,200	1,200
Pseudo R^2	0.230	0. 230	0. 230	0. 230	0. 230	0. 230

Notes: This table represents a multinomial logistic regression model that demonstrates the 6 specific outcomes associated with objectives where gaining strong profits is used as a comparison base in the analysis. The analysis tests the relationship between financing options and firm characteristics on the objectives that high-tech SMEs plan to achieve. The analysis within the model explains the relationship the influence of the independent variable through the use of relative risk ratio (RRR) which compares the outcome to the table values is X the times the risk of gaining customers, given the value X on the corresponding point on the table. The results provide a clearer interpretation of the findings and effects on the dependent variables. The regression analysis uses the specific survey modelling approach of the analysis, which is processed through Stata using the prefix; svy. This provides for the generation of robust results, given the low number of observations associated with survey data. The primary focus is on the effect of equity and debt finance. The standard errors are reported in parentheses. ***, **, and * represent significance at the 5%, 1% and 0.1% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables.

8.5.1 Sold After 5 Years

While the findings demonstrate the projected long-term objectives, a previous study by DeTienne & Cardon (2012) found that 70 percent of firms follow an exit strategy as the most likely path for them. Therefore, the reported objective in Table 7.7 of selling after 5 years has a high probability of occurring with such figures. Subsequently, the results should prove beneficial upon examination and discussion in this key topic. The first objective which has traction is that a primary objective of high-tech SMEs is to sell the business after five years. Previous business start-up experience can strongly influence the long-term objective of selling the high-tech SME after five years. Firms that have an increase in experience have 0.000 times the risk of selling the business after 5 years, compared to generating strong profits as the long-term objective. This is a highly substantial factor decrease when other variables are stable. In turn, it equates to high-tech SMEs being much more likely to set strong profits as their primary long-term objective in comparison to selling the firm after 5 years. A reason for this is that there is literature relating to high-tech firms which are sold often too early before they can reach their maximum value (DeTienne, McKelvie, & Chandler, 2014). Strong start-up experience provides the firms with opportunities to gain adequate finance and improved valuations from venture capitals (Hsu, 2004). *Hypothesis 24: Experience decreases the likelihood of selling the business after 5 years for high-tech SMEs*, is accepted.

The generation of strong profits would prove that firms are worth more than previous and so with an increase in experience, there is a considerable decline in the likelihood that selling the firm after 5 years is the primary long-term objective. This suggests that businesses can sustain themselves with the acquired knowledge and the generation of profits is critical, with no intention of selling. Subsequently, older businesses often find it easier to retain their earnings than younger ones, which can provide some support to the pecking order theory (Berger & Udell, 1998; López-Gracia & Sogorb-Mira, 2008). Founder experience has been interpreted as a key method to gain venture capital, which can impact on the future of the business (Zhang, 2011). These previous findings combined with the result of Table 8.7 suggest that more experienced high-tech SMEs may implement the modified pecking order theory. Subsequently, with previous experience, these businesses are aware of valuation difficulties and would have a greater understanding of whether their firms can sell at their optimal valuation. Management experience within start-ups can positively signal a high-quality firm that can reduce information asymmetries (Kim, Aldrich, & Keister, 2006).

The relationship between equity finance and the increased objective of selling the business after 5 years has a statistically insignificant relationship. Without a relevant result, *hypothesis 23: Equity use positively increases the likelihood of selling the business after 5 years for high-tech SMEs,* cannot be accepted. Therefore, no additional support or rejection regarding prior research can be addressed. This relates to research such as owners know more information about their firm than external investors and lenders (Leland & Pyle, 1977) and that the issuance of new equity can be a poor market signal resulting in a higher cost of equity (Greenwald et al., 1984).

8.5.2 Initial Public Offering

Entrepreneurs who believe that their firm has a truly innovative product or service are more likely to follow an exit strategy which results in an IPO or the sale to another business (DeTienne et al., 2014). A key reason for this is so they can accumulate a substantial increase in wealth through these exit paths. It has been found that key elements such as founder experience, education and age can impact the end objective of the entrepreneur, with founder experience demonstrating a strong positive influence on an IPO objective (DeTienne & Cardon, 2012). Previous start-up experience can strongly influence a firm's objectives and goals (Westhead et al., 2003: Westhead et al., 2001b). However, while experience has an hugely positive effect on the risk of having an IPO as the main objective as opposed to growing profits, it does not provide a statistically significant result. Therefore, *hypothesis 24: Experience increases the likelihood of an IPO for high-tech SMEs,* cannot be accepted. However, the result of 94.003, does compliment the previous finding relating to sold after 5years that had a value of 0.000. Given this lack of significance, the result cannot offer additional findings in the support or rejection of DeTienne & Cardon (2012) who discover that the founder's previous experience can affect the firm's primary objective of becoming publicly listed via IPO. The increased use of equity finance is shown to have a 59.1 percent less risk of an IPO occurring than generating profits, as the primary objective. This finding is practical given that equity finance can dilute the ownership and decrease the overall value of the firm due to the signalling od bad news (Myers & Majluf, 1984). Subsequently, an IPO would be less likely to occur with the use of equity finance, per the result in Table 8.7.

When high-tech SMEs use internal finance this results in 5.5 percent more likely to have an IPO compared to obtaining high profits as their primary objective. This finding suggests that the owners and management of high-tech SMEs do not want to sell shares when undervalued due to information asymmetries. By allowing an IPO, the firm should be adequately valued given its record and future outlook. The finding in Table 8.7 further expands on the research by DeTienne, McKelvie, & Chandler (2014) in which entrepreneurs that believe their firm is particularly innovative will select an IPO strategy or eventual sale to another business. Furthermore, the finding can also be interpreted as allowing for an increase in the likelihood of a greater valuation since the market observes internally generated capital as a positive signal for future investments (Giudici & Paleari, 2000). Subsequently, *hypothesis 26: Internal finance increases the likelihood of an IPO for high-tech SMEs,* is accepted.

8.5.3 Merge With another Firm

While selling off the business is often an option open to some owners, others may want to maintain some level of control. Therefore, in order to take the business to the next growth stage, a merger with a complementary firm may need to occur. The previous result of equity decreases the likelihood of an IPO and equity which again has a similar effect on the likelihood for mergers becoming the primary objective with a relative risk value of 0.203 times gaining strong profits. A merger is thus 79.7 percent less likely to be the top long-term objective than generating strong profits with an increase in the overall equity percentage implemented. Entrepreneurs who previously had financial success may seek this excitement again and set up new firms, with a possibility of selling or merging them in the future (Spivack, McKelvie, & Haynie, 2014). High-tech firms have a severe issue in securing sufficient finance (North et al., 2013), and so generating internal finance is another option to ensure the survival and possible growth of the firm.

The result in Table 8.7 is coherent from a financial management viewpoint, as by expanding the shareholder base, this makes it harder to take into account their value with the merge. The majority of innovative businesses, including those in the high-tech sector need significant capital from outside sources to meet their objectives (Schneider & Veugelers, 2010). It is more straightforward to merge when fewer shares are available on the stock market and, thus this finding follows business logic. Furthermore, an increase in equity will result in a larger amount of capital available to the firm, and so a merger may not be necessary with a greater pool of financing to utilise on current and proposed projects. Furthermore, equity finance can decrease the overall firm value (Myers & Majluf, 1984) which could hinder the value from a merger. This finding provides support to the previous result that discussed the objective of an IPO when an increase in overall equity financing occurs, as a merger is unlikely to happen. Therefore, *hypothesis 27: Equity has a negative relationship with completing a merger for high-tech SMEs,* is accepted.

8.5.4 Other Objectives

Other long-term objectives could comprise of a range of objectives such as increasing market share, gain market territory in foreign countries, produce innovative products and diversify the product range, amongst others. The increase in internal finance as an overall percentage of capital structure results in the other outcome having 0.904 times the risk compared to strong profits. Subsequently, strong profit generation is more important for the high-tech SMEs in this circumstance and so other objectives are not primary in this instance. Given the nominal RRR of 0.106 with an increase in debt, there is little change for either objective. An increase in debt can result in high-tech SMEs focusing on strong profits compared to the remaining other goals; however, banks tend to provide limited finance to new high-tech firms to dilute risk due to the issues and costs of screening such firms (Colombo & Grilli, 2007). There are often higher costs for both new equity and debt issues for smaller companies due to scaling issues (Titman & Wessels, 1988). As disseminated previously, the increase in equity has a significant impact on both the objectives and challenges and also the other objectives category. Subsequently, for TBSFs, the risk of other objectives as the primary long-term objective was 87.8 percent less likely than strong profits as the main long-term intention when overall capital structure increased equity by 1 percent. This finding illustrates once again that when equity is used; the goal of increasing profits often becomes the primary aim, while the same is valid for ensuring the issue of gaining and keeping customers as the primary challenge with equity increase. For innovative businesses to accomplish their objectives, the majority need substantial capital from outside sources (Schneider & Veugelers, 2010).

8.6 Regression Analysis: Exports

8.6.1 Regression Analysis: Exports and Sales Region

From the results in Table 8.8 a large dependence on internal financing possesses a minimal influence on sales in a domestic or foreign market. This should be noted when examining whether the pecking order theory provides a definite option as firms that follow it tend to favour domestic sales or exports. Subsequently, the analysis of both debt and equity provide an even greater emphasis on the nature of these firms, given the placid finding from internal finance. As per the pecking order theory, debt finance is favoured before equity financing due to the issues of information asymmetry, valuation and control of the firm (Myers & Majluf, 1984). Information asymmetry is included within this model and is examined further within this paper as a provision regarding the findings of debt and equity. Firstly, debt has a similar relationship to internal finance, given the magnitude of their influence upon both domestic and exports sales are quite minuscule, compared to other variables within the model. However, debt is found to garner a positive influence upon the domestic sales and a negative on exports although to a much smaller impact than equity. The results of the model are now discussed in detail, testing some of the previously developed hypotheses.

Table 8.8: Regression analysis on the influence of capital structure and key characteristics upon domestic and international sales regions

	(1) Domestic	(2) Total Exports	(3) EMEA (Ex. Ire & UK)	(4) USA	(5) UK	(6) ROW
Profitable: Yes	30.740***	-34.420***	-16.640**	-14.760***	-12.630*	-3.877
	(7.532)	(7.881)	(7.269)	(4.741)	(7.401)	(3.440)
Internal Finance	0.288**	-0.295**	0.181	-0.175**	-0.120	-0.0291
	(0.124)	(0.140)	(0.124)	(0.076)	(0.103)	(0.053)
Debt Finance	0.568***	-0.723***	0.711***	-0.622***	-0.123	0.151
	(0.205)	(0.265)	(0.207)	(0.159)	(0.283)	(0.113)
Equity Finance	42.570***	-40.900***	1.515	7.935	-35.01*	-1.791
	(8.776)	(10.32)	(11.89)	(6.167)	(18.990)	(6.076)
Size	-4.429***	3.300**	0.0397	-0.564	1.461	1.088
	(1.372)	(1.450)	(1.407)	(0.914)	(1.322)	(0.850)
Last Applied Bank Loan:						
-Over 1 Year Ago	-17.220**	24.500***	-15.150	18.490***	-0.019	5.161
	(7.705)	(8.866)	(9.786)	(5.562)	(6.413)	(4.364)
- Within the Last Year	-18.070**	30.500***	1.544	18.760***	5.918	0.833
	(7.684)	(8.497)	(9.194)	(5.677)	(7.718)	(3.246)
Bank Understands:						
- Strongly Agree	-46.890***	34.760***	-5.627	18.620	-4.345	12.09
	(13.920)	(11.270)	(12.260)	(18.490)	(8.717)	(9.716)
- Agree	1.177	-5.949	-21.940**	-4.423	1.490	-1.030
	(9.083)	(9.698)	(9.965)	(5.326)	(6.938)	(4.567)
- Disagree	-11.800	10.290	2.634	6.180	-4.881	0.180
	(9.180)	(10.80)	(10.34)	(5.891)	(5.638)	(3.959)
- Strongly Disagree	-18.710*	3.098	-3.361	-0.760	4.263	9.687
	(10.43)	(11.13)	(9.311)	(7.425)	(7.850)	(6.766)
Target Debt Ratio: Yes	6.248	-4.759	19.600**	-5.438	18.410	-7.199***
	(9.300)	(9.577)	(8.323)	(5.061)	(11.43)	(2.680)
Experience in Start-ups	4.652	-3.020	-6.920	-0.411	-3.211	-1.473
	(4.716)	(5.186)	(4.185)	(2.814)	(2.974)	(2.058)
R&D Expenses	-0.137	0.173	0.0678	-0.017	0.119	0.0292
	(0.130)	(0.149)	(0.197)	(0.116)	(0.153)	(0.075)
Sales & Marketing Expenses	-0.861***	0.719*	0.168	0.203	0.498*	0.197
	(0.302)	(0.365)	(0.318)	(0.173)	(0.296)	(0.144)
Constant	11.590	97.570***	21.900	14.750	73.760**	-3.173
	(15.850)	(19.510)	(17.660)	(13.010)	(28.940)	(16.730)
Observations	76	76	39	76	54	76
Population Size	1,216	1,216	624	1,216	864	1,216
R^2	0.467	0.420	0.401	0.359	0.373	0.194
Rmse	28.880	32.224	19.687	19.670	21.038	15.038

Notes: This table represents 6 separate models that explain the relationship between capital structure and firm characteristics with the international and domestic performance of high-tech measures of high-tech SMEs. The dependent variable in model 1 represents revenue sales that occur in the domestic market and Model 2 has a dependent variable that entails the total export sales these firms generate. The dependent variables used in models 3 to 6 are a categorised by region of the total exports variable that is implemented in model 2. The profitable variable is a binary, Last applied to bank loan is a categorical variable, bank understands the business is a categorical variable, the target debt ratio is a binary variable. OLS regression analysis is implemented utilising the specific survey modelling approach of the analysis, which is processed through Stata using the prefix; svy. This provides for the generation of robust results, given the low number of observations associated with survey data. The primary focus is on the effect of equity and debt finance. The standard errors are reported in parentheses. ***, **, and * represent significance at the 5%, 1% and 0.1% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables.

8.6.1.1 Profitable

The most noticeable finding in Table 8.8 relates to the influence that a profitable firm has upon exports and domestic sales. If a firm is profitable it has a strong positive influence on domestic sales with a 30.740 percentage increase and this finding is clarified when analysis shifts to exports. When a high-tech SME is profitable, it negatively affects the percentage of sales which encompass exports with a decrease of 26.560. This result provides support for Lu & Beamish (2001) whereby Japanese SMEs tend to be unprofitable when they undertake exports, but it does support steady growth. However, the results reject prior research, whereby exporting is often viewed as a sign that a business is in a good economic position (Ganesh- Kumar et al., 2001).

The findings for EMEA, USA and UK regions, which are components of the total exports, confirm this result, as they show that if a firm is profitable, it will have a negative impact on sales in these regions. It demonstrates the difference between more traditional firms and high-tech SMEs since UK manufacturers that are financially strong will export more than less successful businesses that rely solely on the domestic market (Greenaway, Guariglia, & Kneller, 2007). According to the results in Table 8.8, the profitable firms remain in the domestic market. The unprofitable high-tech SMEs will export, perhaps in the hope of gaining new customers and market share to help their business. The result also negates the previous belief that, upfront sunk costs can be barriers to international trade and exporting, particularly if the firms have no profits (Roberts & Tybout, 1997). Subsequently, given the significant negative impact of profitability on exports, no support is provided to *hypothesis 28: Profitable high-tech SMEs have a positive relationship with exports,* and it is rejected. This is an interesting finding as although overall 70 percent of the firms within this analysis are software based and thus by the very nature find it easier to export their product or service, the finding disseminates that if firms are profitable, this will encourage domestic sales. This finding is something which would not be expected, given the impact of globalisation and born-global firms. However, the results may instead provide analysis that is best for high-tech SMEs to gain a foothold into domestic sales and therefore grow at a steadier more manageable rate. This viewpoint is characterised by the analysis of technology start-ups whereby international expansion was due to two crucial reasons; profitability and firm growth (McDougall & Oviatt, 1996; Oviatt & McDougall, 1994).

8.6.1.2 Internal Finance and Debt

When discussing the capital structure of these firms, it is interesting to find that a 1 percent increase in internal finance has a small positive effect on domestic sales by 0.288

percent. Furthermore, when examining the effect of increased internal finance on exports a corresponding negative value of -0.295 percent of sales is reported. Similar results are found regarding the USA, but the coefficient is small compared to other independent variables. The result provides support that exporting is expensive to undertake through the use of internal finance, due to upfront sunk costs. Exporting expenses can have a severely negative influence on firms with limited capital that want to export, due to the sunk costs financial restrictions (Chaney, 2016; Manova, 2012). Further support for the results on Table 8.8 for a negative relationship with internal finance and exporting, as suggested in previous research whereby a positive relationship exists between external finance and exporting for smaller firms (Bellone et al., 2010). The results of the analysis and the previous literature suggest that *hypothesis 32: Internal finance has a positive relationship with domestic sales in high-tech SMEs*, is accepted.

When investigating the effect of debt on exports, a 1 percent increase has a negative relationship due to a corresponding -0.723 percent effect. Following the previous analysis for both internal finance and profitability, the corresponding influence on domestic sales is also positive, at a value of 0.568 percent. The negative value can relate to previous research where banks often refuse to provide debt to young SMEs that want to export as a critical component of their business plan and growth strategy (Riding et al., 2012). Subsequently, exporting is not associated with the use of debt finance in order to best serve the firm, due to the loan repayments that such businesses are legally obliged to repay. Furthermore, this is particularly relevant for high-tech SMEs and SMEs alike, due to their limited assets and so they should be more risk-averse when entering foreign markets (Erramilli & D'Souza, 1993). *Hypothesis 30: Debt has a positive relationship with exports in high-tech SMEs,* is rejected. This finding suggests that debt is a poor choice of finance for firms wanting to export, since it must be paid back with interest and carries the risk of bankruptcy, unlike internal finance or equity. However, when businesses first begin to export and meet the sunk costs involved, they are highly leveraged with a large proportion of illiquid assets (Greenaway et al., 2007).

8.6.1.3 Equity

The results of equity are noteworthy as they have a substantial magnitude, with a strong influence upon the sales regions for high-tech SMEs. Given that equity is likely to be utilised sparingly when following the pecking order theory, but may be used more if the modified high-tech pecking order theory is implemented, the results are quite absorbing particularly given the current financing of these firms as discussed in Table 8.2. If firms utilise equity finance it produces an extensive impact on domestic sales and an almost exact opposite effect on exports. A 1 percent increase in equity financing results in staunch support for domestic sales with a 42.570 increase and a subsequent negative relationship with exports of -40.900. The results provide some robustness to each other given the corresponding similar strength of the values. This finding is perhaps the most noteworthy, given that both internal finance and debt have limited overall influences yet equity financing supports domestic sales. Previous analysis suggests that the availability of finance strongly impacts on an SME's ability to sell their products or services globally (Graves & Thomas, 2008); however, it does seem to hold for equity finance amongst high-tech SMEs. This could be due to the extra challenges involved within exporting and gaining sales in foreign markets, and so perhaps the firms' shareholders prefer growth in the domestic market. Some support for this finds that a proportion of small businesses that obtain external sources of capital for either exporting or innovation purposes without any problems tends to be substantially low (Ughetto, 2008). The results demonstrate that *hypothesis 31: Equity has a positive relationship with exports in high-tech SMEs,* should be rejected.

Given the previous finding of profitable firms and the positive influence within domestic sales, it supports the less risky and more secure option of not exporting. Exporting is found to possess a negative relationship with external finance, the opposite of previous findings by Bellone et al. (2010) where firms with limited capital have difficulties in reaching international markets. It may relate to providing shareholders and banks with a more secure investment through domestic sales and allow for market and financial stability for these TBSFS to become a priority. Given the negative impact of both debt and equity upon exporting, the crucial component which inhibits non-exporters from this can relate to the analysis in which many non-exporting small firms may deem the upfront capital for sunk costs too costly (Moini, 1991), perhaps even regardless of their financing position.

8.6.1.4 Size

While it may seem as though remaining within the domestic market would be the most sustainably viable option to high-tech SMEs it is critical to examine this through the size variable further. The results are unequivocal and illustrate that the larger the size of the SME, the greater the scale of export-based sales. A 1 percent increase in size results in the 3.300 percent increase in exports; while it has a -4.429 percent decrease on domestic sales. The results support previous analysis that smaller firms should be more risk-averse when entering foreign markets, often due to their limited assets (Erramilli & D'Souza, 1993). This result is maintained by previous research whereby a clear strategy for SMEs' growth is through exporting if it is deemed to be a useful approach (Freeman et al., 1983). *Hypothesis 29: Firm size has a positive relationship with exports in high-tech SMEs,* is acceptable given these findings. This is an engaging result as the findings of profitable firms are opposed to this.

Consequently, it can be emphasised that high-tech SMEs can be profitable and large as they are not solely exclusive and such firms can be large but not profitable, or also small and profitable. This leads to a key finding whereby high-tech firms which possessed elevated growth had a comparatively strong percentage of foreign sales (Feeser & Willard, 1990). From that aspect, it must be remembered that larger firms do not always have to be profitable to survive and may take on more substantial risks such as exporting. Previous literature has disseminated that firms which export are often strongly positively correlated with size (Bonaccorsi, 1992). Consequently, smaller firms cannot mitigate this risk and will remain in the domestic market, whereas profitable firms tend to stay and thus following the trend for such success could play a role in this finding.

8.6.1.5 Information Asymmetry

Information asymmetry in this instance relates to a banks' understanding of the high-tech sector, portrayed by 5 different values ranging from very knowledgeable to a considerable knowledge gap. The base outcome used for this categorical variable is unsure, for which the other findings are compared. Interestingly when a large knowledge gap is present denoted as strongly disagree, when compared to those who are unsure, it results in a significant negative impact on domestic sales occurring at -18.710 percent for high-tech SMEs. Information can relate to intangible assets within the high-tech sector, and previous research has discovered the higher percentage of intangible assets are strongly correlated with firms dealing with financing difficulties (Brierley, 2001). When the banks of high-tech SMEs have a great understanding about the high-tech sector and businesses, resulting in limited information asymmetries, a strong positive influence occurs on total exports, with an increase of 34.760 percent existing for these firms. The analysis supports the result that a strong understanding diminishes the number of sales via the domestic region by -46.890 percent, and so the results prove robust. High-tech SMEs must contend with a high proportion of information asymmetries due to the innovative technical aspects of R&D and projects (Bhattacharya & Ritter, 1983; Revest & Sapio, 2012). Given the range of results demonstrated in Table 8.8 regarding this specific analysis, *hypothesis 34: Limited information asymmetry has a positive relationship with the exports of high-tech SMEs*, is accepted.

Subsequently, when information asymmetry diminishes it allows such businesses to carry out larger risk projects with the strategy of improving the business. Indeed the analysis forms a solid viewpoint and provides a substantial insight into how banks can have a crucial role in high-tech SMEs exporting if they are very knowledgeable about the sector. As found previously, problems can occur when firms are seeking outside capital as founders of the business are deemed to have greater information than outside stakeholders due to the limited age profile of the firms (Stiglitz & Weiss, 1981). The conclusion of information asymmetry is in tandem with the previous result regarding loan applications to be discussed next, as both have a positive impact on exports and relate to positive insights into the banking industry and relationship with debt.

8.6.1.6 Bank Applications, Experience and Others

When examining the importance of a bank application upon the sales regions, it is significant since it is a topic which has little previous analysis and it provides an engaging insight into the mindset of the decision makers regarding the firm's relationship with debt. In this model, the base result is that the firms have never applied for a loan and so both application types have a positive influence on sales with the exports illustrating how extra capital, such as a loan, is a necessary mainstay of exporting. The positive relationship on exports of 24.500 for applying within a year and 30.500 applying over a year ago are substantial for high-tech SMEs. Further details show the USA is the export region where the application of loans has the most substantial positive statistically significant result within 1 year. The USA would be viewed as the most beneficial market to break into for the high-tech SME sector. Subsequently, ensuring adequate capital is available when exporting to such a highly valuable market seems to be an essential management decision. However, SMEs can face many challenges, with a major issue being the inadequate access to finance (Lange, Ottens, & Taylor, 2000).

Previous start-up experience and the proportion of revenue used for R&D do not have statistically significant results and thus confirms that they have no tangible influence on the location for sales. In previous research, it was found that a strong positive correlation exists amongst; exporting, undertaking R&D and the nature of utilising innovation (Harris & Moffat, 2011). However, these findings cannot be supported given their statistically insignificant result. The negative impact of sales marketing expenses on domestic sales is statistically significant and sheds some light as to the likelihood of exporting. Indeed an increase in these expenses will result in a decrease in domestic sales and a positive, but statistically insignificant improvement in export revenue.

8.6.2 Exports Logistic Regression Analysis

Given the previous regression analysis, which identified critical drivers for revenue in different international markets via exports and also revenue within the domestic market, further analysis would prove beneficial. A logistic regression examining the determinants that influence whether high-tech SMEs export is produced with the outcome represented in Table 8.9. The link test investigates the goodness of fit of the model and their results. This test utilises the presence of a specification error through analysis of predicted linear values. The results illustrate that the model is sufficient given the value of 0.050 for the predicted linear value, as this needs to be statistically significant and 0.717 for the squared value, which should not be statistically significant. Subsequently, any additional independent variables may not be statistically significant, meaning the current model used is sufficient in examining the logistic regression with exports as the dependent variable. The Wald test is also undertaken as a robustness test to specify the significance of the independent variables as suitable predictors, in which the null hypothesis suggests that removing the variables would not damage the models fit as the prediction power of the coefficient is quite small. The test was run using a combination of the independent variables and each time they were statistically significant with values less than 0.05. Therefore this finding allows for the rejection of the null hypothesis which declares that the corresponding coefficient has a zero value. The use of all the predictor variables within the logistic model is supported, and the finding also verifies the previous results using the Link test. The inclusion of statistically important variables will produce a better model fit, and thus the findings relating to exports are improved with the inclusion of the given independent variables. Tests on collinearity are also successful from both the VIF and Tolerance aspects, thus supporting the use of this model. It must be noted that given the logistic regression nature, the analysis simply examines whether the firm will export or not, but does not cover the magnitude of the exporting scale. Subsequently, this is a critical reason as to why the regression analysis examining the different regions of sales was produced. The combined results provide robust analysis, examining the topic from a range of invaluable yet different methods.

Table 8.9: Capital structure and key firm characteristics as determinants of high-tech SME exports

	(1)	(2)	Tests of Collinearity	
	Export: Yes Log Odds	Export: Yes Odds Ratio	VIF	Tolerance
Profitable: -Yes	-0.001	0.995	1.630	0.614
	(-0.010)	(-0.010)		
Internal Finance	-0.032**	0.969*	1.370	0.729
	(-2.030)	(-2.030)		
Debt Finance	-0.083***	0.921**	1.450	0.690
	(-3.410)	(-3.410)		
Firm Size	0.166	1.180	1.210	0.828
	(1.120)	(1.120)		
Apply to Bank				
1. Within Last Year	2.836***	17.050**	1.310	0.766
	(3.130)	(3.130)		
2. Over a Year Ago	2.054**	7.799**		
	(2.030)	(2.030)		
Target Debt Ratio-Yes	-1.263	0.283	1.070	0.936
	(-1.350)	(-1.350)		
R&D Expenses	0.060**	1.062**	1.430	0.701
	(2.590)	(2.590)		
Sales & Marketing Expenses	0.051	1.053	1.160	0.863
	(1.220)	(1.220)		
Constant	-0.458	0.632		
	(-0.220)	(-0.220)		
Observations	84	84		
Population Size	1,344	1,344		
Pseudo R2	0.304	0.304		
Chi-sq.	20.942	20.942		
Link Test:				
Predicted Linear Value	0.050			
Predicted Linear Value Squared	0.717			
Constant	0.993			

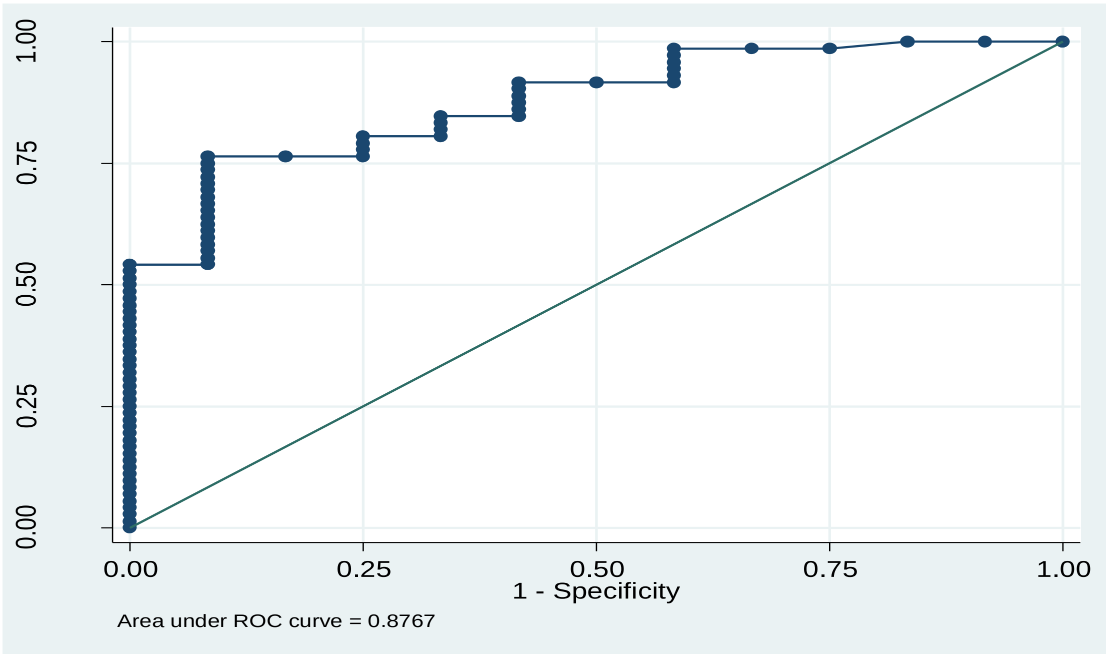
Notes: This table represents a logistic regression model that demonstrates two the specific outcomes of the same analysis by providing both the log odds and odds ratio results. The model explains the relationship between financing sources and firm characteristics in regards to the effect on whether the firm exports or not. The analysis within the model explains the relationship between capital structure elements and exporting. The results are produced as both log odds and odds ratios to allow a clearer interpretation of the findings and effects on the dependent variables. The profitable variable is a binary, last applied to bank loan is a categorical variable; the target debt ratio is a binary variable. Logistic regression analysis is implemented, utilising the specific survey modelling approach of the analysis, which is implemented through Stata using the prefix; svy, which provide for the generation of robust results, given the low number of observations. The primary focus is on the effect R&D expenses, debt finance and previously applied to a bank. The t statistics are reported in parentheses. ***, **, and * represent significance at the 1%, 5% and 10% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables

A 1 percent increase in the total amount of R&D expenditure has a weak, but a positive influence on the likelihood for high-tech SMEs to export with an odds ratio of 1.062. The finding provides some support for Love, Roper, & Hewitt-Dundas (2010) who claim that innovation can only truly flourish via substantial performance benefits when foreign markets are available. The result is engaging as although there is a minimum increase, for high-tech SMEs, R&D expenditure increases the likelihood to export. Due to the large international markets available through implementing exporting as a growth strategy could negate the R&D costs in the medium term. This is supported by previous research which finds that young, focused SMEs which possess an intangible competitive advantage will quickly engage with international markets (Oviatt & McDougall, 1994). With this result, *hypothesis 12: R&D investment has a positive impact on the likelihood to export for high-tech SMEs,* is only partially accepted due to the weakened effect.

The coefficients for variables representing the effects of internal finance and debt finance are small negative log odds and odds ratio close to 1, within 5 percent and 1 percent confidence levels accordingly. Subsequently, the ideology behind these figures suggests there is just less than 50 percent probability that the firms will export if the corresponding variables increase by a unit. The results demonstrate a statistically significant weak, negative influence on the likelihood of exporting for both internal finance and debt. Further support is provided to the rejection of *hypothesis 30: Debt has a positive relationship with exports in high-tech SMEs.* In order to quantify this, it is of utmost importance to put this in a context whereby start-ups and high-tech SMEs have trouble gaining any such adequate capital (Angelini & Generale, 2008; North, Baldock, & Ullah, 2013).

In summary of these findings on the likelihood to export, it has been discovered that innovative firms must apply for external capital in order to obtain their full commercial potential (Beck & Demirguc-Kunt, 2006). Subsequently, the application for a bank loan can represent the acknowledgement that high-tech SMEs understands this predicament and are willing to fix the problem, even if the debt is not their preferred option. The odds ratio value of 17.050 for those firms that applied to a bank within the previous year illustrates the importance. Indeed, further research on this topic would be beneficial. It is important to reaffirm that the physical process of applying is under analysis and does not represent a successful or unsuccessful application. It does illustrate that these high-tech SMEs are willing to obtain external finance and demonstrates the impact of this on exports. This can relate to previous findings whereby businesses which are less likely to receive banking debt finance are those which are innovative (Freel, 2007).

The results find that firms which previously applied for bank credit and separately those which undertake R&D expenditure will have a positive influence on whether high-tech SMEs will export. This is illustrated and discussed in Table 8.9 and is often due to intangible assets and information asymmetry as the capital providers assets will use less debt and equity while the costs are found to be too expensive for such firms (Frank & Goyal, 2009). Innovative firms within the high-tech sector while likely to have the strongest potential for growth will be hampered by their innovation when seeking external financing such as debt. It is a subjective finding, given that high-growth firms are often those within the technology sector (Mason & Brown, 2013). If they do not apply for loans, due to high rejection, then from the findings, they may also never export or reach their potential growth. Consequently, it needs to be addressed from a policy perspective.



Logistic ROC for EXPORTY_N Model
Number of observations 1344
Area under ROC curve 0.8767

Figure 8.3: Logistics receiver operating characteristics for the model examining the capital structure and key firm characteristics as determinants of high-tech SME exports

Notes: This figure represents the logistic model used in Table 8.9 regarding the dependent variable to export or not. The logistic receiver operating characteristics is used to test the suitability of the model in regards to what is being tested, values that are close 1 are deemed strong models of analysis, and so the value of 0.8767 demonstrates that the model is sufficient.

Figure 8.3 provides a graphical representation of the ROC which illustrates a reliable result of 87.67 percent. This value gives further support to the previous test that the model provides a strong role in predicting whether a high-tech SME will export or not. This provides robustness and allows for the strong support of the findings discussed within the logistic model and, to some level, the regression analysis which investigates financing and firm determinants on the revenue generated in domestic and international export regions.

Table 8.10: Predicted probability for application of bank role on exporting when remaining variables are at their means

	(1) Predicted prob.	(2) Log Odds	(3) Odds
Last Applied to Bank			
1. Within the last year	0.985***	4.160***	64.070
	(0.012)	(0.759)	(48.650)
2. Over 1 year ago	0.967***	3.378***	29.310
	(0.032)	(1.006)	(29.480)
3. Never	0.790***	1.324**	3.758**
	(0.084)	(0.507)	(1.907)
Observations	84	84	84
Population Size	1,344	1,344	1,344
Pseudo R2	0.304	0.304	0.304

Notes: This table represents the logistic regression model in Table 8.9 when all of the predictor variables are held at their mean value apart from the categorical variable, last applied to bank, which has 3 separate outcomes (1. Within the last year, 2. Over 1 year ago, 3. Never.) and the results of the effect on exporting or not are reported for each of these outcomes. The results are presented in predicted probabilities, the log odds and also odds, to provide further insights into the outcomes and effect on whether the firm exports or not. Applied to bank loan is a categorical variable. Logistic regression analysis is implemented, utilising the specific survey modelling approach of the analysis, which is implemented through Stata using the prefix; svy, which provide for the generation of robust results, given the low number of observations. Primary focus the effect previous bank applications have on the predicted probability to export. The standard errors are reported in parentheses. ***, **, and * represent significance at the 1%, 5% and 10% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables.

The critical finding in Table 8.10 reveals that a stark relationship exists between the likelihood to export and the time frame when applying for a loan. The predicted probability of a high-tech SME exporting is 98.5 percent when they have applied for a bank loan within the last year. In comparison to those which have never applied for a loan, a 19.5 percent greater probability exists when the remaining variables within the model are held at their mean. It demonstrates how loan applications are not a critical component in deciding if such firms should export. However, it does demonstrate that when there is a willingness to attempt to gain external capital, such as debt, this produces a 96.7 percent probability that high-tech SMEs will export at the 1 percent statistical significance. This further strengthens the finding that in order to gain their full commercial potential, innovative firms must apply for external funding (Beck & Demirguc-Kunt, 2006). The results are similar to the OLS findings in Table 8.8 analysis whereby exporting is the dependent variable, and large positive coefficients exist for both positive loan application options when compared to the base value of applying. Subsequently, it can be concluded firmly that this table shows the probability of exporting increases by a substantial amount when firms have previously applied for bank credit and within the last year, a stronger probability exits due to marginal increases. The findings reinforce and support previous results discussed regarding percentage sale of exports and whether high-tech SMEs export.

Table 8.11: The predicted probbilities of the effect of different debt ranges on exporting for high-tech SMEs after logit estimations

	(1) Predicted prob.	(1) Log Odds	(1) Odds
Total Debt Within Capital Structure			
0%	0.970***	3.484***	32.590*
	(0.017)	(0.587)	(19.140)
10%	0.934***	2.656***	14.240**
	(0.027)	(0.447)	(6.361)
20%	0.862***	1.828***	6.223**
	(0.049)	(0.414)	(2.578)
30%	0.731***	1.000*	2.719*
	(0.100)	(0.511)	(1.390)
40%	0.543***	0.173	1.188
	(0.170)	(0.684)	(0.813)
50%	0.342*	-0.655	0.519
	(0.200)	(0.891)	(0.463)
60%	0.185	-1.483	0.227
	(0.168)	(1.112)	(0.252)
100%	0.008	-4.795**	0.008
	(0.017)	(2.045)	(0.017)
Observations	84	84	84
Population Size	1,344	1,344	1,344
Pseudo R2	0.304	0.304	0.304

Notes: This table represents the logistic regression model in Table 8.9 when all of the predictor variables are held at their mean value apart from the debt value, which is presented in percentage amounts of the total capital structure. The results of the effect on exporting or not are reported for each of these outcomes. The results are presented in predicted probabilities, the log odds and also odds, to provide further insights into the outcomes and effects different debt levels have on whether the firm exports or not. Logistic regression analysis is implemented, utilising the specific survey modelling approach of the analysis, which is implemented through Stata using the prefix svy, which provide for the generation of robust results, given the low number of observations. The primary focus is the 0 percent debt, 30 percent debt and the 50 percent level levels have on the predicted probability to export. The standard errors are reported in parentheses. ***, **, and * represent significance at the 1%, 5% and 10% levels respectively. Please refer to section 4.3.2 for an accurate description of the variables

Previous findings in Table 8.8 demonstrate that debt used has a negative effect on exports and a positive impact on domestic sales. Thus those firms which use a large amount of debt will likely have limited to no exports. Exporting has been illustrated to have a positive relationship with firms that can gain adequate external finance as per the finding by Bellone et al. (2010). This finding was also supported by the logistic regression results in Table 8.9 whereby debt has a value of less than 1.00 for the odds. According to the analysis in Table 8.11, high-tech SMEs have just over a 50 percent probability of exporting when their capital structure consists of 40 percent of the debt. To analyse these results further, the model provides the predicted probabilities broken down into 10 percent ranges up to 60 percent to debt as the capital structure and then 100 percent for comparison. The reason for this is that the majority of the firms possess less than 40 percent of debt within their overall capital structure according to the findings in Table 8.2 and so focusing on this should allow for some beneficial findings and insights regarding the makeup of their financing.

When comparing the predicted probabilities of debt regarding that of applying for bank credit, unexpected results occur. High-tech SMEs which possess no debt at all, have a 97 percent probability of exporting, while those firms which have 30 percent of debt within the capital structure, have only a 73 percent predicted probability to export. This is quite interesting as it was discussed previously how applying for a loan would increase the probability of exporting. However, the trend in Figure 8.4 illustrates that high-tech SMEs which increase their proportion of debt, lower their probability of exporting. The result is the opposite of *hypothesis 30: Debt has a positive relationship with exports in high-tech SMEs,* therefore, it should be rejected. The results demonstrate how the threat of bankruptcy should not be ignored and why debt finance can be dangerous if utilised incorrectly. Subsequently, the findings in Table 8.11 and Figure 8.4 reinforce the belief that firms with limited assets need to risk-averse when deciding to do business in international markets (Erramilli & D'Souza, 1993).

These findings are supported by the log odds and odds ratio figures which were included for robustness. Indeed up to a debt level of 40 percent, the results are highly statistically significant for the predicted probabilities. This provides support to the analysis whereby due to the large bank loan rejection rate, young SMEs will export to gain more capital for use as retained earnings (Riding et al., 2012). Subsequently, it can be concluded firmly from this finding that the use of debt will lower the probability of such businesses exporting. High-tech SMEs are willing to stay safe and remain in the domestic market regardless of the additional sources of capital they can obtain, as discussed previously within the chapter. Furthermore, the findings of Table 8.11 and Figure 8.4 reject that of Greenaway, Guariglia, & Kneller (2007) who declare that firms often use substantial levels of debt to account for the expenses involved with the sunk costs when they first begin to export.

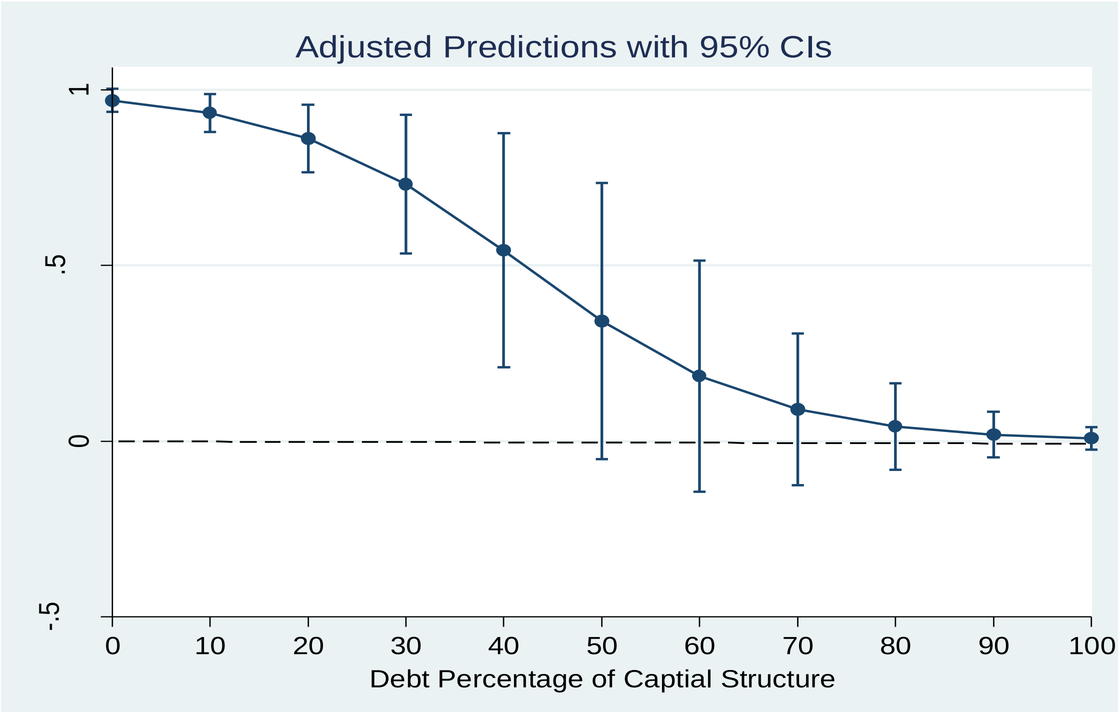


Figure 8.4: Predicted probability of high-tech SMEs exporting with the given debt percentage of capital structure

Notes: This figure is a graphical representation of Table 8.11 that utilises the results of the logistic regression model in Table 8.9 when all of the predictor variables are held at their mean value apart from the debt value, which is presented in percentage amounts of the total capital structure. The results are presented in predicted probabilities of an increase in the total proportion of debt on exporting. The primary focus is the effects that the 0 percent debt, 30 percent debt and the 50 percent level levels have on the predicted probability to export. The results are provided at the 95 % confidence level. Please refer to section 4.3.2 for an accurate description of the variables

8.7 Conclusion

This chapter researches 2 specific areas of high-tech SMEs concerning their capital structure: the objectives & challenges and the exports. This chapter tests some of the hypotheses produced in Chapter 4 and the analysis utilises primary survey dataset to examine these previously under-researched topics.

The first section of the analysis provides descriptive statistics regarding a breakdown of the financing sources used by high-tech SMEs and this provides an insight into the level which they account for the overall financing. Internal finance is found to be the most used source with 46.41 percent of the capital structure, where it also accounts for 16.75 percent of high-tech SMEs that depend on it by between 80 to 100 percent of their financing sources. Equity financing is the second more used source with 25.84 percent and debt finance third with 14.35 percent, while the remaining 13.40 percent accounts towards other sources. Interestingly, the use of the modified high-tech pecking order theory can be suggested from this breakdown, given the strength of the 3 sources of capital. The descriptive analysis also provides findings regarding the profitable high-tech SMEs and the largest shareholders and then the preferred alternative sources of finance that would be utilised by these firms.

The focus of the descriptive analysis then concentrates on the challenges and objectives that high-tech SMEs deem to be the most important. The issue of gaining customers is the primary challenge these firms will face, with 30 percent, closely followed by the access to adequate capital with 23 percent. Given that gaining customers will, in turn, produce profits that can then be used as retained earnings, the top 2 challenges these firms will face relate to the financing of the business, with 53 percent. The objectives follow a similar pattern with 46 percent of high-tech SMEs declaring that generating high profits is the primary long-term objective for the business. Interestingly the second selected primary objective with 23 percent is to sell the business within 5 years. This provides an insight into the current position high-tech SMEs are in and allows a greater understanding of the multinomial regression analysis undertaken in the chapter that examines the effects of capital structure on these challenges and objectives. Such information would not be available through the use of secondary datasets and so the results prove engaging.

The first section of regression analysis examines the effects of capital structure on the challenges of high-tech SMEs. The first main finding demonstrates that the increased use of internal finance results in the inability to meet expenses, providing support to *hypothesis 20.* The use of debt positively increases the challenge of gaining adequate future capital for high-tech SMEs, while equity finance did not have statistically significant results; therefore, *hypothesis 21* is rejected. This finding illustrates that obtaining external capital is not always sufficient for high-tech SMEs, as it is essential to ensure it is adequate; otherwise, it may harm the future ability to obtain capital. Increased use of debt will increase the challenge of obtaining future staff, supporting *hypothesis 22.* Finally, the increased use of equity finance reduced the challenges of both regulatory issues and meeting future expenses. This suggests that equity may prove more beneficial for high-tech SMEs in meeting challenges than debt finance, perhaps since equity does not carry the threat of bankruptcy or loan repayments.

The second section of regression analysis investigates the influence of capital structure on the objectives of high-tech SMEs. The first finding demonstrates that internal finance increases the likelihood of an IPO becoming the primary objective for high-tech SMEs, and so *hypothesis 26* is accepted. Equity has a negative relationship with completing a merger and so *hypothesis 27* is accepted. Finally, experience adversely affects the likelihood of selling the business after 5 years, providing some support to *hypothesis 24.* This finding combined with the previous literature suggests that a modified high-tech pecking order may be implemented by high-tech SMEs with previous start-up experience and is discussed in the chapter.

The final section of analysis investigates the impact of capital structure on the exports of high-tech SMEs. Larger firms are found to have a positive relationship with exports in high-tech SMEs and so *hypothesis 29 is* accepted. Interestingly, the use of debt has a negative relationship with exports and a positive relationship with domestic sales, which rejects *hypothesis 30.* Furthermore, an additional source of external finance, equity, has a substantial negative effect on the exporting of high-tech SMEs, while the domestic sales are positively influenced. This rejects *hypothesis 31.* Domestic sales are positively affected by the use of internal finance, resulting in the acceptance of *hypothesis 32.* When limited information asymmetry exists, this results in a positive impact with exports, which supports *hypothesis 34.* Finally, the analysis examines the predicted probability that high-tech SMEs will export given differing levels of debt finance within their capital structure and as debt increases, the probability of exporting decreases steadily. The analysis and results within the chapter focus on other ventures of performance, not solely financial performance and demonstrates the effects of capital structure and firm characteristics on topics not researched in relation to this topic.

Chapter 9. Conclusion

9.1 Introduction

The thesis investigates the capital structure of high-tech SMEs based in Ireland and Europe, through the analysis of two separate datasets. The thesis incorporates primary survey data of 100 Irish high-tech SMEs and secondary panel data containing over 7,300 European high-tech SMEs during a 10-year period. The thesis examines important topics such as the determinants of financing options, the impact on financial performance, goals, challenges and exports concerning how capital structure affects them. A crucial factor in the research is the use of both a quantitative and qualitative approach in this thesis. It allows for an in-depth analysis into topics not available through secondary data and provides a large sample size on more standard financial figures while incorporating panel data. This thesis is broken down into separate chapters, with Chapter 6 providing a strong overview of some of the key topics by using the European panel data set. The topics are further examined, tested and expanded upon in Chapter 7 and Chapter 8 through the analysis of the primary questionnaire dataset. The thesis examines and analyses the capital structure of high-tech SMEs, through the analysis of 4 distinct research questions:

1. *What are the sources of finance utilised by high-tech SMEs and how are they influenced by firm characteristics?*

2. *What effects do the capital structure, firm characteristics and human capital have on the goals and challenges of high-tech SMEs?*

3. *How do key firm characteristics and financing sources impact the exporting of high-tech SMEs?*

4. *What effects do the financing sources of high-tech SMEs have on their financial performance?*

The research questions are investigated in detail through survey and panel data, comprising of samples of both Irish and European high-tech SMEs and the benefits of implementing a mixed methods dual approach and triangulation is discussed in Chapter 4 and Chapter 5. A thorough review and investigation of the literature were undertaken in Chapter 3, and this review assisted in the formulation and development of the hypotheses, as demonstrated in Chapter 4. The produced hypotheses encompass an element of the research questions under review and their testing assist in the attainment of knowledge to answer the research questions. Combined with this approach, a further investigation into the capital structure of high-tech SMEs using descriptive findings provides a keen insight into the topic. The use of such analysis allows for a greater understanding of the challenges and opportunities high-tech SMEs face about financing themselves and the importance of capital structure. Critical topics such as high-tech SMEs' current capital structure and initial capital structure are examined as well as the breakdown of the largest shareholders regarding their profitability. The importance of lender sectorial knowledge, future objectives, intangible assets and alternative financing options are disseminated throughout the thesis. In particular, the findings are broken down into specific key categories such as number of employees, revenue and age of the firm to provide more in-depth findings.

This chapter reviews the key findings of the thesis and discusses both the academic contribution and the practical implications regarding high-tech SMEs, lenders and investors. The study contributes to this topic providing new, novel analysis and the limitations of the research and the future areas of analysis are discussed. The objectives of the research questions are also examined in relation to the thesis findings. Finally, the chapter ends with a conclusion and a final insight.

9.2 Discussion of the Results and Theories

The thesis has provided a large-scale analysis into the effects of capital structure regarding some critical areas of performance for high-tech SMEs, several of which are novel topics not previously researched. Furthermore, an investigation into the determinants of the capital structure has also been undertaken. The results have been portrayed and disseminated in Chapters 6, 7 and 8 through the testing of developed hypotheses. These hypotheses were formulated through the review of prior literature with the objective to produce results that answer the 4 research questions previously mentioned.

9.2.1 Financial performance and the modified high-tech pecking order theory

According to the analysis in Chapter 6, the total debt ratio is found to have an adverse effect overall on the financial performance measures. It provides additional support to previous research where debt possesses a negative influence on financial performance (Titman & Wessels, 1988; Margaritis & Psillaki, 2010). Concerning the signalling theory, the finding provides additional confirmation to Fama & French (1998) who state that debt is a signal of poor financial performance value. The findings of the total debt analysis provide additional support to the work of Goddard, Tavakoli, & Wilson (2005) and suggest that high-tech SMEs are similar to firms in other sectors regarding the negative influence of debt on financial performance. For the effects of long-term debt use on the financial performance of high-tech SMEs, the results portray that a negative effect exists. This supports the theory that a negative relationship exists between future earnings and the maturity level of debt (Flannery, 1986). It also reinforces previous findings relating to debt's negative impact on financial performance (M. Harris & Raviv, 1991; Smith & Watts, 1992). Short-term debt also has a similar negative effect on financial performance. The overall results are contrary to previous analysis regarding short-term debt and financial performance, which demonstrate a positive relationship (Salawu & Awolowo, 2009). This result further strengthens the belief of Rajan & Zingales (1995) that debt has a negative relationship with the financial performance of high-tech SMEs.

Contrary to the effect of debt finance, an overall positive relationship exists between the total equity ratio and financial performance. The results are very engaging given that equity has been viewed as a last resort amongst many businesses (Cotei & Farhat 2009). These results dispel the previous findings that equity finance is implemented in order to dilute the expected losses due to poor performance, according to the asymmetric information theory (Schmid Klein, O'Brien, Peters, 2002). The results of equity support the discovery that technology-based firms have been shown to have a capital structure that consisted more of equity than debt (Hogan & Hutson, 2005).

Analysis undertaken in Chapter 7 finds that internal finance has a positive influence on the financial performance of high-tech SMEs and together with the descriptive findings of the firms, debt should be the final option of finance. The combined results of the financial sources provide support to the implementation of the high-tech modified pecking order theory, for firms that seek to improve their financial performance. The results propose that debt finance should not be utilised for high-tech SMEs that want improved financial performance. Internal finance has been shown in the descriptive findings to be the most used source of capital for high-tech SMEs which support Minola, Cassia, & Criaco (2013). The findings provide support to the modified high-tech pecking order theory since this negative effect of debt usage resonates with the issue of technological uncertainty, market uncertainty and information asymmetry (Serrasqueiro et al., 2014). Therefore, given the limited amount of tangible assets, combined with the need for external sources of finance, high-tech SMEs may optimally perform if equity is the preferred external source. The combined results also reject the signalling theories that an increase in equity signals a decrease in firm value (Ross, 1977; Leland & Pyle, 1977). The positive result gives credence to a belief that a modified version of the pecking order theory is supported by high-tech start-ups that favour equity use (Minola et al., 2013). It does reject the introduction of the standard pecking order theory, given the preference for debt over equity finance. It is an engaging concept to consider that extra capital will allow such firms to expand and take on further projects and one, which such firms could implement into their financing strategy.

9.2.2 The Determinants of Capital Structure

The research in Chapter 6 and Chapter 7 investigate the determinants of capital structure by analysing hypotheses 1 to 12. The first result of note is that larger high-tech SMEs will use more internal finance, since a positive relationship is found to exist. Furthermore, when examining the ability to gain adequate future capital, firm size has a positive relationship with both debt and equity values. These results support prior research that an increase in size is positively correlated to an enlargement in debt (Harris & Raviv, 1991; Rajan & Zingales, 1995). Most findings demonstrate that larger high-tech SMEs have an easier time in either generating internal finance or can obtain external capital. Additional support is provided in prior research whereby larger SMEs amend their capital structure through different financial sources (Newman et al., 2012). The age of the business, however, is not found to have any significant influence on the capital structure of high-tech SMEs. This can relate to the prior descriptive findings in Chapter 7 whereby over 30 percent of the firms that are 11 years or older employ less than 10 staff members. Some of these firms may not grow as strongly as others and so this provides some support regarding the lack of effect age has on the financing sources.

Profitable high-tech SMEs are found to have a negative relationship with debt use, but a positive exists with the use of equity. This negates the findings of Modigliani & Miller (1963) who note that a highly leveraged capital structure should be implemented to produce optimal performance. While it also rejects the trade-off theory that supports the use of a level of debt to provide sufficient benefits to firms. However, this result relating to high-tech SMEs further builds upon the discussed use of a modified high-tech pecking order theory, and given the findings, it provides robustness to the analysis that investigated the financial performance. This is of particular importance given the finding that often internal finance is not a sufficient sole source of capital for SMEs (Lange et al., 2000). Indeed, the modified pecking order theory is also found to be more accessible, due to issues surrounding debt finance with the need for collateral and its limited availability (Cosh et al., 2009b). The results within the study demonstrate that it is a theory that high-tech SMEs could benefit from and one that could have greater accessibility than alternative options. It is important to note, since new SME public growth markets are planned on being improved and introduced to meet the needs of SMEs within the EU (ESMA Securities and Markets Stakeholder Group, 2017).

R&D expenditure negatively affects internal finance, often due to the need to utilise additional external sources, given the nature and costs associated with R&D. However, small businesses focused on R&D are most likely to get their loan applications rejected (Freel, 2007). This result thus strengthens the implementation of a modified pecking order theory to ensure high-tech SMEs can meet their targets adequately. Indeed, firms that undertake R&D can often signal unobserved growth opportunities, however businesses with considerable debt levels do not have R&D expenses (Fama & French, 2002). The findings of the determinants of capital structure demonstrate that a modified pecking order theory would prove most beneficial for high-tech SMEs.

9.2.3 Challenges and Objectives

A new topic of capital structure research investigates the relationship between the financing sources and the challenges and objectives of the high-tech SMEs. Little to no previous literature exists on this topic and so the results produced are novel and shed some insight into another of the performance areas often overlooked when analysing business financial data. This demonstrates the importance of using primary questionnaire data as new topics of interest are examinable. Gaining customers is the primary challenge high-tech SMEs firms will face, with 30 percent, closely followed by the access to adequate capital with 23 percent. Since gaining customers related to generating revenue and in turn retained earnings, the top 2 challenges, relate to financing issues and account for 53 percent of the total challenges.

Interestingly, the primary objective with 23 percent is to sell the business within 5 years. It provides an insight into the current position high-tech SMEs are in and allows a greater understanding of the issues facing the firms. This relationship between a lack of adequate finance and the objective of selling the business demonstrates an interesting insight about high-tech SMEs and the critical role capital structure has on their daily and long-term performance. Findings that examine the objectives show that internal finance increases the likelihood of an IPO becoming the primary objective for high-tech SMEs. Other analysis provides the insight that previous start-up experience has a negative effect on the likelihood of selling the business after 5 years. This can relate to prior research where start-up experience provides the firms with more opportunities for improved valuations from venture capitalist firms and obtain sources of adequate finance (Hsu 2004). Under this finding, it would negate the challenges previously mentioned and so selling the business would become less important, given the adequate capital to ensure the business can financially survive.

Additional findings demonstrate that the increased use of internal finance results in the inability to meet expenses and furthermore, use of debt positively increases the challenge of gaining adequate future capital for high-tech SMEs. Indeed, the results illustrate that external finance alone is not beneficial in the long-term and so it is essential to utilise the financing source that is sufficient and improves business, not hinders it. These combined results would suggest that the uptake of a modified high-tech pecking order theory would prove beneficial to assist in finding solutions for these challenges. This theory has previously been found to be implemented by tech start-ups that favour equity over debt finance by Minola, Cassia, & Criaco (2013) and so high-tech SMEs may use this theory of capital structure to perform at a more optimal level.

9.2.4 Exports and International Markets

The final section of research examines the relationship between capital structure and the sales location and internationalisation of high-tech SMEs. The analysis focuses on the exports of high-tech SMEs, and the influence capital structure has on selling to international markets. Research is undertaken using both the panel data database and the survey dataset, which examines exports in more detail given the additional relevant information available from this data. The results are presented and discussed in Chapter 6 and Chapter 8.

The number of employees and total assets can be used as measures of firms size, and both have a positive relationship with exports, in particular when an increase in employees occurs. Given the previous discussion of the limited number of employees within SMEs, this can offer insight as to the significance an increase can have. This result is supported by the findings from the questionnaire data; where an increase in exports occurs as firms become larger. Both debt and equity finance have a positive effect on exporting and this can relate to the issue of upfront expenses, known as sunk costs, which can hamper SMEs from exporting due to the considerable amount of capital required initially. Firms that have no internal finance will struggle to export according to Roberts & Tybout (1997), who find that sunk costs can act as barriers to international trade and exporting, particularly when the business has no profits. However, the research in Chapter 8 suggests that profitable firms will not export. Interestingly, the findings that implemented the survey data discover that additional equity has a substantial negative effect on the exporting of high-tech SMEs, while a positive influence occurs for domestic sales. Furthermore, domestic sales are positively affected by the use of internal finance.

This mixed set of results demonstrates that the topic is in its infancy and further analysis of the influence of capital structure on exports may provide further insight into the results. Finally, the last two key findings relate to patents and information asymmetry. A patent can be a signal to possible investors and lenders regarding the firm's strong position high-tech SMEs that possess patents are found to benefit with exports. Concerning the impact of information asymmetries, when limited information asymmetry exists this results in a positive effect with exporting for high-tech SMEs.

9.3 Contribution Towards the Capital Structure of High-Tech SMEs

The investigation into the determinants of financing options and their implementation by high-tech SMEs was discussed in detail when answering Research Question 1. The contribution of this analysis found that the size, intangible assets, future growth opportunities, R&D expenditure and profitability all have substantial influences on the capital structure. This provides insights into a topic not overly researched and contributes to a greater understanding of why high-tech SMEs may use different financing options. The findings have a positive contribution to the literature as they denote how different financing options have a positive or negative relationship with certain business characteristics, some of which are out of the firm’s control, such as age. High-tech SMEs can implement this information in the knowledge that the utilisation of equity or debt has a relationship with such characteristics. Subsequently, firms should review their circumstances to ascertain what finance type is obtainable given their situation. The analysis demonstrates the importance of differentiating some aspects of the capital structure literature between large firms, SMEs and high-tech SMEs. A positive relationship exists between firm size and debt values, while such profitable firms have a negative relationship with debt, but a positive relationship with equity. Intangible assets have a positive relationship with internal finance for high-tech SMEs. Therefore, if the average small sized, profitable high-tech SME with a high proportion of intangible assets find it difficult to obtain debt finance, then they should perhaps expand their resources and focus on utilising another form of capital. The analysis towards this research question provides the high-tech SMEs with the knowledge of determinants of capital structure. It develops insights regarding how the implementation of this to adequately finance themselves by improving the knowledge within the literature.

In relation to Research Question 2, the exercised capital structure can have significant effects on the performance relating to the objectives and challenges of high-tech SMEs. Financing options have a relationship with the challenges firms may face and the objectives they are aiming to meet. Internal finance has a negative relationship with the ability to meet future expenses for high-tech SMEs. Therefore, the firms will need to employ a strategy to utilise external finance since an inability to pay their expenses will have a detrimental effect, often leading to bankruptcy. Given that the additional use of debt finance increases the challenge of gaining adequate future capital for high-tech SMEs, a combination of these findings provide an engaging contribution to the increased acceptance and application of the modified pecking order theory. Subsequently, if firms that solely utilise internal finance cannot meet their expenses and employing debt increases the difficulty in obtaining sufficient finance in the future, the results suggest the use of equity as the preferred second option once a sufficient amount of internal capital is exercised. This should provide the strongest contribution to the benefit of high-tech SMEs.

An increase of internal finance improves the likelihood of an IPO for high-tech SMEs, which provides some support to the modified pecking order theory; given that, equity is the second preferred option. Interestingly, no specific limit or valuations are provided in the modified pecking order theory and so this result could contribute to a stronger undertaking by relevant firms to utilise the theory, especially those seeking to undertake an IPO as a primary objective. Previous start-up experience decreases the likelihood of selling the business after 5 years for high-tech SMEs, which demonstrates the importance of human capital for such firms. Subsequently, the firms may seek to employ people with previous start-up experience if their objective is to sell the business in the long-term. This finding could result in an improvement and spread of knowledge and experience within high-tech SMEs, contributing to their long-term success. Therefore, the importance of human capital to these firms is a vital aspect, and this makes an interesting contribution to the knowledge within the literature.

The use of debt finance has a negative relationship with the challenge of obtaining future staff for high-tech SMEs, while an increase in equity decreases the challenges of meeting expenses and regulatory issues. Therefore, this analysis offers additional support for the modified high-tech pecking order theory and contributes to the implementation of this capital structure. Support for this relates strongly to the Access to Finance programme undertaken by the EU, which seeks to implement policies to improve financing options such as equity (European Commission, 2018a). The findings of the analysis provide a strong knowledge of high-tech SMEs that utilising equity finance could remove financing challenges and help obtain certain objectives. This could have a telling contribution to the future performance of the firms and may help them to address the importance of finance in regards to their objectives and challenges. The results demonstrate how high-tech

SMEs should be viewed as different entities compared to SMEs and large firms and that the capital structure literature can benefit from such novel analysis to contribute towards a new area of high-tech SME financing. Finally, equity has a negative relationship with the objective of completing a merger for high-tech SMEs and this relates to the previous finding whereby mergers can become more complicated with a variety of owners. Subsequently, equity finance benefits firms that may want to remain a whole entity or seek to undertake an IPO. The contribution to the financing of these high-tech SMEs demonstrates how the implementation of certain finance can improve or harm the challenges and objectives. The capital structure should be viewed as an essential component of successfully running a business, particularly high-tech SMEs and their specific characteristics.

Limited literature exists regarding the relationship between capital structure and exports particularly for high-tech SMEs. This engaging and crucial topic is examined through Research Question 3 with an important and novel contribution to the literature. Exporting is a method that can improve revenue by increasing the potential customers in international markets; however, the analysis finds that an increased percentage use of internal finance results in an improvement in domestic sales for high-tech SMEs. This may attest to the belief, the firm is performing effectively and that implementing a new sales strategy could detrimentally affect the revenue. It is a critical contribution to the literature particularly given the findings discussed regarding internal finance. The analysis also found that profitable firms actually do not have a positive relationship with exports, but instead, a negative one exists. Subsequently, those firms who are profitable will have less revenue generated from exports, which was a result not expected. This provides support to the results regarding internal finance as these firms may be unwilling to alter their strategy given that it is currently working and they are successful to a point. However, a key contribution towards the capital structure of high-tech SMEs is the belief that unprofitable businesses may see exporting as their sole option to generate revenue and will take the chance, while profitable firms are content with creating revenue streams domestically. This could result in poorer quality firms exporting out of sheer necessity in the hope that they could gain some market share in external markets.

Furthermore, while the increase in internal finance and, increase in debt both result in small, nominal decreases in export revenue, an increase in equity finance has a substantially large negative impact on export revenue. The finding can be interpreted as a fear of the unknown and justifying management of the new finds with a low-risk approach by decreasing exports and increasing domestic sales. The contribution of this work demonstrates that high-tech SMEs that raise improve their capital will benefit domestically and this may be due to the market share still available for smaller firms in domestic markets. The contribution to the capital structure literature is engaging and provides a foundation for further analysis on this crucial aspect of financing for high-tech SMEs.

An increase in R&D expenditure has a positive, but weak, impact on export revenue. When high-tech SMEs possess a patent, it will have a positive effect on the exports of high-tech SMEs. These two findings signal how innovation improves the revenue generated from exports, particularly when patents are applied given the legal benefits they provide. This improved risk profile is vital towards the capital structure of high-tech SMEs, and the enhanced provision of financing options that benefit is an area that the EU policies will focus on through the Access to Finance programme (European Commission, 2018a). When high-tech SMEs have previously applied for a loan application, it results in a positive influence on export revenue. The application can be viewed as a signal of intent for growth and openness to risk; however it decreases domestic sales. The findings and contribution to the literature should note that applying for and obtaining debt can have different effects on the domestic and export sales for high-tech SMEs. The result demonstrates an important aspect regarding the intricacies of financing for these firms and the effect they can have on their performance, with a novel contribution to the literature.

Finally, Research Question 4 examines the effects of capital structure on the financial performance of high-tech SMEs. According to the analysis, internal finance has a positive effect on revenue generation and provides some support to the implementation of the modified pecking order theory to improve their performance. Further analysis of the topic was undertaken using the European dataset and six separate financial performance measures. An increase in equity finance provides a positive influence on the financial performance indicators, which demonstrates that the modified pecking order theory should be viewed as a primary theory for high-tech SMEs to follow. A contribution to the literature demonstrates the benefits of this capital structure theory and illustrates how SMEs differ from high-tech SMEs, particularly for the benefits of financing options. This contributes actively to the literature and emphasises the importance of financing options and their selection regarding adequate financial sources. The finding reinforces that an increase in the long-term debt, short-term debt and total debt ratios result in a negative relationship with financial performance. Support to the previous analysis of the Irish firms, in which debt decreases the total revenue of the firms further contributes to the importance of capital structure to literature and how high-tech SMEs differ from more traditional and larger businesses

Experience in an incubator or accelerator program negatively affects financial performance and profitability of high-tech SMEs. This finding is significant, given the importance deemed on such programmes to assist start-ups and demonstrates how high-tech SMEs may not need to be involved in such programmes to improve their financial performance. The contribution towards the literature provides a novel result in this new area and is a foundation for additional analysis, while firms can use the findings to deciding upon entering such programmes. When high-tech SMEs possess a target debt ratio, a positive relationship with the generation of revenue exists and not an adverse effect as per the debt values. This result offers a beneficial contribution to the literature since the percentage of the target debt ratio is not examined and so merely having a target to obtain, positively affects revenue. The relevance of this finding reveals that a financing target is beneficial since it exemplifies that high-tech SMEs should address their financing, and this provides a novel insight into the capital structure of these businesses. Furthermore, the contribution to the literature interprets firms which seek to manage their capital structure will improve their financial performance, meaning that the adequate management of financing should not be an afterthought.

9.4 Implications for High-Tech SME Owners and Management

The research throughout the thesis examines both the determinants of capital structure and the effects financing options have on different performance areas. These business areas include the objectives and challenges, the internationalisation of sales and the financial performance of high-tech SMEs. The results demonstrate the significance of capital structure for high-tech SMEs and the effects different sources have on these spectrums of performance. Therefore, management should employ the outcomes of the investigation and place greater importance on capital structure decision making. The selection of financing options should not be due to ease of availability, but management should research and review the capital sources before making a decision. Owners and managers that want the business to eventually be listed through an IPO could improve this likelihood by using internal finance; however, a drawback of this financing option resulted in an increased inability to meet future expenses. Therefore, the management must address the benefits for shareholders by employing a financing strategy that improves their main performance measures, with an eye on the challenges that different financing options can incur. However, it is vital that shareholders are also aware of the performance effects that capital sources possess and understand that the best strategy for improvement may be to utilise retained earnings for new investment or issue more equity. This will ensure that both the owners and management are informed, which can assist in reducing friction on financing decisions while also increasing the awareness of the benefits and drawbacks associated with each source. Importantly, the management and owners should note the research that examined the determinants of capital structure. Certain firm characteristics such as the size of the firm or proportion of intangible assets could reduce the obtainment of specific finance. Subsequently, a significant implication of this research should instigate the relevance of capital structure and ensure it becomes a more inclusive part of running high-tech SMEs.

Subsequently, management and the owners should address the findings throughout the thesis when deciding upon a capital structure strategy. The research supports the significance of the modified high-tech pecking order theory and high-tech SMEs that should employ it to improve their financial performance and reduce financing challenges. By employing the research outcomes, management should advance a key aspect of performance while ensuring the business is in a stable financial position. The maximisation of shareholder value is a critical objective for management, and Wippern (1966) maintains that implementing a capital structure that supports this. If management can employ a capital structure that has a strong relationship with key performance measures and objectives while mitigating serious challenges, this will progress the businesses and increase their value. This should help improve the economic performance of the countries they are based in; given the importance of employment provided by SMEs and the critical significance of the high-tech sector within the EU. It is significant that management and owners note the role and effects that changes in capital structure can provide and the associated benefits with financing options.

9.5 Implications for Lenders and Investors

The research has shown that the prevalence of tangible assets when seeking to value a firm in order to provide capital, can negatively affect high-tech SMEs given their high proportion of intangible assets. The findings in the thesis demonstrate how intangible assets result in a greater amount of internal finance being used for businesses to begin projects and investments. This thesis has established that intangible assets and future growth opportunities can have a significant impact on the successful performance of the firms. Given that in particular lenders, such as banks do not provide loans without collateral, this can discourage high-tech SMEs from applying for debt finance. Equity purchasers and lenders need to be aware that firms will need some external capital, but to ensure they do not meet financial distress, a new system to value the businesses should be incorporated. A motivating finding notes that when firms believed that banks understood their sector, they were able to generate substantial revenue from exports. This demonstrates that when high-tech SMEs gain external capital, they can use it to open new revenue streams. Some high-tech firms may be unwilling to accept certain terms in exchange for capital. It is important for capital providers to demonstrate their knowledge and expertise in their sector and provide some security to the owners and management of high-tech SMEs.

9.6 Limitations and Future Research Areas

This thesis has undertaken research that includes studies that examine the influence of capital structure and firm characteristics on the challenges and objectives of high-tech SMEs and the relationship between capital structure and exports. The thesis also adds to the limited knowledge regarding the financial performance and capital structure for these firms, through another study. A novel database is also created using questionnaires, consisting of 100 Irish high-tech SMEs which encapsulates over 40 separate questions, provided in Appendix A.

Given that the studies are new for the two topics, some issues do arise and limitations which affect the research. The research focuses on a new approach to understanding capital structure by reviewing not only the impact on financial performance but also how capital structure choices can affect the goals and challenges of a firm, such as employing adequate staff, selling the firm or the ability to meet expenses. Therefore, the thesis seeks to change the outlook on capital structure and the impact it can have when investigating high-tech SMEs.

A key limitation of the questionnaire is that it relates to a certain number of businesses during a snapshot in time and so there is limited analysis regarding the impact of time. The questionnaire implemented into the analysis of Chapters 7 and 8 analysed the makeup of the capital structure amongst high-tech SMEs. The use of the panel dataset in Chapter 6 allows for analysis over 10 years, but the variables and analysis are different.

Another limitation regarding the question styles asked in the questionnaire as the majority of the figures incorporated band answers, and not many were open-ended. The reason for this is to encourage more participants as it is less personal to answer in bands than exact numbers. This resulted in some issues, which had to be addressed in the questionnaire data design and data cleaning sections.

Another limitation is the sample size of the analysis undertaken with the survey data. While as shown previously in the academic overview discussion, 100 SME firms is a decent sample size, if given more time a larger sample size to work with would have proved beneficial. 3 reminder emails were sent out to over 1,000 high-tech SMEs based in Ireland over 2 months, meaning sometimes people do not have the time to participate in such surveys. Some interesting outcomes proved statistically insignificant, and the size of the sample could account for some of this.

A topic for further deatailed analysis regards the relationship between exports and capital structure. Little to no research exists on this topic, the literature used to base the knowledge on hypothesis creation and understandings were from the international business sphere. While covered in detail, the time pressures did not allow for a fully immersive analysis into the components of internationalisation, as that itself would incorporate substantial research in a different field to finance. However, it would be interesting to undertake further research in this area as a part of collaboration given that the results found within the thesis are novel.

Further analysis of the dynamic panel models would prove interesting, given that the findings illustrate a method not overly undertaken throughout the topic of capital structure particularly within SME analysis. The results produced in Appendix D demonstrate that this analysis approach should garner support in the future. Indeed, such analysis models should gain more focus primarily if more time cross-sectional, series data becomes available for high-tech SMEs. It is an engaging analysis method, particularly for a topic such as capital structure.

In future research, it would be interesting to undertake similar survey questions to high-tech SMEs in different European countries and test to see if the results are broadly in line with those of Irish firms. This is of particular importance given the analysis in chapter 2, which demonstrates the critical role the high-tech sector and SMEs have towards the economy in these countries.

A limitation regarding the European database used is that the data is provided by the Orbis database, which often contains blank values for many of the most interesting variables. Subsequently, the range of analysis was limited given this, and it would be interesting to utilise different European databases to create a fully completed dataset. However, given the time pressures of completing the PhD, this was not possible during this study, but it is a valuable avenue for further analysis.

9.7 Conclusion

This research investigated the importance of capital structure concerning critical topics of financial performance, goals and opportunities, exporting and the significant determinants of financing for high-tech SMEs. 2 databases were used in the analysis, including a novel database, produced through questionnaire data, which provide further details not available on secondary databases. The thesis investigates new areas regarding high-tech SMEs' capital structure, which in turn relate to investigating the importance of financing options from a business perspective. It is the first research to examine exports, objectives and challenges concerning the capital structure of high-tech SMEs. A range of econometric, regression analysis was undertaken on 2 separate datasets, resulting in novel and engaging findings regarding the capital structure of high-tech SMEs. Future research areas to investigate are also introduced.

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Appendix A: Questionnaire Questions and Answers

The following questions were used in the generation of the data used in the analysis for chapters 5, 6 and 7. It represents the original results, before the data was cleaned and fixed for use in the analysis.

TABLE QA.1. Survey to be completed by one of the following, please select which of these best describes your main role within the business?

Response	Chart	Percentage	Count
CEO		43.8%	70
CFO		6.2%	10
CTO		9.4%	15
Managing Director / General Manager		22.5%	36
Chairman		3.8%	6
Majority Owner		7.5%	12
Founder		40.6%	65
	Total Responses		**160**

TABLE QA.2a. Do you hold any equity in the business?

Response	Chart	Percentage	Count
Yes		91.2%	146
No		8.8%	14
	Total Responses		**160**

TABLE QA.2b. If yes, what Percentage of equity in the business do you currently own?

Response	Chart	Percentage	Count
1-25%		17.1%	26
26-50%		40.1%	61
51-75%		13.2%	20
76-99%		11.2%	17
100%		14.5%	22
N/A		3.9%	6
	Total Responses		**152**

TABLE QA.3a. What percentage of initial capital was sourced from the following options?

	0%	1-10%	10-20%	20-30%	30-49%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%	Total Responses
Personal Savings	42 (27.5)	16 (10.5)	15 (9.8)	14 (9.2)	6 (3.9)	6 (3.9)	6 (3.9)	5 (3.3)	4 (2.6)	1 (0.7)	38 (24.8)	153
Investment from Family and Friends	115 (76.2)	9 (6.0)	8 (5.3)	7 (4.6)	2 (1.3)	2 (1.3)	1 (0.7)	4 (2.6)	1 (0.7)	0 (0.0)	2 (1.3)	151
Bank Borrowing < 1 year	127 (85.2)	7 (4.7)	6 (4.0)	6 (4.0)	1 (0.7)	1 (0.7)	0 (0.0)	0 (0.0)	1 (0.7)	0 (0.0)	0 (0.0)	149
Retained Earnings	110 (74.8)	1 (0.7)	7 (4.8)	3 (2.0)	2 (1.4)	6 (4.1)	2 (1.4)	3 (2.0)	2 (1.4)	4 (2.7)	7 (4.8)	147
Equity from Angel Financer	119 (79.3)	7 (4.7)	6 (4.0)	2 (1.3)	2 (1.3)	4 (2.7)	0 (0.0)	0 (0.0)	2 (1.3)	1 (0.7)	7 (4.7)	150
Equity from Venture Capital	134 (88.7)	1 (0.7)	3 (2.0)	1 (0.7)	1 (0.7)	1 (0.7)	2 (1.3)	2 (1.3)	2 (1.3)	3 (2.0)	1 (0.7)	151
Other	94 (61.4)	8 (5.2)	6 (3.9)	8 (5.2)	3 (2.0)	8 (5.2)	3 (2.0)	6 (3.9)	5 (3.3)	4 (2.6)	8 (5.2)	153

( ) represents the overall percentage usage of each finance type in relation to their band value

TABLE QA.3b. What percentage of current capital is sourced from the following options?

	0%	1-10%	10-20%	20-30%	30-49%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%	Total Responses
Personal Savings	97 (64.2)	13 (8.6)	13 (8.6)	9 (6.0)	0 (0.0)	5 (3.3)	2 (1.3)	2 (1.3)	1 (0.7)	0 (0.0)	9 (6.0)	151
Loans from Friends and Family	140 (93.3)	4 (2.7)	1 (0.7)	1 (0.7)	0 (0.0)	2 (1.3)	1 (0.7)	0 (0.0)	0 (0.0)	1 (0.7)	0 (0.0)	150
Bank Borrowing < 1 year	118 (78.1)	12 (7.9)	12 (7.9)	3 (2.0)	2 (1.3)	3 (2.0)	1 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	151
Retained Earnings	55 (36.7)	6 (4.0)	6 (4.0)	6 (4.0)	5 (3.3)	8 (5.3)	4 (2.7)	7 (4.7)	8 (5.3)	5 (3.3)	40 (26.7)	150
Equity from Friends and Family	126 (84.0)	9 (6.0)	6 (4.0)	4 (2.7)	1 (0.7)	2 (1.3)	0 (0.0)	1 (0.7)	1 (0.7)	0 (0.0)	0 (0.0)	150
Equity from Angel Financer	114 (75.0)	2 (1.3)	6 (3.9)	15 (9.9)	3 (2.0)	2 (1.3)	4 (2.6)	1 (0.7)	1 (0.7)	0 (0.0)	4 (2.6)	152
Equity from Venture Capital	121 (79.6)	2 (1.3)	8 (5.3)	4 (2.6)	3 (2.0)	3 (2.0)	5 (3.3)	2 (1.3)	0 (0.0)	1 (0.7)	3 (2.0)	152
Other	112 (72.7)	5 (3.2)	12 (7.8)	5 (3.2)	2 (1.3)	9 (5.8)	1 (0.6)	3 (1.9)	2 (1.3)	1 (0.6)	2 (1.3)	154

( ) represents the overall percentage usage of each finance type in relation to their band value

TABLE QA.4a. In relation to setting up businesses, how many businesses you been involved with during the creation stage?

Response	Chart	Percentage	Count
0		12.0%	19
1-2		47.5%	75
3-5		38.0%	60
5-10		6.3%	10
10+		1.3%	2
	Total Responses		**158**

TABLE QA.4b. If the answer is more than zero, how many of the businesses you were involved in creating are still in operation?

Response	Chart	Percentage	Count
0		5.8%	8
1-2		70.1%	96
3-5		19.0%	26
5-10		2.9%	4
10+		2.2%	3
	Total Responses		**137**

TABLE QA.5. What return on investment would you deem necessary before undertaking a new project?

Response	Chart	Percentage	Count
<5%		1.3%	2
5-10%		7.6%	12
11-15%		15.3%	24
16-20%		17.8%	28
20%+		58.0%	91
	Total Responses		**157**

TABLE QA.6. What sector is the business involved in?

Response	Chart	Percentage	Count
Software		69.6%	110
Hardware		15.2%	24
Professional / Consulting		26.6%	42
Managed Services Provider		15.2%	24
Distributor		4.4%	7
Systems		12.0%	19
Other (Specify)		13.3%	21
	Total Responses		**158**

TABLE QA.6.1. What sector is the business involved in? (Other (Specify))

#	Response
1.	Hotel Management
2.	manufacturing and service delivery
3.	M
4.	Ecommerce
5.	Social Services Not For Profit
6.	SUB CONTRACTOR TO MANUFACTURING COMPANIES
7.	HW/SW integrated with a client management platform
8.	Medical
9.	Cloud Services Broker
10.	Telecommunications
11.	Broadcasting
12.	Internet website
13.	online services
14.	Travel
15.	Retail
16.	Media & Marketing
17.	Digital Health
18.	Travel
19.	Medical Devices
20.	Fintech
21.	Education

TABLE QA 7. How many years has your business been in operation?

Response	Chart	Percentage	Count
Up to 2 years		20.7%	29
2 - 4 years		20.7%	29
5 - 10 years		22.1%	31
11 years +		36.4%	51
	Total Responses		**140**

TABLE QA.8. Including yourself, how many people are currently employed in your business?

Response	Chart	Percentage	Count
1 – self employed		5.7%	8
2-4		23.6%	33
5-9		27.1%	38
10-20		13.6%	19
21-49		16.4%	23
50-249		11.4%	16
250+		2.1%	3
	Total Responses		**140**

TABLE QA.9 Where is the business headquarters located?

Response	Chart	Percentage	Count
Carlow		0.0%	0
Cavan		0.0%	0
Clare		0.0%	0
Cork		9.3%	13
Derry		0.0%	0
Donegal		0.0%	0
Dublin		61.4%	86
Galway		4.3%	6
Kerry		5.0%	7
Kildare		2.1%	3
Kilkenny		0.7%	1
Laois		0.0%	0
Leitrim		0.7%	1
Limerick		6.4%	9
Longford		0.0%	0
Louth		0.7%	1
Mayo		0.0%	0
Meath		0.7%	1
Monaghan		0.0%	0
Offaly		0.0%	0
Roscommon		0.0%	0
Sligo		2.1%	3
Tipperary		1.4%	2
Waterford		1.4%	2
Westmeath		0.0%	0
Wexford		0.0%	0
Wicklow		1.4%	2
Other		2.1%	3
	Total Responses		**140**

TABLE QA.10. Which party controls the largest stake in the business?

Response	Chart	Percentage	Count
The CEO		38.6%	54
Family or Friends		2.1%	3
Venture Capital		7.1%	10
Business Angels		2.1%	3
Various Small Shareholders		2.1%	3
Businesses or Enterprises		0.7%	1
The Owner		39.3%	55
Other (Specify)		7.9%	11
	Total Responses		**140**

TABLE QA.10. Which party controls the largest stake in the business? (Other (Specify))

#	Response
1.	Myself and my partner 50/50
2.	3 co-founders including myself
3.	Management
4.	Employees
5.	CTO (via personal stake + family & friends)
6.	Founding shareholders
7.	The founders
8.	myself, the other main investor plus the angel inv have 90%
9.	Founders
10.	2 owners (50/50)
11.	Founding partners (CEO * COO) own 85%

TABLE QA.11. Does your firm actively use social media to generate sales, if so which do you find to be the most effective platform?

Response	Chart	Percentage	Count
Twitter		11.8%	16
LinkedIn		38.2%	52
Google Plus		2.2%	3
Facebook		8.1%	11
Yes; but none are useful		15.4%	21
Don’t use social media		19.9%	27
Other (Specify)		4.4%	6
	Total Responses		**136**

TABLE QA.11. Does your firm actively use social media to generate sales, if so which do you find to be the most effective platform? (Other (Specify))

#	Response
1.	Do Not Use social media
2.	YouTube
3.	Vimeo and YouTube
4.	We are pre sales
5.	YouTube

TABLE QA.12. Please rank which of these objectives are the most important for your business to achieve in the next two years. ?

	1	2	3	4	5	Total Responses
Grow headline revenue	46 (32.9%)	33 (23.6%)	18 (12.9%)	22 (15.7%)	21 (15.0%)	140
Enter a new market	15 (10.8%)	24 (17.3%)	40 (28.8%)	41 (29.5%)	19 (13.7%)	139
Increase profits	34 (24.3%)	38 (27.1%)	26 (18.6%)	28 (20.0%)	14 (10.0%)	140
Introduce a new product or service	33 (23.7%)	28 (20.1%)	35 (25.2%)	29 (20.9%)	14 (10.1%)	139
Diversify into another business area	12 (8.6%)	15 (10.8%)	20 (14.4%)	20 (14.4%)	72 (51.8%)	139

TABLE QA.13. From the following list, please select the three biggest challenges the business will face in the coming three years.

	1	2	3	N/A	Total Responses
Access to adequate capital	43 (30.9%)	27 (19.4%)	30 (21.6%)	39 (28.1%)	139
Gaining more customers	64 (45.7%)	36 (25.7%)	27 (19.3%)	13 (9.3%)	140
Regulation requirements	14 (10.0%)	8 (5.7%)	26 (18.6%)	92 (65.7%)	140
Ensuring a skilled technical workforce	31 (22.3%)	37 (26.6%)	30 (21.6%)	41 (29.5%)	139
Ensuring a skilled business workforce	18 (12.9%)	37 (26.4%)	30 (21.4%)	55 (39.3%)	140
Competition	13 (9.4%)	38 (27.5%)	38 (27.5%)	49 (35.5%)	138
Increasing costs	18 (12.9%)	26 (18.6%)	40 (28.6%)	56 (40.0%)	140
Other	8 (5.8%)	1 (0.7%)	5 (3.6%)	124 (89.9%)	138

TABLE QA.14. Which two of the following are the long-term goals for your business?

	1	2	N/A	Total Responses
Initial Public Offering (IPO)	13 (9.4%)	18 (13.0%)	107 (77.5%)	138
Generate High Profits each year	70 (50.0%)	45 (32.1%)	25 (17.9%)	140
Bought Out within 5 years	35 (25.2%)	39 (28.1%)	65 (46.8%)	139
Bought Out after 5 years	16 (11.4%)	41 (29.3%)	83 (59.3%)	140
Merge with another firm	14 (10.1%)	31 (22.3%)	94 (67.6%)	139
Acquire firms	8 (5.8%)	27 (19.6%)	103 (74.6%)	138
Other	10 (7.2%)	10 (7.2%)	118 (85.5%)	138

TABLE QA.15. – Which of the following areas are the most important for your business to invest in?

	1	2	3	Total Responses
Research and Development	24 (20.0%)	39 (32.5%)	57 (47.5%)	120
Sales and Marketing	57 (47.5%)	40 (33.3%)	23 (19.2%)	120
Technical Staff	39 (32.5%)	41 (34.2%)	40 (33.3%)	120

TABLE QA.16a. What percentage of turnover did you invest in these three areas in 2014?

	0%	1-20%	20-40%	40-60%	60-80%	80-100%	Total Responses
Research and Development 2014	19 (15.8%)	49 (40.8%)	29 (24.2%)	10 (8.3%)	5 (4.2%)	8 (6.7%)	120
Sales and Marketing 2014	11 (9.2%)	70 (58.3%)	30 (25.0%)	8 (6.7%)	1 (0.8%)	0 (0.0%)	120
Technical Staff 2014	13 (10.8%)	36 (30.0%)	25 (20.8%)	28 (23.3%)	13 (10.8%)	5 (4.2%)	120

TABLE QA.16b. What percentage of turnover do you plan to invest in these three areas in 2016?

	0%	1-20%	20-40%	40-60%	60-80%	80-100%	Total Responses
Research and Development 2016	11 (9.2%)	56 (46.7%)	34 (28.3%)	16 (13.3%)	2 (1.7%)	1 (0.8%)	120
Sales and Marketing 2016	4 (3.3%)	47 (39.2%)	48 (40.0%)	19 (15.8%)	2 (1.7%)	0 (0.0%)	120
Technical Staff 2016	6 (5.0%)	41 (34.2%)	38 (31.7%)	26 (21.7%)	7 (5.8%)	2 (1.7%)	120

TABLE QA.17. Is the business currently profitable?

Response	Chart	Percentage	Count
Yes		55.8%	67
No		44.2%	53
	Total Responses		**120**

TABLE QA.18. How have the business' revenues and profits in 2014 compared with 2013?

	Increased significantly	Increased marginally	No change	Decreased Marginally	Decreased significantly	Total Responses
Revenue	54 (45.0%)	33 (27.5%)	22 (18.3%)	9 (7.5%)	2 (1.7%)	120
Profit	24 (20.0%)	38 (31.7%)	37 (30.8%)	15 (12.5%)	6 (5.0%)	120

TABLE QA.19. What percentage of the firm's total assets would be intangible?

Response	Chart	Percentage	Count
0-15%		33.3%	40
15-25%		10.8%	13
25-40%		7.5%	9
40 -55%		4.2%	5
55-70%		9.2%	11
70-85%		10.0%	12
85-100%		25.0%	30
	Total Responses		**120**

TABLE QA.20. What was the business' revenue figure for 2014?

Response	Chart	Percentage	Count
<€250,000		36.1%	43
€250,000 - €1,000,000		23.5%	28
€1,000,000 - €2,500,000		13.4%	16
€2,500,000 - €5,000,000		9.2%	11
€5,000,000+		17.6%	21
	Total Responses		**119**

TABLE QA.21. EBITDA is a strong measure of a business' financial performance. What was the business' EBITDA for 2014?

Response	Chart	Percentage	Count
<€250,000		69.7%	83
€250,000 - €1,000,000		21.8%	26
€1,000,000 - €2,500,000		1.7%	2
€2,500,000 - €5,000,000		2.5%	3
€5,000,000+		4.2%	5
	Total Responses		**119**

TABLE QA.22. If you were seeking finance, please rank on a scale of 1 to 5, which of the following sources would be preferred?

	1	2	3	4	5	N/A	Total Responses
Personal Savings / Loans from Friends and Family	7 (6.4%)	14 (12.8%)	15 (13.8%)	14 (12.8%)	23 (21.1%)	36 (33.0%)	109
Bank Borrowings	14 (12.8%)	25 (22.9%)	22 (20.2%)	12 (11.0%)	21 (19.3%)	15 (13.8%)	109
Equity from Angel Financer	11 (10.1%)	29 (26.6%)	14 (12.8%)	20 (18.3%)	15 (13.8%)	20 (18.3%)	109
Equity from Venture Capital	11 (10.1%)	25 (22.9%)	21 (19.3%)	25 (22.9%)	12 (11.0%)	15 (13.8%)	109
Crowd Sourcing	3 (2.8%)	6 (5.5%)	22 (20.2%)	13 (11.9%)	20 (18.3%)	45 (41.3%)	109
Retained Earnings	67 (61.5%)	14 (12.8%)	10 (9.2%)	7 (6.4%)	5 (4.6%)	6 (5.5%)	109
Other	9 (8.3%)	4 (3.7%)	3 (2.8%)	4 (3.7%)	12 (11.0%)	77 (70.6%)	109

TABLE QA.23a. Does your business envisage taking on alternative sources of finance in the next 2 -5 years?

Response	Chart	Percentage	Count
Yes		46.8%	51
No		53.2%	58
	Total Responses		**109**

TABLE QA.23b. If yes, which of the following will you use? Tick all that apply

Response	Chart	Percentage	Count
Crowd Sourcing		11.5%	9
P2P		20.5%	16
N/A		37.2%	29
Other (Specify)		30.8%	24
	Total Responses		**78**

TABLE QA.23b. If yes, which of the following will you use? Tick all that apply (Other (Specify))

#	Response
1.	Asset Finance
2.	Equity
3.	Venture debt
4.	Not sure yet
5.	EIS (old BES scheme)
6.	PE
7.	debt financing
8.	unknown at this time
9.	Merge or sold
10.	Angel or VC
11.	Overseas Broadcasting Production funding & broadcasting series production
12.	BES
13.	VC
14.	Contracting
15.	Venture / Angel
16.	Grants (EU, EI)
17.	Investor
18.	Grants
19.	EU H2020
20.	We always like grant aid. :-)
21.	VC
21.	VC
23.	not sure

TABLE QA.24. Please rank how you think the bank funding environment for technology businesses has changed over the past 12 months?

Response	Chart	Percentage	Count
Significantly Better		4.8%	5
Slightly Better		26.9%	28
Neither better nor worse		48.1%	50
Slightly Worse		14.4%	15
Significantly Worse		5.8%	6
	Total Responses		**104**

TABLE QA.25a. How likely is your business to apply for a bank loan during 2015?

Response	Chart	Percentage	Count
Extremely Likely		9.3%	10
Likely		20.4%	22
Unsure		9.3%	10
Unlikely		25.9%	28
Not likely at all		35.2%	38
	Total Responses		**108**

TABLE QA.25b. If likely, how many banks do you plan to approach?

Response	Chart	Percentage	Count
1		15.6%	14
2		17.8%	16
3		12.2%	11
4		0.0%	0
5+		1.1%	1
N/A		53.3%	48
	Total Responses		**90**

TABLE QA.26. When was last time you applied for bank credit?

Response	Chart	Percentage	Count
Within the last year		34.9%	38
Over a year ago		29.4%	32
Never		35.8%	39
	Total Responses		**109**

TABLE QA.27. Rank each of the following finance options for your business in order of preference.

	1	2	3	4	5	6	Responses
A bank loan would suit my business	7 (6.4%)	16 (14.7%)	29 (26.6%)	16 (14.7%)	19 (17.4%)	22 (20.2%)	109
Prefer to use retained profits when possible	56 (51.4%)	27 (24.8%)	11 (10.1%)	8 (7.3%)	6 (5.5%)	1 (0.9%)	109
Prefer to use venture debt when possible	7 (6.4%)	17 (15.6%)	20 (18.3%)	17 (15.6%)	29 (26.6%)	19 (17.4%)	109
Prefer retained profits and bank loans when possible, raise equity only when essential	25 (22.9%)	28 (25.7%)	19 (17.4%)	23 (21.1%)	11 (10.1%)	3 (2.8%)	109
Would issue external equity	13 (11.9%)	17 (15.6%)	21 (19.3%)	23 (21.1%)	24 (22.0%)	11 (10.1%)	109

TABLE QA.28a. Does the business have a target range for the firm's debt ratio, such as a specific leverage value, comprising of a certain percentage of debt to use?

Response	Chart	Percentage	Count
Yes		12.8%	14
No		87.2%	95
	Total Responses		**109**

TABLE QA.28b. If so, what is this leverage range?

Response	Chart	Percentage	Count
0-10%		51.4%	19
10-20%		10.8%	4
20-30%		13.5%	5
30-40%		8.1%	3
40-50%		8.1%	3
50-60%		0.0%	0
60-70%		0.0%	0
70-80%		0.0%	0
80-90%		2.7%	1
90-100%		5.4%	2
	Total Responses		**37**

TABLE QA.29. On a scale of 1 to 5, please rank which capital sources are and have been the most important to this business ,from the following options.

	Personal Savings	Retained Earnings	Loans from Friends and Family	Bank Borrowing < 1 year	Bank Borrowing > 1 year	Equity from Friends & Family	Equity from Angel Financier	Equity from Venture Capital	Crowd Sourcing	Other	Total Responses
1	30 27.5%	41 37.6%	3 2.8%	1 0.9%	3 2.8%	1 0.9%	9 8.3%	10 9.2%	2 1.8%	9 8.3%	109
2	23 21.1%	21 19.3%	8 7.3%	12 11.0%	11 10.1%	7 6.4%	6 5.5%	9 8.3%	3 2.8%	9 8.3%	109
3	6 5.5%	12 11.0%	14 12.8%	17 15.6%	15 13.8%	7 6.4%	14 12.8%	8 7.3%	3 2.8%	13 11.9%	109
4	7 6.4%	12 11.0%	6 5.5%	17 15.6%	10 9.2%	10 9.2%	6 5.5%	12 11.0%	3 2.8%	26 23.9%	109
5	5 4.6%	7 6.4%	8 7.3%	12 11.0%	13 11.9%	14 12.8%	4 3.7%	6 5.5%	7 6.4%	33 30.3%	109

TABLE QA.30. What is the primary source of revenue for your business?

Response	Chart	Percentage	Count
Licence		15.5%	16
Subscription		17.5%	18
Contract		26.2%	27
One-off payment		12.6%	13
Hybrid		13.6%	14
Fremium		1.9%	2
Managed Services		7.8%	8
Other (specify)		4.9%	5
	Total Responses		**103**

TABLE QA.30. What is the primary source of revenue for your business? (Other (specify))

#	Response
1.	Hybrid license & subscription
2.	Pay per usage, growing recurring monthly revenue model
3.	software License (20%), Implementation(50%) & Support (30%)
4.	Customer-funded product modifications.
5.	Support, License & Implementation

TABLE QA.31. What percentage of sales are from the following regions?

	0%	1-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%	Total Responses
Ireland	16 15.5%	19 18.4%	9 8.7%	6 5.8%	3 2.9%	7 6.8%	3 2.9%	4 3.9%	12 11.7%	9 8.7%	15 14.6%	103
UK	33 32.0%	28 27.2%	19 18.4%	6 5.8%	5 4.9%	4 3.9%	0 0.0%	2 1.9%	2 1.9%	2 1.9%	2 1.9%	103
EMEA	49 47.6%	19 18.4%	12 11.7%	9 8.7%	6 5.8%	3 2.9%	1 1.0%	1 1.0%	2 1.9%	0 0.0%	1 1.0%	103
USA	43 41.7%	20 19.4%	7 6.8%	4 3.9%	6 5.8%	5 4.9%	3 2.9%	6 5.8%	5 4.9%	1 1.0%	3 2.9%	103
Rest of the World	57 55.3%	20 19.4%	9 8.7%	5 4.9%	6 5.8%	3 2.9%	0 0.0%	1 1.0%	0 0.0%	0 0.0%	2 1.9%	103

( ) represents the overall percentage usage of each finance type in relation to their band value

TABLE QA.32. What are your top three challenges, in order of rank, in entering and growing in new geographic markets?

	1	2	3	N/A	Total Responses
Finding the right channel partner	25 (24.3%)	21 (20.4%)	25 (24.3%)	32 (31.1%)	103
Communicating the value of your product/service	38 (36.9%)	24 (23.3%)	20 (19.4%)	21 (20.4%)	103
Gaining good data on competitive trends /market size	10 (9.7%)	19 (18.4%)	23 (22.3%)	51 (49.5%)	103
Having sales team who understand/ have experience the market	43 (41.7%)	28 (27.2%)	9 (8.7%)	23 (22.3%)	103
Strength of incumbent vendors	8 (7.8%)	24 (23.3%)	33 (32.0%)	38 (36.9%)	103
Not having digital marketing capability (webinars etc)	6 (5.8%)	9 (8.7%)	16 (15.5%)	72 (69.9%)	103

TABLE QA.33. In terms of outside support for early stage technology businesses. Please rank what you think are the top 3 priorities?

	1	2	3	N/A	Total Responses
Increase in number of broad based accelerators/ incubation units	12 (11.7%)	26 (25.2%)	30 (29.1%)	35 (34.0%)	103
More accelerators focused on specific industries (i.e. telecoms, FinTech)	24 (23.3%)	22 (21.4%)	36 (35.0%)	21 (20.4%)	103
Change in tax incentives for investors	52 (50.5%)	24 (23.3%)	16 (15.5%)	11 (10.7%)	103
Increase in number of venture capital funds	23 (22.3%)	30 (29.1%)	20 (19.4%)	30 (29.1%)	103

TABLE QA.34. In terms of supporting established technology businesses, please rank what you think are the top 3 priorities?

	1	2	3	N/A	Total Responses
Supports towards building up sales & marketing function	35 (34.0%)	36 (35.0%)	18 (17.5%)	14 (13.6%)	103
Supports towards hiring technical staff	26 (25.2%)	36 (35.0%)	21 (20.4%)	20 (19.4%)	103
Supports towards building organisational capability in HR/Finance/Law	9 (8.7%)	16 (15.5%)	35 (34.0%)	43 (41.7%)	103
Change in tax incentives for investors	40 (38.8%)	22 (21.4%)	17 (16.5%)	24 (23.3%)	103
Increase in number of venture capital funds	20 (19.4%)	18 (17.5%)	26 (25.2%)	39 (37.9%)	103

TABLE QA.35. How has your bank's understanding of the technology sector changed over the past 2 to 3 years?

Response	Chart	Percentage	Count
Significantly Improved		5.1%	5
Slightly Improved		23.5%	23
Neither better nor worse		48.0%	47
Slightly Worse		16.3%	16
Significantly Worse		7.1%	7
	Total Responses		**98**

TABLE QA.36. To what extent do you agree or disagree with the following statements about your business bank?

	Strongly Agree	Agree	Neither/Nor	Disagree	Strongly Disagree	Total Responses
Understands my business	3 (2.9%)	21 (20.4%)	30 (29.1%)	31 (30.1%)	18 (17.5%)	103
Keeps me up to date on banking products and services relevant to my business	1 (1.0%)	16 (15.5%)	35 (34.0%)	34 (33.0%)	17 (16.5%)	103
Makes me feel like a valued customer	3 (2.9%)	15 (14.6%)	32 (31.1%)	31 (30.1%)	22 (21.4%)	103
Is available when I need help/advice	3 (2.9%)	31 (30.1%)	35 (34.0%)	24 (23.3%)	10 (9.7%)	103
Would be approachable if my business was in financial difficulty	2 (1.9%)	20 (19.4%)	31 (30.1%)	23 (22.3%)	27 (26.2%)	103
Responds within an agreed timeframe regarding queries or applications	4 (3.9%)	28 (27.2%)	34 (33.0%)	23 (22.3%)	14 (13.6%)	103

TABLE QA.37. What level of understanding of the technology sector do you think the following banks have?

	Strong Understanding	Good Understanding	Adequate	Limited Understanding	Poor Understanding	N/A	Total Responses
Bank A	4 (3.9%)	15 (14.6%)	22 (21.4%)	19 (18.4%)	24 (23.3%)	19 (18.4%)	103
Bank B	5 (4.9%)	12 (11.7%)	15 (14.6%)	21 (20.4%)	25 (24.3%)	25 (24.3%)	103
Bank C	2 (1.9%)	3 (2.9%)	9 (8.7%)	17 (16.5%)	22 (21.4%)	50 (48.5%)	103
Bank D	2 (1.9%)	1 (1.0%)	9 (8.7%)	10 (9.7%)	33 (32.0%)	48 (46.6%)	103
Bank E	2 (1.9%)	7 (6.8%)	11 (10.7%)	23 (22.3%)	20 (19.4%)	40 (38.8%)	103

TABLE QA.38. Of the following options, in order of preference, would you prefer to own?

	First Preferred Option	Second Preferred Option	Least Preferred Option	Total Responses
Intellectual and intangible capital which could be worth €5,000,000	47 (46.5%)	26 (25.7%)	28 (27.7%)	101
Intellectual and intangible capital which are worth €2,000,000	34 (33.7%)	43 (42.6%)	24 (23.8%)	101
Tangible assets which are worth €1,000,000	24 (23.8%)	30 (29.7%)	47 (46.5%)	101

TABLE QA.39. Between the following options, would you prefer to own?

Response	Chart	Percentage	Count
1% of a €4,000,000 business		58.4%	59
100% of a €40,000 business		24.8%	25
50% of a €80,000 business		28.7%	29
	Total Responses		**101**

TABLE QA.40. Which of the following three Irish tech businesses are you most interested in / do you most admire?

	1	2	3	N/A	Total Responses
Stripe	44 (43.6%)	13 (12.9%)	10 (9.9%)	34 (33.7%)	101
Realex Payments	13 (12.9%)	32 (31.7%)	15 (14.9%)	41 (40.6%)	101
Version 1	5 (5.0%)	14 (13.9%)	17 (16.8%)	65 (64.4%)	101
Hostel World	8 (7.9%)	11 (10.9%)	17 (16.8%)	65 (64.4%)	101
CarTrawler	11 (10.9%)	15 (14.9%)	12 (11.9%)	63 (62.4%)	101
Openet	14 (13.9%)	7 (6.9%)	21 (20.8%)	59 (58.4%)	101
Storyful	12 (11.9%)	11 (10.9%)	13 (12.9%)	65 (64.4%)	101
Movidius	9 (8.9%)	10 (9.9%)	18 (17.8%)	64 (63.4%)	101

TABLE QA.41a. Did the business use any of the services provided by incubator centres or accelerator facilities before?

Response	Chart	Percentage	Count
Yes		46.0%	46
No		54.0%	54
	Total Responses		**100**

TABLE QA.41b. If yes, How did you find it?

Response	Chart	Percentage	Count
Very good		24.6%	14
Good		45.6%	26
Neither good nor poor		24.6%	14
Poor		3.5%	2
Very poor		1.8%	1
	Total Responses		**57**

TABLE QA.41c. If yes, which of the following do you think needs to be the top priority to improve these incubator services and accelerator facilities?

Response	Chart	Percentage	Count
Be more specialised and tailored on specific market segments which different businesses are in (e.g: health, travel, etc)		36.7%	22
Have more generalised business advice		21.7%	13
Greater emphasis on dealing with change and challenges		11.7%	7
Greater access / links to funders (banks , venture capitalists etc)		55.0%	33
Better use of a mentor system		33.3%	20
No need for improvement		5.0%	3
Other (specify)		15.0%	9
	Total Responses		**60**

TABLE QA.42., which of the following do you think needs to be the top priority to improve these incubator services and accelerator facilities? (Other (specify))

#	Response
1.	Ability to share resources between companies - including people
2.	a good VC should be a good mentor, need a good board
3.	better customer acquisition focus
4.	NDRC LaunchPad fulfilled all our needs. I can't say they need to improve in any of these areas.
5.	N/A
6.	N/A
7.	More access to technical architects at early stage product design
8.	n\a
9.	Na

Appendix B: Sources of Finance for High-Tech SMEs

The following tables and of the sources of finance through regarding the high-tech SMEs used for the analysis in Chapter 7 and Chapter 8. The results are provided in both table and figure formats.

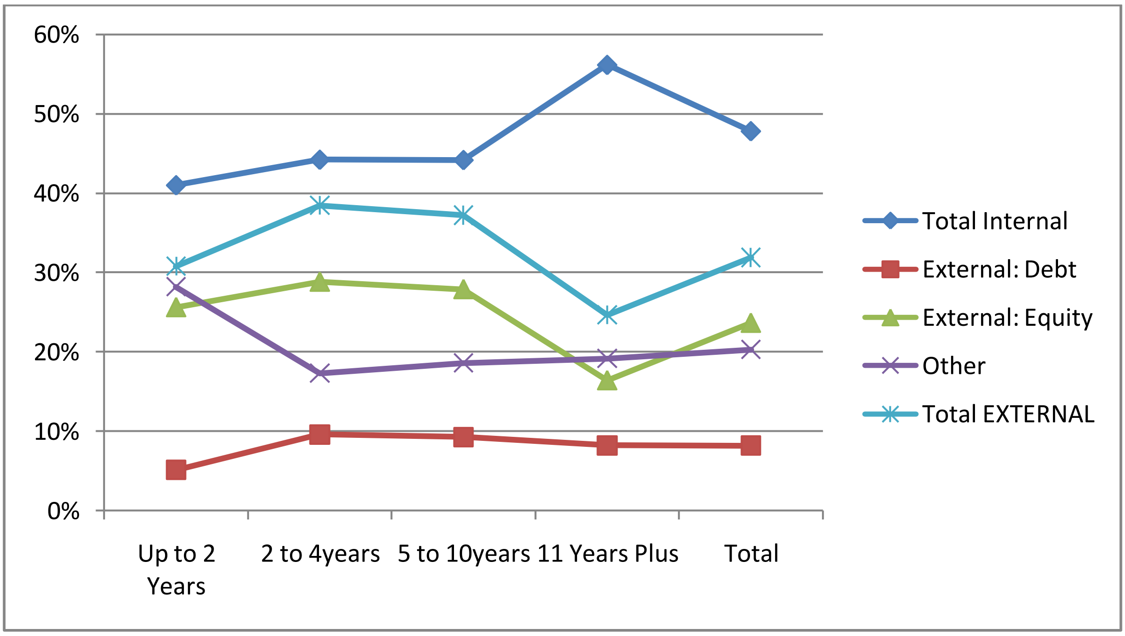

Figure B.1: Initial capital sources compared to business age

Table B.1: Initial Capital Types compared to business age

Initial Finance Type	Up to 2 Years	2 to 4years	5 to 10years	11 Years Plus	Total
Personal Savings	38.46%	36.54%	30.23%	35.62%	35.27%
Retained Earnings	2.56%	7.69%	13.95%	20.55%	12.56%
Total Internal	41.03%	44.23%	44.19%	56.16%	47.83%
Bank Borrowing Less than 1 year	5.13%	9.62%	9.30%	8.22%	8.21%
External: Debt	5.13%	9.62%	9.30%	8.22%	8.21%
Family and Friends Equity	12.82%	19.23%	9.30%	8.22%	12.08%
Angel Finance Equity	7.69%	5.77%	9.30%	6.85%	7.25%
Venture Capital Equity	5.13%	3.85%	9.30%	1.37%	4.35%
External: Equity	25.64%	28.85%	27.91%	16.44%	23.67%
Other	28.21%	17.31%	18.60%	19.18%	20.29%
Total	100%	100%	100%	100%	100%

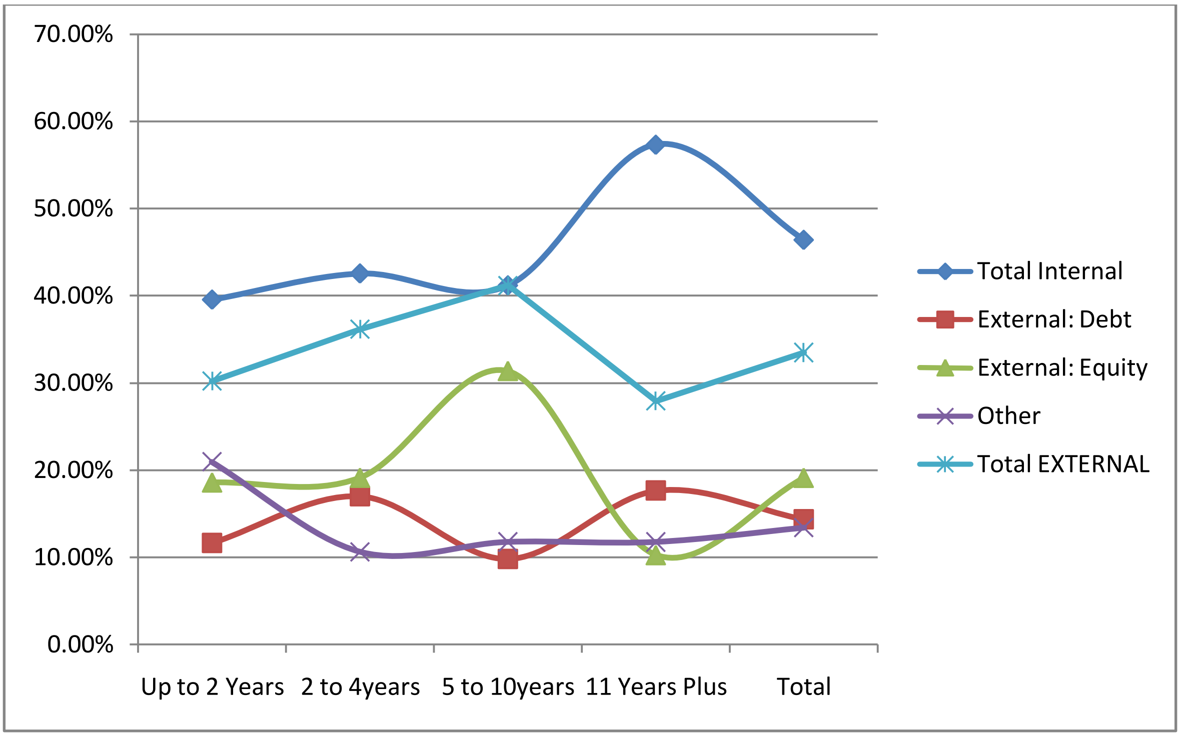

Figure B.2: Current financing sources compared to business age

Table B.2: Current Capital sources compared to business age

Current Finance Type	Up to 2 Years	2 to 4years	5 to 10years	11 Years Plus	Total
Personal Savings	23.26%	25.53%	13.73%	5.88%	15.79%
Retained Earnings	16.28%	17.02%	27.45%	51.47%	30.62%
Total Internal	39.53%	42.55%	41.18%	57.35%	46.41%
Loans from Family and Friends	6.98%	8.51%	0.00%	0.00%	3.35%
Bank Borrowing Less than 1 year	4.65%	8.51%	9.80%	17.65%	11.00%
External: Debt	11.63%	17.02%	9.80%	17.65%	14.35%
Family and Friends Equity	9.30%	10.64%	5.88%	2.94%	6.70%
Angel Finance Equity	11.63%	8.51%	13.73%	5.88%	9.57%
Venture Capital Equity	6.98%	10.64%	17.65%	4.41%	9.57%
External: Equity	18.60%	19.15%	31.37%	10.29%	19.14%
Other	20.93%	10.64%	11.76%	11.76%	13.40%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

From the initial source of capital, equity from friends and family was the clear winner between the three equity choices given. However an interesting change occurred when firms began to get older as venture capital and angel finance began to play a less significant role as a source of equity finance. Other sources tended to be non-traditional such as crowdfunding and other alternative types of finance. Perhaps the most intriguing finding was that as these high-tech firms got older they actually became more reliant on internal sources of finance, most notably retained earnings, with over 50% of firms 11 years or older utilising it. From the analysis in the survey it accounted for 14% of overall firms who utilised retained earnings as 80-100% of its capital.

Table B.3 Initial finance sources and the percentage use of each source overall

	1 to 20 percent	20 to 40 percent	40 to 60 percent	60 to 80 percent	80 to 100 percent	Total
Personal Savings	11.59%	5.31%	4.35%	2.90%	11.11%	35.27%
Retained Earnings	2.90%	1.93%	2.42%	1.93%	3.38%	12.56%
Bank Borrowing	5.31%	2.42%	0.48%	0.00%	0.00%	8.21%
Family and Friends Equity	5.80%	2.90%	2.42%	0.97%	0.00%	12.08%
Angel Finance Equity	3.38%	1.93%	0.48%	1.45%	0.00%	7.25%
Venture Capital Equity	1.45%	0.48%	0.97%	0.48%	0.97%	4.35%
Other	4.35%	4.35%	4.83%	1.93%	4.83%	20.29%
Total	34.78%	19.32%	15.94%	9.66%	20.29%	100.00%

Table B.4 Current finance sources and the percentage use of each source overall l

	1 to 20 percent	20 to 40 percent	40 to 60 percent	60 to 80 percent	80 to 100 percent	Total
Personal Savings	7.18%	2.39%	2.87%	0.48%	2.87%	15.79%
Retained Earnings	4.31%	2.87%	3.83%	5.74%	13.88%	30.62%
Loans from Family and Friends	1.91%	0.48%	0.96%	0.00%	0.00%	3.35%
Bank Borrowing	8.61%	1.91%	0.48%	0.00%	0.00%	11.00%
Family and Friends Equity	4.31%	0.96%	0.48%	0.96%	0.00%	6.70%
Angel Finance Equity	1.91%	5.74%	0.96%	0.48%	0.48%	9.57%
Venture Capital Equity	3.35%	2.39%	2.39%	0.48%	0.96%	9.57%
Other	5.26%	2.39%	2.87%	1.44%	1.44%	13.40%
Total	36.84%	19.14%	14.83%	9.57%	19.62%	100.00%

Appendix C: Regression Models Employing Instrumental Variable Analysis

The following analysis relates to additional regression analysis undertaken for the investigation throughout chapter 6. IV regression analysis is used to produce a "consistent estimator of the unknown coefficients of the population regression function when the regressors, X, is correlated with the error term, u" (Stock & Watson, 2007 p.421).

Appendix C. 1 Impact of Capital Structure on Financial Performance

On average the instruments used are valid, and the endogeneity tests illustrates that it is not necessary to use instrumental variable analysis or simultaneous equations. Such results demons state that the use of fixed effects OLS analysis the OLS is valid. Financial expenses and export revenue whre used as the instrumental variables to account for the problematic endogenous regressors, expected to have correlation with the error term in each model. The endogenous regressors are; long term debt ratio in Table C.1, short term debt ratio in Table C.2, total debt ratio in Table C.3 and total equity ratio in Table C.4.

Table C.1: Two Stage Least Squares Estimation Implementing Multiple Instrumental Variables Regressions for the Analysis of The Long Term Debt Ratio on Financial Performance over a 10 year Period

	(1) ROA using Net income %	(2) ROA using P/L before tax %	(3) ROE using Net income %	(4) ROE using P/L before tax %	(5) Profit margin %	(6) EBITDA margin %
Total Debt Ratio	-0.256***	-0.278***	-0.299	-0.625*	-0.317***	0.129**
	(0.0444)	(0.0559)	(0.244)	(0.265)	(0.0479)	(0.0449)
Employees	-1.201**	-1.062*	-6.219**	-5.726*	-3.187***	-4.327***
	(0.415)	(0.523)	(2.305)	(2.497)	(0.450)	(0.416)
Cashflow	7.315***	7.541***	18.26***	17.81***	5.331***	6.576***
	(0.180)	(0.226)	(1.035)	(1.122)	(0.195)	(0.178)
Future Growth Opportunities	-0.00395	-0.00473	0.109	0.145	0.0888*	0.0621
	(0.0346)	(0.0435)	(0.189)	(0.205)	(0.0375)	(0.0345)
Sales Growth	0.00854***	0.0118***	0.0250***	0.0344***	0.00452**	-0.00288*
	(0.00138)	(0.00174)	(0.00749)	(0.00811)	(0.00150)	(0.00138)
Size: Total Assets	-5.607***	-5.470***	-10.66***	-8.577**	0.677	-1.590***
	(0.459)	(0.578)	(2.691)	(2.916)	(0.496)	(0.457)
Observations	3988	3987	3914	3911	3984	3990
R^2	0.401	0.324	0.122	0.091	0.189	0.328
Adjusted R^2	0.282	0.190	-0.052	-0.090	0.029	0.194
rmse	6.017	7.570	32.43	35.13	6.511	6.002
Anderson canon. corr.	0.000	0.000	0.000	0.000	0.000	0.000
Sargan Statistic	0.038	0.003	0.926	0.398	0.123	0.477
Endogeneity Test	0.000	0.000	0.034	0.003	0.000	0.002

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.2: Two Stage Least Squares Estimation Implementing Multiple Instrumental Variables Regressions for the Analysis of the Short Term Debt Ratio on Financial Performance over a 10 year Period

	(1) ROA using Net income %	(2) ROA using P/L before tax %	(3) ROE using Net income %	(4) ROE using P/L before tax %	(5) Profit margin %	(6) EBITDA margin %
Short Term Debt Ratio	-0.809***	-0.837***	-0.932	-1.887*	-1.002***	0.369**
	(0.167)	(0.199)	(0.823)	(0.907)	(0.189)	(0.142)
Employees	0.358	0.535	-4.532	-2.430	-0.998	-5.029***
	(0.550)	(0.654)	(2.605)	(2.873)	(0.627)	(0.473)
Cashflow	7.410***	7.688***	18.30***	17.95***	5.264***	6.497***
	(0.212)	(0.252)	(1.041)	(1.148)	(0.242)	(0.183)
Future Growth Opportunities	-0.0317	-0.0384	0.0485	0.0357	0.0570	0.0658
	(0.0395)	(0.0470)	(0.184)	(0.203)	(0.0448)	(0.0339)
Sales Growth	0.00699***	0.0101***	0.0243***	0.0321***	0.00259	-0.00208
	(0.00159)	(0.00189)	(0.00731)	(0.00807)	(0.00180)	(0.00137)
Size: Total Assets	-7.414***	-7.478***	-13.18***	-13.71***	-1.594**	-0.571
	(0.449)	(0.534)	(2.076)	(2.290)	(0.511)	(0.384)
Observations	4290	4289	4215	4212	4286	4292
R^2	0.170	0.151	0.115	0.053	-0.286	0.276
Adjusted R^2	0.013	-0.009	-0.052	-0.126	-0.528	0.139
rmse	7.065	8.406	32.23	35.56	8.008	6.066
Anderson canon. corr.	0.000	0.000	0.000	0.000	0.000	0.000
Sargan Statistic	0.032	0.003	0.843	0.239	0.082	0.317
Endogeneity Test	0.000	0.000	0.22	0.032	0.000	0.004

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.3: Two Stage Least Squares Estimation Implementing Multiple Instrumental Variables Regressions for the Analysis of The Total Debt Ratio on Financial Performance over a 10 year Period

	(1) ROA using Net income %	(2) ROA using P/L before tax %	(3) ROE using Net income %	(4) ROE using P/L before tax %	(5) Profit margin %	(6) EBITDA margin %
Total Debt Ratio	-0.256***	-0.278***	-0.299	-0.625*	-0.317***	0.129**
	(0.0444)	(0.0559)	(0.244)	(0.265)	(0.0479)	(0.0449)
Employees	-1.201**	-1.062*	-6.219**	-5.726*	-3.187***	-4.327***
	(0.415)	(0.523)	(2.305)	(2.497)	(0.450)	(0.416)
Cashflow	7.315***	7.541***	18.26***	17.81***	5.331***	6.576***
	(0.180)	(0.226)	(1.035)	(1.122)	(0.195)	(0.178)
Future Growth Opportunities	-0.00395	-0.00473	0.109	0.145	0.0888*	0.0621
	(0.0346)	(0.0435)	(0.189)	(0.205)	(0.0375)	(0.0345)
Sales Growth	0.00854***	0.0118***	0.0250***	0.0344***	0.00452**	-0.00288*
	(0.00138)	(0.00174)	(0.00749)	(0.00811)	(0.00150)	(0.00138)
Size: Total Assets	-5.607***	-5.470***	-10.66***	-8.577**	0.677	-1.590***
	(0.459)	(0.578)	(2.691)	(2.916)	(0.496)	(0.457)
Observations	3988	3987	3914	3911	3984	3990
R^2	0.401	0.324	0.122	0.091	0.189	0.328
Adjusted R^2	0.282	0.190	-0.052	-0.090	0.029	0.194
Rmse	6.017	7.570	32.43	35.13	6.511	6.002
Anderson canon. corr.	0.000	0.000	0.000	0.000	0.000	0.000
Sargan Statistic	0.038	0.003	0.926	0.398	0.123	0.477
Endogeneity Test	0.000	0.000	0.034	0.003	0.000	0.002

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.4: Two Stage Least Squares Estimation Implementing Multiple Instrumental Variables Regressions for the Analysis of The Total Equity Ratio on Financial Performance over a 10 year Period

	(1) ROA using Net income %	(2) ROA using P/L before tax %	(3) ROE using Net income %	(4) ROE using P/L before tax %	(5) Profit margin %	(6) EBITDA margin %
Total Equity Ratio	0.314***	0.341***	0.328	0.741*	0.384***	-0.146**
	(0.0577)	(0.0705)	(0.291)	(0.325)	(0.0639)	(0.0531)
Employees	-1.498***	-1.408*	-6.732**	-7.028**	-3.320***	-4.135***
	(0.448)	(0.548)	(2.299)	(2.570)	(0.496)	(0.409)
Cashflow	6.979***	7.193***	17.84***	16.75***	4.766***	6.681***
	(0.247)	(0.302)	(1.333)	(1.491)	(0.274)	(0.222)
Future Growth Opportunities	-0.0862*	-0.0976*	0.00288	-0.0727	-0.0101	0.0911**
	(0.0387)	(0.0473)	(0.194)	(0.217)	(0.0429)	(0.0352)
Sales Growth	0.0112***	0.0147***	0.0284***	0.0412***	0.00775***	-0.00402**
	(0.00167)	(0.00205)	(0.00816)	(0.00912)	(0.00185)	(0.00152)
Size: Total Assets	-4.970***	-4.848***	-9.421**	-5.302	1.430*	-1.676***
	(0.551)	(0.674)	(3.653)	(4.086)	(0.609)	(0.499)
Observations	4290	4289	4215	4212	4286	4292
R^2	0.257	0.198	0.095	0.005	-0.096	0.276
Adjusted R^2	0.117	0.047	-0.076	-0.182	-0.303	0.139
rmse	6.683	8.170	32.59	36.44	7.394	6.066
Anderson canon. corr.	0.000	0.000	0.000	0.000	0.000	0.000
Sargan Statistic	0.194	0.024	0.886	0.676	0.499	0.656
EnodgeneityTest	0.000	0.000	0.005	0.000	0.000	0.001

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix C.2 Determinants of Capital Structure

The Following tables, Table C.5 and Table C.6 seek examine which variables influence the debt and equity use by high-tech SMEs. Sales Growth is used as the instrumental variable, with future growth opportunities as problematic endogenous regressors for both Model 2 and Model 3 in Table C5. The endogeneity test demonstrates that the use of Fixed Effects OLS is more suitable model to use given that endogeneity is not shown to exist. Model 1 has endogeneity but t the results of the analysis, bar one variable are not statistically significant. In relation to Table C6, all models bar model 4 demonstrate that according to the endogeneity test Fixed Effects OLS analysis is more suitable than 2SLS.

Table C.5: Two Stage Least Squares Estimation Implementing Multiple Instrumental Variables Regressions to Analyse the Determinants of the Gearing Ratios using Panel Data over a 10 year Period

	(1) Gearing %	(2) Gearing: Total Debt to Assets	(3) Gearing: Total Debt to Capital
Future Growth Opportunities	96.72	7.211	-29.31
	(104.3)	(7.692)	(51.02)
Size: Sales	7.018	1.152	-2.666
	(20.99)	(2.023)	(13.35)
Current Ratio	2.794	0.176	-1.076
	(3.027)	(0.258)	(1.717)
Tangible Fixed Assets	24.75	2.989^{***}	1.428
	(12.95)	(0.800)	(5.357)
Profitability	-0.0420	-0.170^{**}	-0.452
	(1.081)	(0.0654)	(0.449)
Employees	-21.99	-3.362	2.632
	(23.51)	(1.817)	(12.07)
Observations	53386	50914	50815
R^2	-8.487	-1.710	-0.355
Adjusted R^2	-9.887	-2.127	-0.564
rmse	286.8	26.16	172.9
Anderson canon. corr.	0.335	0.255	0.258
Sargan Test	0.000	0.000	0.000
Endogeneity Test	0.004	0.118	0.499

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.6: Two Stage Least Squares Estimation Implementing Multiple Instrumental Variables Regressions to Analyse the Determinants of Capital Structure using Panel Data over a 10 year Period

	(1) Long Term Debt	(2) Short Term Debt	(3) Total Debt	(4) Equity
Future Growth Opportunities	-0.00923	0.347	0.325	-1.495
	(0.405)	(0.287)	(0.297)	(3.289)
Number of employees	-0.000207	0.00309	0.000618	0.0101
	(0.00253)	(0.00174)	(0.00148)	(0.0163)
Current Ratio	0.0184	-0.120*	-0.0000143	-0.0173
	(0.0178)	(0.0562)	(0.0187)	(0.0841)
EBITDA margin %	0.00569	-0.0128	-0.00186	0.0250
	(0.00697)	(0.0101)	(0.00533)	(0.0531)
Size: Total Assets	1.106***	0.766***	0.982***	1.037*
	(0.186)	(0.0673)	(0.0910)	(0.424)
Profitability	-0.0118	0.00273	-0.00511	-0.0290
	(0.00987)	(0.00965)	(0.00718)	(0.0797)
Observations	25027	26507	32166	56162
R^2	0.118	-1.244	-1.277	-86.583
Adjusted R^2	-0.060	-1.660	-1.687	-98.620
Rmse	0.792	1.374	1.267	4.550
Anderson canon. corr	0545	0.129	0.177	0.649
Sargan Statistic	0	0	0.000	0.000
Endogeneity Test	0.972	0.0625	0.084	0.000

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix C.3 The Influence of Capital Structure and Key Characteristics on Export Revenue

Throughout a multitude of tests including a combination of different instrumental variable variables, all of the findings resulted non-valid instruments according to the under-identification and over-identification tests. Therefore, the results are invalid and are of no statistical significance. To provide an example of such findings, the following model in Table C.6 is presented. This incorporates sales growth and operating revenue are both instrumental variables to account for the expected correlation of the total equity ratio and long-term debt ratio with the error term.

Table C.7: Two Stage Least Squares Estimation Implementing Multiple Instrumental Variables Regressions to Analyse Influence of Finance on Exports using Panel Data over a 10 year Period

	(1) Export revenue	(2) Export revenue / Operating revenue %
Total Equity Ratio	-24.67	-0.154^{*}
	(34.07)	(0.0697)
Long Term Debt Ratio	-613.6^{*}	-0.805
	(279.3)	(0.537)
Short Term Debt Ratio	-167.0^{*}	-0.215
	(69.14)	(0.135)
Cash flow	-0.379	-0.000157
	(0.557)	(0.00110)
Size: Log TA	2747.7^{**}	5.928^{**}
	(969.9)	(1.845)
Number of employees	-2.956	0.0275
	(14.25)	(0.0274)
Profitability	-24.38	0.0514
	(34.92)	(0.0693)
Future Growth Opportunities	-17.75	0.0654
	(29.23)	(0.0589)
Observations	8759	8739
R^2	-111.501	-0.805
Adjusted R^2	-127.608	-1.064
Rmse	7222.6	14.78
Anderson canon. corr. (Under-identification)	0.0438	0.0328
Endogeneity Test	0.000	0.000

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix D: Dynamic Panel Model Analysis

In this analysis, the past values of dependent variables are taken and used as regressors. GMM is used as the estimator in this model to account for autocrelation (Nielsen, 2005).

Table D.1: Arellano-Bover/Blundell-Bond GMM Estimator Analysis on the Short Term Debt Ratio Influence on Financial Performance

	(1) ROA: Net income	(2) ROA: P/L before tax	(3) ROE: Net income	(4) ROE: P/L before tax	(5) Profit margin	(6) EBITDA margin
ST Debt Ratio	-0.110***	-0.118***	-0.508***	-0.506***	-0.0378*	-0.0252
	(0.0115)	(0.0133)	(0.0695)	(0.0779)	(0.0184)	(0.0146)
L.ST Debt Ratio	0.0615***	0.0652***	0.247***	0.294***	0.0513***	0.0625***
	(0.0130)	(0.0146)	(0.0553)	(0.0624)	(0.0139)	(0.0140)
L2.ST Debt Ratio	0.0193	0.0227*	0.0209	0.0825	0.00261	0.0177
	(0.0104)	(0.0113)	(0.0429)	(0.0522)	(0.0143)	(0.0144)
Size	8.170***	9.131***	25.48***	28.77***	7.912***	7.121***
	(0.634)	(0.676)	(2.821)	(2.976)	(0.528)	(0.553)
L.Size:	-8.573***	-9.447***	-22.06***	-25.45***	-7.207***	-5.657***
	(0.538)	(0.577)	(2.012)	(2.170)	(0.415)	(0.443)
L2.Size	-2.412***	-2.707***	-6.639***	-10.27***	-0.977***	-0.907**
	(0.355)	(0.406)	(1.379)	(1.550)	(0.291)	(0.310)
Employees	0.0284	0.0353	-0.0431	-0.0231	0.000702	-0.0189
	(0.0236)	(0.0251)	(0.0876)	(0.0977)	(0.0254)	(0.0220)
L.Employees	-0.0332*	-0.0487**	-0.170*	-0.185*	-0.0347*	-0.0313*
	(0.0160)	(0.0163)	(0.0733)	(0.0787)	(0.0153)	(0.0141)
L2.Employees	0.0213	0.0164	0.0839	0.137*	0.00183	-0.000895
	(0.0117)	(0.0122)	(0.0652)	(0.0645)	(0.0139)	(0.0138)
Cash flow	0.0132***	0.0108***	0.0494***	0.0472***	0.0134***	0.0113***
	(0.00184)	(0.00208)	(0.00751)	(0.00750)	(0.00211)	(0.00176)
Fut. Growth Opps.	-0.0999	-0.125*	-0.474*	-0.495*	-0.0868*	-0.0771
	(0.0519)	(0.0504)	(0.207)	(0.220)	(0.0423)	(0.0428)
Sales Growth	0.00279*	0.00349*	0.00592*	0.00771*	0.00192	0.00181
	(0.00125)	(0.00159)	(0.00275)	(0.00363)	(0.00120)	(0.00111)
L. ROA: Net income	0.165***					
	(0.0142)					
L. ROA: P/L before tax		0.199***				
		(0.0132)				
L. ROE: Net income			0.154***			
			(0.0206)			
L.ROE P/L before tax				0.173***		
				(0.0207)		
L.Profit margin					0.190***	
					(0.0153)	
L.EBITDA margin						0.188***
						(0.0164)
Constant	20.68***	23.94***	23.44	52.26*	3.779	2.090
	(3.862)	(3.992)	(19.78)	(20.44)	(3.069)	(3.361)
Observations	50501	50460	48454	48441	50314	50057
Arellano-Bond ^	0.0995	0.2100	0.6548	0.7768	0.6795	0.0994

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ ^ Arellano-Bond test for zero autocorrelation

Table D.2: Arellano Bover/Blundell Bond GMM Estimator Analysis on the Long Term Debt Ratio Influence on Financial Performance

	(1) ROA using Net income %	(2) ROA using P/L before tax %	(3) ROE using Net income %	(4) ROE using P/L before tax %	(5) Profit margin %	(6) EBITDA margin %
Long Term Debt Ratio	-0.0409***	-0.0541***	0.0269	0.0407	-0.0329***	0.0139
	(0.00552)	(0.00651)	(0.0514)	(0.0651)	(0.00568)	(0.00913)
L.Long Term Debt Ratio	0.000164	-0.00880	0.0754**	0.110**	-0.0127*	0.00352
	(0.0105)	(0.0112)	(0.0258)	(0.0360)	(0.00635)	(0.00830)
L2.Long Term Debt Ratio	0.00411	0.00735	0.0188	0.0480	0.00320	0.00838
	(0.0106)	(0.0114)	(0.0292)	(0.0450)	(0.00746)	(0.00736)
Size: Total Assets	-3.903***	-4.450***	-4.815**	-5.313**	0.850**	-0.133
	(0.365)	(0.459)	(1.533)	(2.055)	(0.283)	(0.284)
L.Size: Total Assets	-2.337***	-2.353***	-8.099***	-10.94***	-2.525***	-1.352***
	(0.293)	(0.350)	(0.940)	(1.263)	(0.257)	(0.234)
L2.Size: Total Assets	-0.907***	-1.382***	-5.101***	-8.798***	-0.597**	-0.549**
	(0.244)	(0.323)	(0.885)	(1.231)	(0.185)	(0.187)
Employees	0.177	0.0931	-0.380	0.696	-0.869***	-1.755***
	(0.208)	(0.262)	(0.841)	(1.194)	(0.215)	(0.245)
L.Employees	-0.0670	-0.173	-0.455	-0.439	-0.412*	-0.143
	(0.174)	(0.245)	(0.738)	(1.022)	(0.193)	(0.200)
L2.Employees	0.300	0.361	1.367*	1.525	-0.190	-0.326
	(0.156)	(0.196)	(0.655)	(0.890)	(0.151)	(0.180)
Cashflow	6.569***	7.309***	17.91***	19.50***	5.171***	5.199***
	(0.128)	(0.149)	(0.565)	(0.653)	(0.105)	(0.101)
Future Growth Opportunities	-0.0124	-0.0374	-0.172*	-0.264*	-0.0124	0.0356
	(0.0292)	(0.0329)	(0.0798)	(0.129)	(0.0326)	(0.0310)
Sales Growth	0.00381**	0.00960***	0.0134**	0.0260***	0.000773	-0.00193*
	(0.00138)	(0.00267)	(0.00433)	(0.00768)	(0.000949)	(0.000962)
L.ROA using Net income %	0.0792***					
	(0.0127)					
L.ROA using P/L before tax %		0.121***				
		(0.0115)				
L.ROE using Net income %			0.0659***			
			(0.0164)			
L.ROE using P/L before tax %				0.0907***		
				(0.0193)		
L.Profit margin %					0.0963***	
					(0.0103)	
L.EBITDA margin %						0.0787***
						(0.0124)
Constant	26.55***	32.47***	59.33***	104.1***	3.046	6.794**
	(2.499)	(2.872)	(11.83)	(15.96)	(2.118)	(2.090)
Observations	36851	36811	35847	35835	36819	36590
Arellano-Bond^	0.1857	0.1035	0.3003	0.1589	0.1490	0.2000

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

^Arellano-Bond test for zero autocorrelation Second Order Prob > Z H0: no autocorrelation

Table D.3: Arellano Bover/Blundell Bond GMM Estimator Analysis on the Total Debt Ratio Influence on Financial Performance

	(1) ROA using Net income %	(2) ROA using P/L before tax %	(3) ROE using Net income %	(4) ROE using P/L before tax %	(5) Profit margin %	(6) EBITDA margin %
Total Debt Ratio	-0.0363***	-0.0528***	0.0184	0.0187	-0.0275***	0.0108
	(0.00454)	(0.00534)	(0.0343)	(0.0463)	(0.00416)	(0.00656)
L.Total Debt Ratio	0.00668	0.00228	0.0821***	0.137***	-0.00252	0.0149*
	(0.00766)	(0.00855)	(0.0210)	(0.0318)	(0.00500)	(0.00634)
L2.Total Debt Ratio	0.00498	0.00588	0.0167	0.0633*	0.00221	0.0101*
	(0.00735)	(0.00801)	(0.0202)	(0.0299)	(0.00522)	(0.00506)
Size: Total Assets	-3.859***	-4.387***	-4.602**	-4.829*	0.900**	-0.0770
	(0.368)	(0.462)	(1.543)	(2.057)	(0.286)	(0.288)
L.Size: Total Assets	-2.369***	-2.405***	-8.221***	-11.27***	-2.559***	-1.369***
	(0.296)	(0.354)	(0.969)	(1.286)	(0.259)	(0.238)
L2.Size: Total Assets	-0.931***	-1.402***	-4.846***	-8.439***	-0.598**	-0.550**
	(0.246)	(0.325)	(0.885)	(1.211)	(0.186)	(0.189)
Employees	0.187	0.103	-0.271	0.961	-0.861***	-1.745***
	(0.209)	(0.263)	(0.841)	(1.190)	(0.217)	(0.248)
L.Employees	-0.0427	-0.146	-0.520	-0.469	-0.395*	-0.143
	(0.175)	(0.246)	(0.742)	(1.034)	(0.194)	(0.201)
L2.Employees	0.325*	0.395*	1.309*	1.467	-0.163	-0.320
	(0.156)	(0.196)	(0.652)	(0.884)	(0.152)	(0.181)
Cashflow	6.553***	7.283***	17.85***	19.42***	5.154***	5.181***
	(0.129)	(0.150)	(0.563)	(0.649)	(0.105)	(0.101)
Future Growth Opportunities	-0.0146	-0.0381	-0.201*	-0.288*	-0.0129	0.0325
	(0.0294)	(0.0331)	(0.0807)	(0.131)	(0.0329)	(0.0314)
Sales Growth	0.00375**	0.00952***	0.0131**	0.0254***	0.000756	-0.00191*
	(0.00137)	(0.00266)	(0.00432)	(0.00763)	(0.000952)	(0.000966)
L.ROA using Net income %	0.0785***					
	(0.0128)					
L.ROA using P/L before tax %		0.121***				
		(0.0116)				
L.ROE using Net income %			0.0668***			
			(0.0166)			
L.ROE using P/L before tax %				0.0936***		
				(0.0194)		
L.Profit margin %					0.0971***	
					(0.0104)	
L.EBITDA margin %						0.0778***
						(0.0125)
Constant	26.64***	32.70***	56.58***	98.91***	2.938	6.237**
	(2.516)	(2.896)	(11.98)	(15.81)	(2.133)	(2.128)
Observations	36457	36418	35456	35445	36426	36198
Arellano-Bond ^	0.1917	0.1070	0.2523	0.1369	0.1227	0.2276

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

^Arellano-Bond test for zero autocorrelation Second Order Prob > Z H0: no autocorrelation

Table D.4: Arellano Bover/Blundell Bond GMM Estimator Analysis on the Total Equity Ratio Influence on Financial Performance

	(1) ROA using Net income %	(2) ROA using P/L before tax %	(3) ROE using Net income %	(4) ROE using P/L before tax %	(5) Profit margin %	(6) EBITDA margin %
Total Equity Ratio	0.0815***	0.111***	-0.305***	-0.423***	0.0382***	0.0102
	(0.0185)	(0.0154)	(0.0461)	(0.0561)	(0.00782)	(0.00671)
L.Total Equity Ratio	-0.0820***	-0.0938***	-0.188***	-0.201***	-0.0143**	-0.0170**
	(0.0243)	(0.0200)	(0.0297)	(0.0339)	(0.00456)	(0.00555)
L2.Total Equity Ratio	-0.0172	-0.00296	0.0480*	0.0539	-0.00953*	-0.00799
	(0.0139)	(0.0157)	(0.0240)	(0.0283)	(0.00457)	(0.00438)
Size: Total Assets	-2.090**	-1.870***	-8.910***	-9.992***	1.824***	0.257
	(0.641)	(0.525)	(2.158)	(2.633)	(0.307)	(0.303)
L.Size: Total Assets	-4.018***	-4.959***	-9.844***	-11.69***	-2.992***	-1.526***
	(0.626)	(0.557)	(1.222)	(1.453)	(0.248)	(0.281)
L2.Size: Total Assets	-1.046**	-1.178**	-1.982*	-3.880***	-0.464**	-0.312
	(0.340)	(0.381)	(0.895)	(1.155)	(0.179)	(0.189)
Employees	0.135	0.00901	-0.310	0.250	-1.100***	-1.955***
	(0.200)	(0.242)	(0.946)	(1.170)	(0.198)	(0.238)
L.Employees	-0.352*	-0.679**	-1.437	-1.701	-0.796***	-0.347
	(0.155)	(0.218)	(0.826)	(0.993)	(0.188)	(0.206)
L2.Employees	0.135	0.198	1.393	1.718	-0.273*	-0.220
	(0.142)	(0.179)	(0.757)	(0.964)	(0.139)	(0.173)
Cashflow	6.858***	7.700***	18.68***	20.69***	5.366***	5.252***
	(0.136)	(0.143)	(0.584)	(0.651)	(0.0986)	(0.0975)
Future Growth Opportunities	-0.0224	-0.0502	-0.134	-0.234*	-0.0128	0.00565
	(0.0275)	(0.0305)	(0.0822)	(0.119)	(0.0281)	(0.0284)
Sales Growth	0.000562	0.00131	0.00114	0.00247	-0.000518***	-0.000696***
	(0.000497)	(0.00109)	(0.00147)	(0.00265)	(0.000125)	(0.000146)
L.ROA using Net income %	0.0496**					
	(0.0163)					
L.ROA using P/L before tax %		0.0986***				
		(0.0153)				
L.ROE using Net income %			0.0884***			
			(0.0191)			
L.ROE using P/L before tax %				0.110***		
				(0.0195)		
L.Profit margin %					0.0836***	
					(0.0101)	
L.EBITDA margin %						0.0773***
						(0.0114)
Constant	27.18***	30.34***	98.37***	133.0***	-1.206	5.095**
	(2.333)	(2.554)	(12.11)	(14.73)	(1.905)	(1.876)
Observations	44755	44711	43641	43625	44707	44417
Arellano-Bond^	0.0032	0.0083	0.3025	0.3879	0.0542	0.6235

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

^Arellano-Bond test for zero autocorrelation Second Order Prob > Z H0: no autocorrelation

Table D.5: Arellano Bover/Blundell Bond GMM Estimator Analysis on the Determinants of Gearing Ratios

	(1) Gearing %	(2) Gearing: Total Debt to Assets	(3) Gearing: Total Debt to Capital
Size: Sales	-3.685	-0.276	2.652
	(2.493)	(0.902)	(12.39)
L.Size: Sales	-4.885*	-0.226	13.37
	(1.974)	(0.631)	(7.742)
L2.Size: Sales	-2.543	-0.998	-18.13*
	(2.071)	(0.773)	(8.733)
Current Ratio	0.325	0.00368	0.120
	(0.335)	(0.0399)	(0.146)
L.Current Ratio	-0.777**	-0.174***	0.119
	(0.252)	(0.0441)	(0.176)
L2.Current Ratio	-0.1000	-0.0783	0.0715
	(0.278)	(0.0451)	(0.140)
Tangible Fixed Assets	15.47***	1.781***	7.597***
	(1.506)	(0.381)	(2.158)
L.Tangible Fixed Assets	-9.861***	-1.879***	1.534
	(1.513)	(0.395)	(2.231)
L2.Tangible Fixed Assets	1.583	-0.664**	-3.813
	(1.162)	(0.240)	(2.799)
Employees	3.492	-0.891	-3.369
	(3.234)	(0.644)	(7.406)
L.Employees	4.124	0.414	6.833
	(2.599)	(0.419)	(4.326)
L2.Employees	-1.562	-0.431	10.58
	(2.787)	(0.448)	(5.489)
Profitability	-1.260***	-0.235**	-0.110
	(0.0970)	(0.0750)	(0.332)
Future Growth Opportunities	0.187	-0.0666	0.299
	(0.395)	(0.0653)	(0.267)
L.Gearing %	0.544***		
	(0.0215)		
L.Gearing: Total Debt to Assets		0.693***	
		(0.114)	
L.Gearing: Total Debt to Capital			0.0423
			(0.0789)
Constant	78.70**	23.33*	-18.59
	(25.86)	(11.07)	(98.85)
Observations	44516	42793	42698
Arellano-Bond test	0.3738	0.0343	0.8418

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

^Arellano-Bond second order test for zero autocorrelation Second Order Prob > Z H0: no autocorrelation

Table D.6: Arellano Bover/Blundell Bond GMM Estimator Analysis on the Determinants of Debt and Equity

	(1) Long Term Debt	(2) Short Term Debt	(3) Total Debt	(4) Equity
Size: Total Assets	1.131^{***}	0.917^{***}	1.226^{***}	0.389^{***}
	(0.0739)	(0.0736)	(0.0629)	(0.0211)
L.Size: Total Assets	-0.875^{***}	-0.487^{***}	-0.873^{***}	-0.254^{***}
	(0.0784)	(0.0741)	(0.0679)	(0.0212)
L2.Size: Total Assets	-0.287^{***}	-0.217^{***}	-0.148^{***}	-0.000958
	(0.0449)	(0.0634)	(0.0446)	(0.0137)
Current Ratio	0.0219^{**}	-0.324^{***}	0.00205	0.00819^{***}
	(0.00740)	(0.0316)	(0.00603)	(0.00128)
L.Current Ratio	-0.0240^{*}	0.0603^{*}	-0.0127	-0.00598^{***}
	(0.0106)	(0.0267)	(0.0101)	(0.00126)
L2.Current Ratio	-0.00444	-0.0155	-0.00113	-0.00169
	(0.00402)	(0.00924)	(0.00309)	(0.00116)
EBITDA	0.0271	-0.0111	0.0148	0.0600^{***}
	(0.0226)	(0.0238)	(0.0185)	(0.0126)
L.EBITDA	0.0528^{***}	0.0297^{*}	0.0386^{**}	-0.0284^{***}
	(0.0143)	(0.0144)	(0.0122)	(0.00419)
L2.EBITDA	0.0333^{*}	-0.0000158	0.00434	-0.00599
	(0.0157)	(0.0144)	(0.0120)	(0.00316)
Employees	-0.0660	-0.0240	-0.0311	0.00214
	(0.0502)	(0.0479)	(0.0403)	(0.0120)
L.Employees	-0.0409	0.0525	0.00797	0.00378
	(0.0443)	(0.0441)	(0.0316)	(0.0103)
L2.Employees	-0.0335	-0.0150	-0.0321	0.00414
	(0.0441)	(0.0439)	(0.0301)	(0.0112)
Profitability	-0.0146^{***}	-0.0134^{***}	-0.0183^{***}	0.00880^{***}
	(0.00275)	(0.00270)	(0.00222)	(0.00152)
Future Growth Opportunities	0.00421	0.000398	0.00873^{*}	0.00240
	(0.00515)	(0.00460)	(0.00405)	(0.00127)
L.Long Term Debt	0.763^{***}			
	(0.0274)			
L.Short Term Debt		0.416^{***}		
		(0.0280)		
L.Total Debt			0.679^{***}	
			(0.0252)	
L.Equity				0.811^{***}
				(0.0271)
Constant	1.169^{*}	1.601^{**}	0.127	0.0202
	(0.521)	(0.576)	(0.396)	(0.118)
Observations	15606	16804	20336	38870
Arellano-Bond test	0.7025	0.0186	0.1906	0.4791

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

^Arellano-Bond second order test for zero autocorrelation Second Order Prob > Z H0: no autocorrelation

Table D.7: Arellano Bover/Blundell Bond GMM Estimator Analysis on the Impact of Capital Structure to Export Revenue of High-Tech SMEs

	(1) Export revenue	(2) Export revenue / Operating revenue %
Total Debt	80.17	2.134
	(192.9)	(1.417)
L.Total Debt	131.9	2.840*
	(196.9)	(1.445)
L2.Total Debt	135.1	0.712
	(194.5)	(0.995)
L3.Total Debt	-344.5	0.523
	(212.8)	(1.697)
Equity	824.2	3.220
	(464.6)	(2.969)
L.Equity	-588.3	0.174
	(317.2)	(4.959)
L2.Equity	112.3	3.002
	(253.2)	(5.097)
L3.Equity	695.1*	2.642
	(325.2)	(3.586)
Size: Total Assets	774.6	-0.313
	(1060.6)	(7.651)
Employees	2262.4	-0.459
	(1622.4)	(8.156)
Age	1878.5	-13.70
	(10434.7)	(64.38)
Patents	4586.3	2.489
	(2857.0)	(31.17)
L.Export revenue	0.115	
	(0.278)	
L.Export revenue / Operating revenue %		-0.0258
		(0.264)
Constant	-30443.8	-18.70
	(38419.4)	(168.7)
Observations	302	302
Arellano-Bond autocorrelation test	0.0476	0.2553

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

^Arellano-Bond second order test for zero autocorrelation Second Order Prob > Z H0: no autocorrelation

Appendix E: Robustness and Misspecification Tests

Appendix E.1 Hausman Tests for the Influence of Capital Structure on Financial Performance

The Hausman test examine both the fixed effects model and the random effects when using panel data regressions and provide a result of which method to use. The tests are undertaken for the analysis used in Chapter 6, where all individual tests demonstrate that the fixed effects model should be implemented for each separate analysis.

Table E.1: Hausman Test Results for Short Term Debt Ratio Influence on ROA: Net Income

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_shdebtra~o	-.0253618	-.0302186	.0048568	.0018226
employees_~g	-.7710019	-.9360616	.1650597	.0746401
cashflow_log	7.284961	7.360922	-.0759613	.01429
N_futgrowopp	-.0924069	-.1067124	.0143055	.0048789
sales_growth	.0011961	.0012761	-.0000799	.000021
log_total_~s	-5.933427	-6.802588	.8691608	.0801113

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 162.50
Prob>chi2 = 0.0000

Table E.2: Hausman Test Results for Short Term Debt Ratio Influence on ROA Profit & loss before tax

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_shdebtra~o	-.0385737	-.0443507	.0057771	.0022751
employees_~g	-.5661012	-1.210211	.6441095	.0927592
cashflow_log	8.221556	8.366052	-.1444956	.017801
N_futgrowopp	-.1249743	-.1411751	.0162008	.0060881
sales_growth	.0016332	.0016834	-.0000502	.0000255
log_total_~s	-6.759918	-7.554593	.794675	.0994201

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 191.28
Prob>chi2 = 0.0000

Table E3: Hausman Test Results for Short Term Debt Ratio Influence on ROE net income

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_shdebtra~o	.0297679	.0692982	-.0395303	.0104338
employees_~g	-2.803725	-2.109584	-.6941404	.4191087
cashflow_log	19.0827	18.81738	.2653223	.0821318
N_futgrowopp	-.4490255	-.4369245	-.012101	.0268267
sales_growth	.0037199	.0040671	-.0003472	.0001553
log_total_~s	-16.14015	-17.7297	1.589543	.4535431

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 47.78
Prob>chi2 = 0.0000

Table E.4: Hausman Test Results for Short Term Debt Ratio Influence on ROE: Profit & Loss Before Tax

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_shdebtra~o	.0936208	.1767791	-.0831583	.0121015
employees_~g	-3.827939	-3.481242	-.346697	.4902726
cashflow_log	20.40371	20.0001	.4036042	.0950102
N_futgrowopp	-.6006262	-.5513445	-.0492818	.031268
sales_growth	.0053721	.0057183	-.0003462	.000178
log_total_~s	-17.58312	-18.30806	.7249321	.531889

Coefficients

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 72.69
Prob>chi2 = 0.0000

Table E.5: Hausman Test Results for Short Term Debt Ratio Influence on Profit Margin

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_shdebtra~o	-.0122553	-.0283396	.0160844	.001216
employees_~g	-2.44828	-3.012447	.5641665	.0680333
cashflow_log	5.406603	5.575181	-.1685778	.0115973
N_futgrowopp	-.1046436	-.1363294	.0316858	.0042387
sales_growth	.0002175	.0003178	-.0001003	2.57e-06
log_total_~s	-.5084207	-2.44533	1.93691	.0739233

Coefficients

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 1046.35
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

Table E.6: Hausman Test Results for Short Term Debt Ratio Influence on EBITDA Margin

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_shdebtra~o	.0103056	.0034628	.0068428	.0010906
employees_~g	-3.197299	-3.371102	.1738028	.0632911
cashflow_log	5.305263	5.49821	-.1929472	.0104311
N_futgrowopp	.0188366	.0072914	.0115452	.0038363
sales_growth	-.0002153	-.0001216	-.0000937	.
log_total_~s	-.2976812	-2.126541	1.82886	.0697897

Coefficients

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 888.81
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

Table E.7: Hausman Test Results Long Term Debt Ratio Influence on ROA: Net Income

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_ltdebtra~o	-.0400017	-.0338451	-.0061566	.0019106
employees_~g	-.6116683	-.8182664	.2065982	.0752313
cashflow_log	6.736645	6.882482	-.145836	.0154822
N_futgrowopp	-.0850442	-.1028632	.0178189	.0049292
sales_growth	.0017472	.0018512	-.000104	.0000359
log_total_~s	-5.561647	-6.474215	.9125678	.0843616

Coefficients

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 203.26
Prob>chi2 = 0.0000

Table E.8: Hausman Test Results Long Term Debt Ratio Influence on ROA: Profit & Loss Before Taxes

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_ltdebtra~o	-.059312	-.054267	-.005045	.0024459
employees_~g	-.4178082	-1.122762	.7049542	.0957863
cashflow_log	7.635779	7.861965	-.2261858	.0198125
N_futgrowopp	-.1176374	-.1381647	.0205273	.0063209
sales_growth	.0024496	.0025172	-.0000676	.0000443
log_total_~s	-6.317194	-7.207569	.8903752	.1070112

```
                 b = consistent under Ho and Ha; obtained from xtreg
  B = inconsistent under Ha, efficient under Ho; obtained from xtreg

  Test:  Ho:  difference in coefficients not systematic

              chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =      256.35
            Prob>chi2 =      0.0000
```

Table E.9: Hausman Test Results Long Term Debt Ratio Influence on ROE: Net Income

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_ltdebtra~o	.0824707	.0842003	-.0017296	.0105578
employees_~g	-2.510133	-2.063488	-.4466452	.4584896
cashflow_log	18.8957	18.52444	.3712613	.0989091
N_futgrowopp	-.4840497	-.4518096	-.0322401	.0300319
sales_growth	.0074534	.008112	-.0006585	.0002675
log_total_~s	-15.81749	-17.37818	1.560695	.5166354

```
                 b = consistent under Ho and Ha; obtained from xtreg
  B = inconsistent under Ha, efficient under Ho; obtained from xtreg

  Test:  Ho:  difference in coefficients not systematic

              chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       36.64
            Prob>chi2 =      0.0000
```

Table E.10: Hausman Test Results Long Term Debt Ratio Influence on ROE: Profit & Loss Before Taxes

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_ltdebtra~o	.0237703	.0042981	.0194722	.0123587
employees_~g	-3.631698	-3.55414	-.0775582	.5419041
cashflow_log	20.10515	19.47832	.626837	.1150148
N_futgrowopp	-.6300497	-.5462042	-.0838455	.035237
sales_growth	.0108602	.0115247	-.0006645	.0003083
log_total_~s	-17.29713	-17.70328	.4061507	.6133627

```
                 b = consistent under Ho and Ha; obtained from xtreg
  B = inconsistent under Ha, efficient under Ho; obtained from xtreg

  Test:  Ho:  difference in coefficients not systematic

              chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       45.47
            Prob>chi2 =      0.0000
```

Table E.11: Hausman Test Results Long Term Debt Ratio Influence on Profit Margin

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_ltdebtra~o	-.0425548	-.0418604	-.0006944	.0013906
employees_~g	-2.125268	-2.771057	.6457884	.0722364
cashflow_log	5.143857	5.362143	-.2182867	.0136499
N_futgrowopp	-.0947936	-.1256129	.0308194	.0045526
sales_growth	.0004263	.0005859	-.0001596	.0000216
log_total_~s	-.6302596	-2.528071	1.897811	.0815423

```
                 b = consistent under Ho and Ha; obtained from xtreg
  B = inconsistent under Ha, efficient under Ho; obtained from xtreg

  Test:  Ho:  difference in coefficients not systematic

              chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =      887.06
            Prob>chi2 =      0.0000
```

Table E.12: Hausman Test Results Long Term Debt Ratio Influence on EBITDA Margin

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_ltdebtra~o	.0023337	.0110878	-.0087541	.0012443
employees_~g	-2.942488	-3.206602	.264114	.0664772
cashflow_log	5.190451	5.420986	-.2305352	.0120325
N_futgrowopp	.0209774	.0082503	.0127271	.0040729
sales_growth	-.0005857	-.0004316	-.0001541	.0000177
log_total_~s	-.4720239	-2.254857	1.782833	.0762838

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 811.00
Prob>chi2 = 0.0000

Table E.13: Hausman Test Results Total Debt Ratio Influence on ROA: Net Income

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_tdebtratio	-.0381894	-.0344837	-.0037056	.0015237
employees_~g	-.6118714	-.8134492	.2015779	.0755634
cashflow_log	6.704789	6.839961	-.1351716	.0155345
N_futgrowopp	-.0826138	-.0986343	.0160205	.0049536
sales_growth	.001736	.001839	-.000103	.0000363
log_total_~s	-5.51726	-6.402723	.8854624	.0848439

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 182.31
Prob>chi2 = 0.0000

Table E.14: Hausman Test Results Total Debt Ratio Influence on ROA: Profit & Loss Before Taxes

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_tdebtratio	-.0565447	-.0536079	-.0029368	.0019528
employees_~g	-.4090704	-1.111387	.7023162	.0962334
cashflow_log	7.587597	7.795499	-.2079012	.0198973
N_futgrowopp	-.1139342	-.1314422	.017508	.0063555
sales_growth	.0024341	.0025007	-.0000667	.0000448
log_total_~s	-6.251569	-7.096785	.8452156	.1076492

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 227.21
Prob>chi2 = 0.0000

Table.15: Hausman Test Results Total Debt Ratio Influence on ROE: Net Income

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_tdebtratio	.056101	.0753479	-.0192469	.0086245
employees_~g	-2.686108	-2.168921	-.5171871	.4598255
cashflow_log	18.93679	18.62548	.3113093	.0985486
N_futgrowopp	-.4873991	-.4624102	-.0249889	.030111
sales_growth	.0074078	.0080872	-.0006794	.0002674
log_total_~s	-15.60863	-17.45226	1.843625	.5180642

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 39.07
Prob>chi2 = 0.0000

Table E.16: Hausman Test Results Total Debt Ratio Influence on ROE: Profit & Loss Before Taxes

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_tdebtratio	.052772	.0740458	-.0212738	.0101052
employees_~g	-3.728296	-3.589816	-.1384796	.5438042
cashflow_log	20.18587	19.64136	.5445094	.1147497
N_futgrowopp	-.6373437	-.5624615	-.0748822	.0353591
sales_growth	.0108274	.0115075	-.0006802	.0003089
log_total_~s	-17.22327	-17.89164	.6683764	.6154237

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 41.15
Prob>chi2 = 0.0000

Table E.17: Hausman Test Results Total Debt Ratio Influence on Profit Margin

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_tdebtratio	-.0332864	-.0388439	.0055574	.0010882
employees_~g	-2.096987	-2.749108	.6521214	.0729234
cashflow_log	5.121235	5.318562	-.1973277	.0137871
N_futgrowopp	-.093003	-.1213499	.0283469	.0046106
sales_growth	.0004236	.0005789	-.0001553	.0000227
log_total_~s	-.6364255	-2.47639	1.839965	.0822191

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 838.78
Prob>chi2 = 0.0000

Table E.18: Hausman Test Results Total Debt Ratio Influence on EBITDA Margin

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_tdebtratio	.0039241	.0073942	-.0034701	.0009632
employees_~g	-2.93743	-3.20466	.2672308	.0668069
cashflow_log	5.188719	5.419331	-.230612	.0120252
N_futgrowopp	.0200507	.0071938	.012857	.0040941
sales_growth	-.0005794	-.0004242	-.0001552	.0000176
log_total_~s	-.4622687	-2.267677	1.805409	.0766545

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 815.87
Prob>chi2 = 0.0000

Table E.19: Hausman Test Results Total Equity Ratio Influence on ROA: Net Income

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_equityra~o	.032377	.014257	.01812	.0013951
employees_~g	-.7535545	-.921877	.1683225	.0735228
cashflow_log	7.241434	7.351809	-.1103746	.0141441
N_futgrowopp	-.0914131	-.1048525	.0134394	.0047225
sales_growth	.0012699	.0013126	-.0000428	.0000193
log_total_~s	-5.911094	-6.850697	.9396038	.0792029

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 348.90
Prob>chi2 = 0.0000

Table E.20: Hausman Test Results Total Debt Ratio Influence on ROA: Profit & Loss Before Tax

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_equityra~o	.0471037	.0227643	.0243394	.0017511
employees_~g	-.5561526	-1.187257	.6311044	.0912081
cashflow_log	8.157291	8.343552	-.1862618	.0175765
N_futgrowopp	-.123638	-.1380779	.0144399	.0058787
sales_growth	.0017428	.0017451	-2.29e-06	.000023
log_total_~s	-6.718553	-7.619393	.9008397	.098154

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 404.20
Prob>chi2 = 0.0000

Table E.21: Hausman Test Results Total Equity Ratio Influence on ROE: Net Income

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_equityra~o	-.4673472	-.4300638	-.0372835	.0081753
employees_~g	-2.772481	-2.209562	-.5629187	.4154335
cashflow_log	20.20167	20.2903	-.0886241	.0812682
N_futgrowopp	-.4677685	-.5331912	.0654227	.0263552
sales_growth	.0027688	.0030229	-.0002542	.000157
log_total_~s	-19.07949	-19.72684	.6473552	.4530193

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 32.69
Prob>chi2 = 0.0000

Table E.22: Hausman Test Results Total Equity Ratio Influence on ROE: Profit & Loss Before Tax

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_equityra~o	-.5822418	-.5647719	-.0174699	.0095296
employees_~g	-3.731485	-3.599811	-.1316746	.4854172
cashflow_log	21.76335	21.82793	-.0645791	.0943848
N_futgrowopp	-.6184806	-.6627017	.0442211	.0307418
sales_growth	.0042006	.004365	-.0001644	.0001838
log_total_~s	-21.20374	-20.74185	-.4618861	.5303676

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 7.88
Prob>chi2 = 0.2471

Table E.23: Hausman Test Results Total Equity Ratio Influence on Profit Margin

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_equityra~o	.0260227	.027295	-.0012723	.0008377
employees_~g	-2.455897	-2.992233	.5363361	.0674283
cashflow_log	5.370579	5.530846	-.160267	.0116504
N_futgrowopp	-.1022321	-.1303984	.0281663	.0041522
sales_growth	.000281	.0003902	-.0001092	6.09e-06
log_total_~s	-.5225814	-2.483094	1.960512	.0733154

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 982.04
Prob>chi2 = 0.0000

Table E.24: Hausman Test Results Total Equity Ratio Influence on EBITDA Margin

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
N_equityra~o	.0099393	.0111629	-.0012236	.0007708
employees_~g	-3.189373	-3.360873	.1714998	.0627368
cashflow_log	5.290193	5.473547	-.1833538	.0104449
N_futgrowopp	.0197838	.0102295	.0095543	.0037541
sales_growth	-.000194	-.0000967	-.0000973	4.20e-06
log_total_~s	-.3253289	-2.118444	1.793115	.0692771

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 843.51
Prob>chi2 = 0.0000

Appendix E.1.1 Hausman Tests for the Influence of on Gearing Values and Capitl Values

Table AE 1: Hausman Test Results for Influence on Gearing Percentage

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
log_sales	-9.310092	-2.855797	-6.454295	.7177009
R_curr_ratio	-.0251038	-.5206399	.4955361	.036494
fix_assets~g	12.39226	11.50801	.8842436	.299818
N_prof	-1.038526	-1.136592	.0980657	.011678
N_futgrowopp	.6814959	1.166378	-.4848819	.048778
employees_~g	-1.33029	-4.920306	3.590016	.8569715

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 360.05
Prob>chi2 = 0.0000

Table AE 2: Hausman Test Results for Influence on Gearing: Total Debt to Assets

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
log_sales	-1.224539	-1.452364	.2278253	.1235886
R_curr_ratio	-.1024834	-.1797699	.0772865	.0079424
fix_assets~g	1.895584	2.028457	-.1328732	.0591604
N_prof	-.18539	-.1927485	.0073584	.0012632
N_futgrowopp	.0431056	.0577865	-.0146809	.0088464
employees_~g	-1.235968	-1.104784	-.1311835	.1494732

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 166.89
Prob>chi2 = 0.0000

Table AE 3: Hausman Test Results for Influence on Gearing: Total Debt to Capital

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
log_sales	2.586347	-.5945896	3.180937	1.81647
R_curr_ratio	-.1414343	-1.385598	1.244164	.1755283
fix_assets~g	4.648795	2.399821	2.248975	.9371765
N_prof	-.1463209	-.241092	.0947711	.0262612
N_futgrowopp	-.0710977	.3463319	-.4174296	.1747762
employees_~g	-2.060172	-1.225055	-.8351166	2.222612

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 80.03
Prob>chi2 = 0.0000

Table AE 4: Hausman Test Results for Influence on Long-Term Debt

	Coefficients (b) fixed	Coefficients (B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
employees_~g	-41.42929	-8.962197	-32.4671	7.235781
R_curr_ratio	1.147421	-.9516489	2.09907	.4890485
R_ebitda_m~n	.2723111	1.737223	-1.464912	.1654329
N_futgrowopp	3.508658	3.810978	-.3023199	.4930213
log_total_~s	253.0277	134.6361	118.3917	7.799311
N_prof	-1.727987	-2.664822	.9368353	.0826201

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 397.82
Prob>chi2 = 0.0000

Table AE 5: Hausman Test Results for Influence on Short-Term Debt

	Coefficients (b) fixed	Coefficients (B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
employees_~g	23.88934	16.97756	6.911777	2.016524
R_curr_ratio	-4.224248	-4.749598	.5253503	.0957075
R_ebitda_m~n	-.2165693	-.3086556	.0920863	.033513
N_futgrowopp	2.405665	3.010529	-.6048641	.1104351
log_total_~s	135.4945	133.5254	1.969113	2.49071
N_prof	-1.031186	-1.082893	.0517071	.0148298

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 129.40
Prob>chi2 = 0.0000

Table AE 6: Hausman Test Results for Influence on Total Debt

	Coefficients (b) fixed	Coefficients (B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
employees_~g	-12.46547	-14.02685	1.56138	6.67073
R_curr_ratio	-3.7419	-6.135518	2.393618	.4040146
R_ebitda_m~n	.1669041	.7343727	-.5674686	.1326582
N_futgrowopp	5.745804	7.182661	-1.436857	.4050947
log_total_~s	404.1751	304.2935	99.88166	7.827047
N_prof	-2.926726	-3.420337	.4936107	.0650367

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 318.42
Prob>chi2 = 0.0000

Table AE 7: Hausman Test Results for Influence on Equity

	Coefficients (b) fixed	Coefficients (B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
employees_~g	1.860644	12.34804	-10.48739	5.039587
R_curr_ratio	18.44477	21.36556	-2.920792	.2348934
R_ebitda_m~n	2.928609	3.623947	-.6953374	.0843178
N_futgrowopp	.7647063	-1.219526	1.984232	.2772106
log_total_~s	631.1536	606.4996	24.65406	6.112365
N_prof	.5878316	.5292522	.0585794	.0374856

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 241.38
Prob>chi2 = 0.0000

Appendix E.2 Unit Root Tests for Financial Performance Measures

The Dickey-Fuller test is used in panel data to test for unit roots throughout the time series (Baltagi, 2005).The augmented Dickey-Fuller test analyses whether all variables are stationary, and tests the series for non-stationarity (Brooks, 2008; Hsiao, 2003). If a unit root is discovered, the standard assumptions and approximations of large samples periods are not valid (Wooldridge, 2012). The Phillips-Perron test produces a more exhaustive analysis into unit-root stationarity (Brooks, 2008). A key difference between this test and the Dickey-Fuller test is that it allows for auto-correlated residuals by implementing an automatic correction (Brooks, 2008). The Phillips-Perron tests an be used in a variety of topics (Greene, 2002).

Appendix E.2.1 Augmented Dickey-Fuller Unit Root Tests

Table E.25: Dickey-Fuller Unit root test for ROA: Net Income

```
Fisher-type unit-root test for R_roa_netincome
Based on augmented Dickey-Fuller tests

Ho: All panels contain unit roots           Number of panels       =   7302
Ha: At least one panel is stationary        Avg. number of periods =   9.88

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included                  Cross-sectional means removed
Drift term:   Not included                  ADF regressions: 2 lags

                                  Statistic      p-value

 Inverse chi-squared(14534)P       2.92e+04       0.0000
 Inverse normal            Z       -14.4199       0.0000
 Inverse logit t(34624)    L*      -40.5840       0.0000
 Modified inv. chi-squared Pm       85.8225       0.0000

 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Table E.26: Dickey-Fuller Unit root test for ROA: Profit and Loss Before Tax

```
Fisher-type unit-root test for R_roa_profloss_bftax
Based on augmented Dickey-Fuller tests

Ho: All panels contain unit roots           Number of panels       =   7302
Ha: At least one panel is stationary        Avg. number of periods =   9.87

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included                  Cross-sectional means removed
Drift term:   Not included                  ADF regressions: 2 lags

                                  Statistic      p-value

 Inverse chi-squared(14520)P       2.91e+04       0.0000
 Inverse normal            Z       -13.5815       0.0000
 Inverse logit t(34639)    L*      -39.9939       0.0000
 Modified inv. chi-squared Pm       85.4763       0.0000

 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Table E.27: Dickey-Fuller Unit Root Test for ROE: Net Income

```
Fisher-type unit-root test for R_roe_netincome
Based on augmented Dickey-Fuller tests

Ho: All panels contain unit roots           Number of panels       =   7240
Ha: At least one panel is stationary        Avg. number of periods =   9.59

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included                  Cross-sectional means removed
Drift term:   Not included                  ADF regressions: 2 lags

                                  Statistic      p-value

 Inverse chi-squared(14040)P       3.16e+04       0.0000
 Inverse normal            Z       -21.2533       0.0000
 Inverse logit t(32039)    L*      -55.8289       0.0000
 Modified inv. chi-squared Pm      105.0304       0.0000

 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Table E.28: Dickey-Fuller Unit Root Test for ROE: Profit and Loss Before Tax

```
Fisher-type unit-root test for R_roe_profloss_bftax
Based on augmented Dickey-Fuller tests

Ho: All panels contain unit roots           Number of panels       =   7240
Ha: At least one panel is stationary        Avg. number of periods =   9.59

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included                  Cross-sectional means removed
Drift term:   Not included                  ADF regressions: 2 lags

                                  Statistic      p-value

 Inverse chi-squared(14032)P       3.11e+04       0.0000
 Inverse normal            Z       -21.4169       0.0000
 Inverse logit t(32069)    L*      -54.2990       0.0000
 Modified inv. chi-squared Pm      101.7133       0.0000

 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Table E.29: Dickey-Fuller Unit Root Test for Profit Margin

```
Fisher-type unit-root test for R_profit_margin
Based on augmented Dickey-Fuller tests

Ho: All panels contain unit roots           Number of panels       =   7302
Ha: At least one panel is stationary        Avg. number of periods =   9.85

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included                  Cross-sectional means removed
Drift term:   Not included                  ADF regressions: 2 lags

                                  Statistic      p-value

 Inverse chi-squared(14518)P       2.79e+04       0.0000
 Inverse normal            Z        -8.8893       0.0000
 Inverse logit t(34469)    L*      -34.3305       0.0000
 Modified inv. chi-squared Pm       78.7573       0.0000

 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Table E.30: Dickey-Fuller Unit Root Test for EBITDA Margin

```
Fisher-type unit-root test for R_ebitda_margin
Based on augmented Dickey-Fuller tests

Ho: All panels contain unit roots           Number of panels       =   7015
Ha: At least one panel is stationary        Avg. number of periods =   9.59

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included                  Cross-sectional means removed
Drift term:   Not included                  ADF regressions: 2 lags

                                  Statistic      p-value

 Inverse chi-squared(13570)P       2.56e+04       0.0000
 Inverse normal            Z        -9.8547       0.0000
 Inverse logit t(31374)    L*      -34.0719       0.0000
 Modified inv. chi-squared Pm       73.2541       0.0000

 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Appendix E.2.2 Phillips-Perron Unit Root Tests

Table E.31: Phillips-Perron Unit Root Test for ROA: Net Income

Fisher-type unit-root test for R_roa_netincome
Based on Phillips-Perron tests

Ho: All panels contain unit roots — Number of panels = 7302
Ha: At least one panel is stationary — Avg. number of periods = 9.88

AR parameter: Panel-specific — Asymptotics: T -> Infinity
Panel means: Included
Time trend: Not included — Cross-sectional means removed
Newey-West lags: 2 lags

		Statistic	p-value
Inverse chi-squared(14586)	P	5.18e+04	0.0000
Inverse normal	Z	-109.6140	0.0000
Inverse logit t(36344)	L*	-145.7860	0.0000
Modified inv. chi-squared	Pm	218.0906	0.0000

P statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels.

Table E.32: Phillips-Perron Unit Root Test for ROA: Profit and Loss Before Tax

Fisher-type unit-root test for R_roa_profloss_bftax
Based on Phillips-Perron tests

Ho: All panels contain unit roots — Number of panels = 7302
Ha: At least one panel is stationary — Avg. number of periods = 9.87

AR parameter: Panel-specific — Asymptotics: T -> Infinity
Panel means: Included
Time trend: Not included — Cross-sectional means removed
Newey-West lags: 2 lags

		Statistic	p-value
Inverse chi-squared(14576)	P	5.16e+04	0.0000
Inverse normal	Z	-107.8593	0.0000
Inverse logit t(36319)	L*	-144.5994	0.0000
Modified inv. chi-squared	Pm	216.8650	0.0000

P statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels.

Table E.33: Phillips-Perron Unit Root Test for ROE: Net Income

Fisher-type unit-root test for R_roe_netincome
Based on Phillips-Perron tests

Ho: All panels contain unit roots — Number of panels = 7240
Ha: At least one panel is stationary — Avg. number of periods = 9.59

AR parameter: Panel-specific — Asymptotics: T -> Infinity
Panel means: Included
Time trend: Not included — Cross-sectional means removed
Newey-West lags: 2 lags

		Statistic	p-value
Inverse chi-squared(14300)	P	6.42e+04	0.0000
Inverse normal	Z	-130.6451	0.0000
Inverse logit t(35354)	L*	-190.3438	0.0000
Modified inv. chi-squared	Pm	295.1327	0.0000

P statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels.

Table E.34: Phillips-Perron Unit Root Test for ROE: Profit and Loss Before Tax

Fisher-type unit-root test for R_roe_profloss_bftax
Based on Phillips-Perron tests

Ho: All panels contain unit roots — Number of panels = 7240
Ha: At least one panel is stationary — Avg. number of periods = 9.59

AR parameter: Panel-specific — Asymptotics: T -> Infinity
Panel means: Included
Time trend: Not included — Cross-sectional means removed
Newey-West lags: 2 lags

		Statistic	p-value
Inverse chi-squared(14300)	P	6.61e+04	0.0000
Inverse normal	Z	-133.0691	0.0000
Inverse logit t(35354)	L*	-196.6550	0.0000
Modified inv. chi-squared	Pm	306.2601	0.0000

P statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels.

Table E.35: Phillips-Perron Unit Root Test for Profit Margin

Fisher-type unit-root test for R_profit_margin
Based on Phillips-Perron tests

Ho: All panels contain unit roots — Number of panels = 7302
Ha: At least one panel is stationary — Avg. number of periods = 9.85

AR parameter: Panel-specific — Asymptotics: T -> Infinity
Panel means: Included
Time trend: Not included — Cross-sectional means removed
Newey-West lags: 2 lags

		Statistic	p-value
Inverse chi-squared(14586)	P	4.69e+04	0.0000
Inverse normal	Z	-98.0808	0.0000
Inverse logit t(36359)	L*	-127.7474	0.0000
Modified inv. chi-squared	Pm	189.4804	0.0000

P statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels.

Table E.36: Phillips-Perron Unit Root Test for EBITDA Margin

Fisher-type unit-root test for R_ebitda_margin
Based on Phillips-Perron tests

Ho: All panels contain unit roots — Number of panels = 7015
Ha: At least one panel is stationary — Avg. number of periods = 9.59

AR parameter: Panel-specific — Asymptotics: T -> Infinity
Panel means: Included
Time trend: Not included — Cross-sectional means removed
Newey-West lags: 2 lags

		Statistic	p-value
Inverse chi-squared(13922)	P	4.35e+04	0.0000
Inverse normal	Z	-90.5975	0.0000
Inverse logit t(34459)	L*	-119.9446	0.0000
Modified inv. chi-squared	Pm	177.4720	0.0000

P statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels.

Appendix E.3 Unit Root Tests for Capital Structure Measures

Appendix E.3.1 Augmented Dickey-Fuller Unit Root Tests

Table E.37: Dickey-Fuller Unit Root Test for Total Debt

Fisher-type unit-root test for total_debt
Based on augmented Dickey-Fuller tests

Ho: All panels contain unit roots — Number of panels = 7146
Ha: At least one panel is stationary — Avg. number of periods = 8.62

AR parameter: Panel-specific — Asymptotics: T -> Infinity
Panel means: Included
Time trend: Not included — Cross-sectional means removed
Drift term: Not included — ADF regressions: 2 lags

		Statistic	p-value
Inverse chi-squared(11954)	P	2.02e+04	0.0000
Inverse normal	Z	-1.6850	0.0460
Inverse logit t(25424)	L*	-26.5741	0.0000
Modified inv. chi-squared	Pm	53.3622	0.0000

P statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels.

Table E.38: Dickey-Fuller Unit Root Test for Long-Term Debt

Fisher-type unit-root test for longterm_debt
Based on augmented Dickey-Fuller tests

Ho: All panels contain unit roots — Number of panels = 7165
Ha: At least one panel is stationary — Avg. number of periods = 8.66

AR parameter: Panel-specific — Asymptotics: T -> Infinity
Panel means: Included
Time trend: Not included — Cross-sectional means removed
Drift term: Not included — ADF regressions: 2 lags

		Statistic	p-value
Inverse chi-squared(12036)	P	3.34e+04	0.0000
Inverse normal	Z	-58.6636	0.0000
Inverse logit t(25829)	L*	-95.5716	0.0000
Modified inv. chi-squared	Pm	137.5704	0.0000

P statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels.

Table E.39: Dickey-Fuller Unit Root Test for Short-Term Debt

```
Fisher-type unit-root test for loans
Based on augmented Dickey-Fuller tests
--------------------------------------
Ho: All panels contain unit roots           Number of panels       =   7294
Ha: At least one panel is stationary        Avg. number of periods =   9.84

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included                  Cross-sectional means removed
Drift term:   Not included                  ADF regressions: 2 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(14482)P       1.56e+04       0.0000
 Inverse normal            Z       103.7890       1.0000
 Inverse logit t(34439)    L*      104.4946       1.0000
 Modified inv. chi-squared Pm        6.5478       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

Table E.40: Dickey-Fuller Unit Root Test for Equity

```
Fisher-type unit-root test for shareholdersfund
Based on augmented Dickey-Fuller tests
-----------------------------------------------
Ho: All panels contain unit roots           Number of panels       =   7303
Ha: At least one panel is stationary        Avg. number of periods =   9.93

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included                  Cross-sectional means removed
Drift term:   Not included                  ADF regressions: 2 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(14606)P       2.04e+04       0.0000
 Inverse normal            Z        43.4548       1.0000
 Inverse logit t(34959)    L*       29.5418       1.0000
 Modified inv. chi-squared Pm       33.8104       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

Appendix E.3.2 Phillips-Perron Unit Root Tests

Table E.41: Phillips-Perron Unit Root Test for Total Debt

```
Fisher-type unit-root test for total_debt
Based on Phillips-Perron tests
-----------------------------------------
Ho: All panels contain unit roots           Number of panels       =   7146
Ha: At least one panel is stationary        Avg. number of periods =   8.62

AR parameter:     Panel-specific            Asymptotics: T -> Infinity
Panel means:      Included
Time trend:       Not included              Cross-sectional means removed
Newey-West lags: 2 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(13930)P       3.27e+04       0.0000
 Inverse normal            Z       -32.6038       0.0000
 Inverse logit t(32794)    L*      -64.3667       0.0000
 Modified inv. chi-squared Pm      112.3198       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

Table E.43: Phillips-Perron Unit Root Test for Short-Term Debt

```
Fisher-type unit-root test for loans
Based on Phillips-Perron tests
------------------------------------
Ho: All panels contain unit roots           Number of panels       =   7294
Ha: At least one panel is stationary        Avg. number of periods =   9.84

AR parameter:     Panel-specific            Asymptotics: T -> Infinity
Panel means:      Included
Time trend:       Not included              Cross-sectional means removed
Newey-West lags: 2 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(14534)P       2.26e+04       0.0000
 Inverse normal            Z        42.4862       1.0000
 Inverse logit t(35959)    L*       28.8533       1.0000
 Modified inv. chi-squared Pm       47.2903       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

Table E.42: Phillips-Perron Unit Root Test for Long-Term Debt

```
Fisher-type unit-root test for longterm_debt
Based on Phillips-Perron tests
--------------------------------------------
Ho: All panels contain unit roots           Number of panels       =   7165
Ha: At least one panel is stationary        Avg. number of periods =   8.66

AR parameter:     Panel-specific            Asymptotics: T -> Infinity
Panel means:      Included
Time trend:       Not included              Cross-sectional means removed
Newey-West lags: 2 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(13984)P       3.19e+04       0.0000
 Inverse normal            Z       -43.6261       0.0000
 Inverse logit t(31559)    L*      -74.5573       0.0000
 Modified inv. chi-squared Pm      107.3620       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

Table E.44: Phillips-Perron Unit Root Test for Equity

```
Fisher-type unit-root test for shareholdersfund
Based on Phillips-Perron tests
-----------------------------------------------
Ho: All panels contain unit roots           Number of panels       =   7303
Ha: At least one panel is stationary        Avg. number of periods =   9.93

AR parameter:     Panel-specific            Asymptotics: T -> Infinity
Panel means:      Included
Time trend:       Not included              Cross-sectional means removed
Newey-West lags: 2 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(14606)P       3.91e+04       0.0000
 Inverse normal            Z       -39.0006       0.0000
 Inverse logit t(35744)    L*      -71.3406       0.0000
 Modified inv. chi-squared Pm      143.0730       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

Appendix E.4 Tests for Time-Fixed Effects

Table E.45: Time-Fixed Effects Test of the Long-Term Debt Ratio Influence on ROA Models

```
testparm i.year

( 1)  2009.year = 0
( 2)  2010.year = 0
( 3)  2011.year = 0
( 4)  2012.year = 0
( 5)  2013.year = 0
( 6)  2014.year = 0
( 7)  2015.year = 0
( 8)  2016.year = 0

      F(  8, 42696) =   44.52
          Prob > F =    0.0000
```

```
. testparm i.year

( 1)  2009.year = 0
( 2)  2010.year = 0
( 3)  2011.year = 0
( 4)  2012.year = 0
( 5)  2013.year = 0
( 6)  2014.year = 0
( 7)  2015.year = 0
( 8)  2016.year = 0

      F(  8, 42664) =   63.79
          Prob > F =    0.0000
```

Table E.46: Time-Fixed Effects Tests of the Long-Term Debt Ratio Influence on ROE Models

```
testparm  i.year

( 1)  2009.year = 0
( 2)  2010.year = 0
( 3)  2011.year = 0
( 4)  2012.year = 0
( 5)  2013.year = 0
( 6)  2014.year = 0
( 7)  2015.year = 0
( 8)  2016.year = 0

       F(  8, 41163) =   14.58
            Prob > F =    0.0000
```

```
testparm  i.year

( 1)  2009.year = 0
( 2)  2010.year = 0
( 3)  2011.year = 0
( 4)  2012.year = 0
( 5)  2013.year = 0
( 6)  2014.year = 0
( 7)  2015.year = 0
( 8)  2016.year = 0

       F(  8, 41147) =   32.99
            Prob > F =    0.0000
```

Table E.47: Time-Fixed Effects Test of the Long-Term Debt Ratio Influnece on Profit Margin Model

```
. testparm  i.year

( 1)  2009.year = 0
( 2)  2010.year = 0
( 3)  2011.year = 0
( 4)  2012.year = 0
( 5)  2013.year = 0
( 6)  2014.year = 0
( 7)  2015.year = 0
( 8)  2016.year = 0

       F(  8, 42570) =   29.73
            Prob > F =    0.0000
```

Table E.48: Time-Fixed Effects Test of the Long-Term Debt Ratio Influence on EBITDA Margin Model

```
testparm  i.year

( 1)  2009.year = 0
( 2)  2010.year = 0
( 3)  2011.year = 0
( 4)  2012.year = 0
( 5)  2013.year = 0
( 6)  2014.year = 0
( 7)  2015.year = 0
( 8)  2016.year = 0

       F(  8, 42664) =   29.10
            Prob > F =    0.0000
```

Table E.49: Time-Fixed Effects Test of the Short-Term Debt Ratio Influence on ROA Models

```
testparm  i.year

( 1)  2009.year = 0
( 2)  2010.year = 0
( 3)  2011.year = 0
( 4)  2012.year = 0
( 5)  2013.year = 0
( 6)  2014.year = 0
( 7)  2015.year = 0
( 8)  2016.year = 0

       F(  8, 49650) =   44.44
            Prob > F =    0.0000
```

```
. testparm  i.year

( 1)  2009.year = 0
( 2)  2010.year = 0
( 3)  2011.year = 0
( 4)  2012.year = 0
( 5)  2013.year = 0
( 6)  2014.year = 0
( 7)  2015.year = 0
( 8)  2016.year = 0

       F(  8, 49612) =   66.15
            Prob > F =    0.0000
```

Table E.50: Time-Fixed Effects Test of the Short-Term Debt Ratio Influence on ROE Models

```
testparm  i.year

( 1)  2009.year = 0
( 2)  2010.year = 0
( 3)  2011.year = 0
( 4)  2012.year = 0
( 5)  2013.year = 0
( 6)  2014.year = 0
( 7)  2015.year = 0
( 8)  2016.year = 0

       F(  8, 47993) =   17.29
            Prob > F =    0.0000
```

```
testparm  i.year

( 1)  2009.year = 0
( 2)  2010.year = 0
( 3)  2011.year = 0
( 4)  2012.year = 0
( 5)  2013.year = 0
( 6)  2014.year = 0
( 7)  2015.year = 0
( 8)  2016.year = 0

       F(  8, 47973) =   36.45
            Prob > F =    0.0000
```

Table E.51: Time-Fixed Effects Test of the Short-Term Debt Ratio Influence on Profit Margin Model

```
. testparm  i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 49484) =   32.45
            Prob > F =    0.0000
```

Table E.52: Time-Fixed Effects Test of the Long Term Debt Ratio Influence on EBITDA Margin Model

```
 testparm  i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 49600) =   36.72
            Prob > F =    0.0000
```

Table E.53: Time-Fixed Effects Test of the Total Debt Ratio Influence on ROA Models

```
 testparm  i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 42356) =   47.84
            Prob > F =    0.0000
```

```
 testparm  i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 42324) =   67.57
            Prob > F =    0.0000
```

Table E.54: Time-Fixed Effects Test of the Total Debt Ratio Influence on ROE Models

```
 testparm  i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 40814) =   35.79
            Prob > F =    0.0000
```

```
 testparm  i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 42230) =   30.23
            Prob > F =    0.0000
```

Table E.55: Time-Fixed Effects Test of the Total Debt Ratio Influence on Profit Margin Model

```
 testparm  i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 42324) =   30.25
            Prob > F =    0.0000
```

Table E.56: Time-Fixed Effects Test of the Total Debt Ratio Influence on EBIDTA Margin Model

```
 testparm i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 51208) =   38.13
            Prob > F =    0.0000
```

Table E.57: Time-Fixed Effects Test of the Equity Ratio Influence on ROA Models

```
. testparm  i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 50218) =   53.99
            Prob > F =    0.0000
```

```
. testparm  i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 50180) =   78.95
            Prob > F =    0.0000
```

Table E.58: Time-Fixed Effects Test of the Equity Ratio Influence on ROE Models

```
 testparm  i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 48548) =   22.59
            Prob > F =    0.0000
```

```
. testparm  i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 48528) =   42.23
            Prob > F =    0.0000
```

Table E.59: Time-Fixed Effects Test of the Equity Ratio Influence on Profit Margin Model

```
. testparm  i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 50051) =   34.68
            Prob > F =    0.0000
```

Table E.60: Time-Fixed Effects Test of the Equity Ratio Influence on EBITDA Margin Model

```
. testparm  i.year

 ( 1)  2009.year = 0
 ( 2)  2010.year = 0
 ( 3)  2011.year = 0
 ( 4)  2012.year = 0
 ( 5)  2013.year = 0
 ( 6)  2014.year = 0
 ( 7)  2015.year = 0
 ( 8)  2016.year = 0

       F(  8, 50168) =   38.59
            Prob > F =    0.0000
```

Appendix E.5 Akaike's Information Criterion and Bayesian Information Criterion

Both the AIC and BIC can be used to compare several different models simultaneously, which is a positive aspect compared to the likelihood ratio test when reporting model fit statistics (Matuschek et al., 2017). They examine cross-sectional heteroskedasticity and autocorrelation (Byoun, 2008).

Table E.61: Akaike's Information Criterion and Bayesian Information Criterion on the determinants of long-term debt

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	57,296	-442427.5	-441887.8	7	883789.6	883852.3

Table E.62: Akaike's Information Criterion and Bayesian Information Criterion on the determinants of short-term debt

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	65,383	-465536.3	-464660.5	7	929335	929398.6

Table E.63: Akaike's Information Criterion and Bayesian Information Criterion on the determinants of total debt

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	56,895	-448346.3	-447241.6	7	894497.3	894559.9

Table E.64: Akaike's Information Criterion and Bayesian Information Criterion on the determinants of total equity

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	66,034	-528015.4	-525001.7	7	1050017	1050081

Table E.65: Akaike's Information Criterion and Bayesian Information Criterion on equity ratio and the other determinants of ROA models

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	50,936	-170169.8	-153785.5	7	307585	307646.9

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	50,892	-178720.7	-164240.9	7	328495.9	328557.7

Table E.66: Akaike's Information Criterion and Bayesian Information Criterion on equity ratio and the other determinants of ROE models

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	50,132	-242743.7	-237734.4	7	475482.8	475544.5

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	50,116	-250222.5	-245806.4	7	491626.8	491688.5

Table E.67: Akaike's Information Criterion and Bayesian Information Criterion on equity ratio and the other determinants of profit margin model

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	50,909	-163867.6	-152245.9	7	304505.8	304567.6

Table E.68: Akaike's Information Criterion and Bayesian Information Criterion on equity ratio and the other determinants of EBITDA margin model

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	50,946	-162981.1	-151472	7	302957.9	303019.8

Table E.69: Akaike's Information Criterion and Bayesian Information Criterion on long-term debt ratio and the other determinants of ROA models

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	44,072	-143607.9	-130221	7	260456	260516.9

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	44,033	-151659.9	-140102.4	7	280218.8	280279.6

Table E.70: Akaike's Information Criterion and Bayesian Information Criterion on long-term debt ratio and the other determinants of ROE models

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	43,318	-208585.1	-204936.8	7	409887.7	409948.4

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	43,306	-215697.7	-212712.5	7	425438.9	425499.7

Table E.71: Akaike's Information Criterion and Bayesian Information Criterion on long-term debt ratio and the other determinants of profit margin model

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	44,063	-139600	-130186.1	7	260386.2	260447.1

Table E.72: Akaike's Information Criterion and Bayesian Information Criterion on long-term debt ratio and the other determinants of EBITDA margin model

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	44,085	-138829.1	-129014.2	7	258042.3	258103.2

Table E.73: Akaike's Information Criterion and Bayesian Information Criterion on short-term debt ratio and the other determinants of ROA models

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	50,394	-168384	-152343.6	7	304701.1	304762.9

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	50,350	-176840.6	-162740.2	7	325494.5	325556.3

Table E.74: Akaike's Information Criterion and Bayesian Information Criterion on short-term debt ratio and the other determinants of ROE models

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	49,592	-240096.8	-235819.8	7	471653.5	471715.2

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	49,576	-247549.9	-243956.8	7	487927.6	487989.3

Table E.75: Akaike's Information Criterion and Bayesian Information Criterion on short-term debt ratio and the other determinants of profit margin model

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	50,367	-162103.9	-150807.6	7	301629.1	301690.9

Table E.76: Akaike's Information Criterion and Bayesian Information Criterion on short-term debt ratio and the other determinants of EBITDA margin model

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	50,404	-161234.4	-149891.9	7	299797.7	299859.5

Table E.77: Akaike's Information Criterion and Bayesian Information Criterion on total debt ratio and the other determinants of ROA models

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	43,730	-142550.3	-129247.2	7	258508.3	258569.1

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	43,691	-150541.7	-139047.6	7	278109.2	278170

Table E.78: Akaike's Information Criterion and Bayesian Information Criterion on total debt ratio and the other determinants of ROE models

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	42,978	-206929.9	-203287.5	7	406589	406649.7

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	42,966	-213992.6	-211013.4	7	422040.9	422101.5

Table E.79: Akaike's Information Criterion and Bayesian Information Criterion on total debt ratio and the other determinants of profit margin model

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	43,721	-138568	-129263.5	7	258540.9	258601.7

Table E.80: Akaike's Information Criterion and Bayesian Information Criterion on total debt ratio and the other determinants of EBITDA margin model

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	43,743	-137781.9	-128050.3	7	256114.7	256175.5

Appendix E.6 Ramsey RESET Test

Through the test for misspecification of functional form, the Ramsey RESET test checks whether a model should be linear (Brooks, 2008). It is used to examine linear models (Tsay, 2005). The RESET test has produced stable outputs when examining functional form misspecification (Wooldridge, 2012).

Table E.81: Ramsey RESET Test of on the determinants of the long-term debt model

F(1, 6855) = 46.33

Prob > F = 0.0000

Table E.82: Ramsey RESET Test of on the determinants of the short-term debt model

F(1, 6995) = 35.61

Prob > F = 0.0000

Table E.83: Ramsey RESET Test of on the determinants of the total debt model

F(1, 6838) = 12.65

Prob > F = 0.0004

Table E.84: Ramsey RESET Test of on the determinants of the total equity model

F(1, 7004)= 34.51

Prob > F = 0.0000

Table E.85: Ramsey RESET Test of the total debt ratio influence on ROA models

chi2 (6640) = 1.1e+36	chi2 (6639) = 3.4e+36
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

Table E.86: Ramsey RESET Test of the total debt ratio influence on ROE models

chi2 (6576) = 2.8e+37	chi2 (6577) = 5.5e+36
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

Table E.87: Ramsey RESET Test of the total debt ratio influence on profit margin model

F(1, 6640) = 599.63

Prob > F = 0.0000

Table E.88: Ramsey RESET Test of the total debt ratio influence on EBITDA margin model

F(1, 6639) = 397.11

Prob > F = 0.0000

Table E.89: Ramsey RESET Test of the long-term debt ratio influence on ROA models

F(1, 6639) = 2287.16	F(1, 6638) = 2261.32
Prob > F = 0.0000	Prob > F = 0.0000

Table E.90: Ramsey RESET Test of the long-term debt ratio influence on ROE models

F(1, 6575) = 8.96	F(1, 6576) = 7.18
Prob > F = 0.0028	Prob > F = 0.0074

Table E.91: Ramsey RESET Test of the long-term debt ratio influence on profit margin model

F(1, 6659) = 480.53

Prob > F = 0.0000

Table E.92: Ramsey RESET Test of the long-term debt ratio influence on EBITDA margin model

F(1, 6658) = 312.04

Prob > F = 0.0000

Table E.93: Ramsey RESET Test of the short-term debt ratio influence on ROA models

F(1, 6837) = 1779.75	F(1, 6836) = 1953.43
Prob > F = 0.0000	Prob > F = 0.0000

Table E.94: Ramsey RESET Test of the short-term debt ratio influence on ROE models

F(1, 6779) = 20.42	F(1, 6780) = 17.56
Prob > F = 0.0000	Prob > F = 0.0000

Table E.95: Ramsey RESET Test of the short-term debt ratio influence on profit margin model

F(1, 6838) = 976.68

Prob > F = 0.0000

Table E.96: Ramsey RESET Test of the short-term debt ratio influence on EBITDA margin model

F(1, 6837) = 522.43

Prob > F = 0.0000

Table E.97: Ramsey RESET Test of the equity ratio influence on ROA models

F(1, 6850) = 1803.67	F(1, 6849) = 1834.43
Prob > F = 0.0000	Prob > F = 0.0000

Table E.98: Ramsey RESET Test of the equity ratio influence on ROE models

F(1, 6792) = 56.11	F(1, 6793) = 65.78
Prob > F = 0.0000	Prob > F = 0.0000

Table E.99: Ramsey RESET Test of the equity ratio influence on profit margin model

F(1, 6851) = 325.52

Prob > F = 0.0000

Table E.100: Ramsey RESET Test of the equity ratio influence on EBITDA margin model

F(1, 6850) = 467.61

Prob > F = 0.0000

Appendix E.7 Wooldridge Test

The Wooldridge test can examine the issues of endogeneity and non-observed heterogeneity of the descriptor variables (Serrasqueiro Nunes, & da Rocha Armada, 2014). It is used to check panel data variables for first-order autocorrelation (Arvanitis & Tzigkounaki, 2012).

Table E.101: Wooldridge test on the determinants of capital structure models

F(1, 6928) = 1453.194

Prob > F = 0.0000

Table E.102: Wooldridge Test on the determinants of financial performance models including equity ratio as a determinant

F(1, 6776) = 4.366

Prob > F = 0.0367

Table E.103: Wooldridge Test on the determinants of financial performance models including long-term debt ratio as a determinant

F(1, 6143) = 1.062

Prob > F = 0.3029

Table E.104: Wooldridge Test on the determinants of financial performance models including short-term debt ratio as a determinant

F(1, 6735) = 4.588

Prob > F = 0.0322

Table E.104: Wooldridge Test on the determinants of financial performance models, total debt ratio as a determinant

F(1, 6112) = 0.837

Prob > F = 0.3603

Appendix E.8 Modified Wald Test

The Wald test checks the independent variables for joint significance (Drobetz & Fix, 2005). The modified Wald test can test for heteroskedasticity in fixed-effects models (Torres-Reyna, 2007).

Table E.105: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on long-term debt

chi2 (6856) = 9.2e+33

Prob>chi2 = 0.0000

Table E.106: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on short-term debt

chi2 (6996) = 2.2e+34

Prob>chi2 = 0.0000

Table E.107: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on total debt

chi2 (6839) = 1.4e+34

Prob>chi2 = 0.0000

Table E.108: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on equity

chi2 (7005) = 3.8e+31

Prob>chi2 = 0.0000

Table E.109: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on ROA models with equity ratio as a determinant

chi2 (6895) = 1.8e+33	chi2 (6894) = 3.4e+36
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

Table E.110: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on ROE models with equity ratio as a determinant

chi2 (6846) = 7.7e+37	chi2 (6847) = 1.6e+34
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

Table E.111: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on profit margin model with equity ratio as a determinant

chi2 (6852) = 9.3e+34

Prob>chi2 = 0.0000

Table E.112: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on EBITDA margin model with equity ratio as a determinant

chi2 (6851) = 5.5e+34

Prob>chi2 = 0.0000

Table E.113: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on ROA models with long-term debt ratio as a determinant

chi2 (6659) = 6.9e+35	chi2 (6658) = 3.1e+37
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

Table E.114: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on ROE models with long-term debt ratio as a determinant

chi2 (6594) = 7.0e+37	chi2 (6595) = 3.8e+37
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

Table E.115: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on profit margin model with long-term debt ratio as a determinant

chi2 (6660) = 9.3e+35

Prob>chi2 = 0.0000

Table E.116: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on EBITDA margin model with long-term debt ratio as a determinant

chi2 (6659) = 8.5e+36

Prob>chi2 = 0.0000

Table E.117: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on ROA margin models with short-term debt ratio as a determinant

chi2 (6838) = 1.7e+33	chi2 (6837) = 3.7e+34
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

Table E.118: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on ROE margin models with short-term debt ratio as a determinant

chi2 (6780) = 4.3e+36	chi2 (6781) = 2.4e+36
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

Table E.119: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on profit margin model with short-term debt ratio as a determinant

chi2 (6839) = 4.1e+34

Prob>chi2 = 0.0000

Table E.120: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on EBITDA margin model with short-term debt ratio as a determinant

chi2 (6838) = 2.3e+37

Prob>chi2 = 0.0000

Table E.121: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on ROA models with total debt ratio as a determinant

chi2 (6640) = 1.1e+36	chi2 (6639) = 3.4e+36
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

Table E.122: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on ROE models with total debt ratio as a determinant

chi2 (6576) = 2.8e+37	chi2 (6577) = 5.5e+36
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

Table E.123: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on profit margin model with total debt ratio as a determinant

chi2 (6641) = 1.0e+36

Prob>chi2 = 0.0000

Table E.124: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on EBITDA margin model with total debt ratio as a determinant

chi2 (6640) = 1.0e+37

Prob>chi2 = 0.0000

Table E.125: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on Exports

chi2 (817) = 1.3+34

Prob>chi2 = 0.0000

Table E.126: Modified Wald test for groupwise heteroskedasticity in fixed effect regression model on export percentage ot total revenue

chi2 (7005) = 3.6e+36

Prob>chi2 = 0.0000

Appendix E.9 Breusch and Pagan Lagrangian Multiplier Test

The Breusch-Pagan LM test can assess whether heteroskedasticity is present (Baltagi, 2005). The LM statistic can test for heteroskedasticity, omitted variables, serial autocorrelation and other model specification issues (Wooldridge, 2012).

Table E.127: Breusch and Pagan Lagrangian Multiplier Test for random effects on the determinants of long-term debt

```
longterm_debt[id,t] = Xb + u[id] + e[id,t]

Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+-----------------------------
        longter~t |   528981.8       727.3114
                e |   332509.3       576.6362
                u |     128006       357.7792

Test:   Var(u) = 0
                    chibar2(01) = 27611.49
                 Prob > chibar2 =   0.0000
```

Table E.128: Breusch and Pagan Lagrangian Multiplier Test for random effects on the determinants of short-term debt

```
loans[id,t] = Xb + u[id] + e[id,t]

Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+-----------------------------
            loans |   487559.5       698.2546
                e |   97625.15       312.4502
                u |   324134.5       569.3281

Test:   Var(u) = 0
                    chibar2(01) =  1.7e+05
                 Prob > chibar2 =   0.0000
```

Table E.129: Breusch and Pagan Lagrangian Multiplier Test for random effects on the determinants of total debt

```
total_debt[id,t] = Xb + u[id] + e[id,t]

Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+-----------------------------
        total_d~t |    1129567       1062.811
                e |   447735.4       669.1303
                u |   569740.3       754.8114

Test:   Var(u) = 0
                    chibar2(01) = 59792.38
                 Prob > chibar2 =   0.0000
```

Table E.130: Breusch and Pagan Lagrangian Multiplier Test for random effects on the determinants of equity

```
shareholdersfund[id,t] = Xb + u[id] + e[id,t]

Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+-----------------------------
        shareho~d |    2815209       1677.858
                e |   527190.8       726.0791
                u |    1403907       1184.866

Test:   Var(u) = 0
                    chibar2(01) =  1.5e+05
                 Prob > chibar2 =   0.0000
```

Table E.131: Breusch and Pagan Lagrangian Multiplier Test for random effects on the determinants of export revenue

```
export_rev_log[id,t] = Xb + u[id] + e[id,t]

Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+-----------------------------
        export_~g |   5.210195       2.282585
                e |   .8475553       .9206277
                u |    2.58569       1.608008

Test:   Var(u) = 0
                    chibar2(01) =  6516.94
                 Prob > chibar2 =   0.0000
```

Table E.132: Breusch and Pagan Lagrangian Multiplier Test for random effects on the determinants of export percentage of total revenue

```
R_exportrev_perc[id,t] = Xb + u[id] + e[id,t]

Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+-----------------------------
        R_expor~c |   872.0732       29.53089
                e |   134.1841       11.58379
                u |    686.625       26.20353

Test:   Var(u) = 0
                    chibar2(01) = 14562.26
                 Prob > chibar2 =   0.0000
```

Appendix F: Sensitivty and Selection Bias Analysis

Appendix F.1 Rosenbaum–Bounds Analysis

Rosenbaum bounds analysis adjusts the strength the influence of an unmeasured confounding variable into treatment selection to weaken the implications about causal effects from the matching analysis (Caliendo & Becker, 2010; DiPrete & Gangl, 2004).

Table F.1: Rosenbaum Bounds Analysis on the effects on EBITDA with possessing a target debt ratio as the treatment group (model 1)

Rosenbaum bounds for delta1 (N = 12 matched pairs)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.013376	.013376	1.00745	1.00745	-2.9e-07	2.04717
1.05	.015319	.011609	1.00745	1.00745	-2.9e-07	2.04717
1.1	.017342	.010083	1.00745	1.00745	-2.9e-07	2.04717
1.15	.019433	.008764	1.00745	1.00745	-2.9e-07	2.43855
1.2	.021582	.007622	1.00745	1.4311	-2.9e-07	2.43855
1.25	.023781	.006632	1.00745	1.4311	-2.9e-07	2.81962
1.3	.026021	.005775	1.00745	1.4311	-2.9e-07	2.81962
1.35	.028294	.00503	1.00745	1.4311	-2.9e-07	2.81962
1.4	.030595	.004384	1.00745	1.4311	-2.9e-07	2.8622
1.45	.032916	.003822	1.00745	1.4311	-2.9e-07	2.8622
1.5	.035253	.003334	1.00745	1.4311	-2.9e-07	3.05462
1.55	.037601	.00291	1.00745	1.4311	-2.9e-07	3.05462
1.6	.039955	.00254	1.00745	1.4311	-2.9e-07	3.05462
1.65	.042311	.002218	1.00745	1.4311	-2.9e-07	3.05462
1.7	.044667	.001937	1.00745	1.81217	-2.9e-07	3.24327
1.75	.047019	.001693	1.00745	1.81217	-2.9e-07	3.24327
1.8	.049364	.00148	-2.9e-07	1.81217	-2.9e-07	3.47827
1.85	.0517	.001294	-2.9e-07	1.81217	-2.9e-07	3.47827
1.9	.054025	.001132	-2.9e-07	1.81217	-2.9e-07	3.47827
1.95	.056338	.00099	-2.9e-07	1.81217	-2.9e-07	3.62434
2	.058636	.000866	-2.9e-07	1.81217	-2.9e-07	3.62434

Table F.2: Rosenbaum Bounds Analysis on the effects on EBITDA with possessing a target debt ratio as the treatment group (model 2)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.023364	.023364	.804719	.804719	-4.2e-07	2.04717
1.05	.02614	.020781	.804719	.804719	-4.2e-07	2.04717
1.1	.028966	.018497	.804719	.804719	-4.2e-07	2.04717
1.15	.031832	.016474	.804719	.804719	-4.2e-07	2.04717
1.2	.034725	.014682	-4.2e-07	.804719	-4.2e-07	2.04717
1.25	.037636	.013091	-4.2e-07	.804719	-4.2e-07	2.04717
1.3	.040557	.011679	-4.2e-07	1.00745	-4.2e-07	2.04717
1.35	.043481	.010424	-4.2e-07	1.00745	-4.2e-07	2.04717
1.4	.0464	.009308	-4.2e-07	1.00745	-4.2e-07	2.04717
1.45	.049311	.008315	-4.2e-07	1.00745	-4.2e-07	2.04717
1.5	.052208	.007431	-4.2e-07	1.00745	-4.2e-07	2.23582
1.55	.055087	.006643	-4.2e-07	1.00745	-4.2e-07	2.23582
1.6	.057946	.005941	-4.2e-07	1.00745	-4.2e-07	2.43855
1.65	.060782	.005315	-4.2e-07	1.00745	-4.2e-07	2.43855
1.7	.063591	.004757	-4.2e-07	1.00745	-4.2e-07	2.85189
1.75	.066373	.004258	-4.2e-07	1.00745	-4.2e-07	2.85189
1.8	.069126	.003813	-4.2e-07	1.00745	-4.2e-07	2.8622
1.85	.071848	.003415	-4.2e-07	1.00745	-4.2e-07	2.8622
1.9	.074539	.00306	-4.2e-07	1.00745	-4.2e-07	2.8622
1.95	.077197	.002742	-4.2e-07	1.00745	-4.2e-07	3.05462
2	.079823	.002458	-4.2e-07	1.21928	-4.2e-07	3.05462

Table F.3: Rosenbaum Bounds Analysis on the effects on EBITDA with possessing a target debt ratio as the treatment group (model 3)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.013376	.013376	1.00745	1.00745	-2.9e-07	2.04717
1.05	.015319	.011609	1.00745	1.00745	-2.9e-07	2.04717
1.1	.017342	.010083	1.00745	1.00745	-2.9e-07	2.04717
1.15	.019433	.008764	1.00745	1.00745	-2.9e-07	2.43855
1.2	.021582	.007622	1.00745	1.4311	-2.9e-07	2.43855
1.25	.023781	.006632	1.00745	1.4311	-2.9e-07	2.81962
1.3	.026021	.005775	1.00745	1.4311	-2.9e-07	2.81962
1.35	.028294	.00503	1.00745	1.4311	-2.9e-07	2.81962
1.4	.030595	.004384	1.00745	1.4311	-2.9e-07	2.8622
1.45	.032916	.003822	1.00745	1.4311	-2.9e-07	2.8622
1.5	.035253	.003334	1.00745	1.4311	-2.9e-07	3.05462
1.55	.037601	.00291	1.00745	1.4311	-2.9e-07	3.05462
1.6	.039955	.00254	1.00745	1.4311	-2.9e-07	3.05462
1.65	.042311	.002218	1.00745	1.4311	-2.9e-07	3.05462
1.7	.044667	.001937	1.00745	1.81217	-2.9e-07	3.24327
1.75	.047019	.001693	1.00745	1.81217	-2.9e-07	3.24327
1.8	.049364	.00148	-2.9e-07	1.81217	-2.9e-07	3.47827
1.85	.0517	.001294	-2.9e-07	1.81217	-2.9e-07	3.47827
1.9	.054025	.001132	-2.9e-07	1.81217	-2.9e-07	3.47827
1.95	.056338	.00099	-2.9e-07	1.81217	-2.9e-07	3.62434
2	.058636	.000866	-2.9e-07	1.81217	-2.9e-07	3.62434

Table F.4: Rosenbaum Bounds Analysis on the effects on EBITDA with experience in an incubator or accelerator programme as the treatment group (model 2)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.000018	.000018	-1.00745	-1.00745	-2.0149	-1.00745
1.05	.000011	.000028	-1.00745	-1.00745	-2.0149	-1.00745
1.1	6.6e-06	.000043	-1.00745	-1.00745	-2.0149	-1.00745
1.15	4.0e-06	.000064	-1.00745	-1.00745	-2.0149	-1.00745
1.2	2.5e-06	.000092	-1.00745	-1.00745	-2.0149	-1.00745
1.25	1.5e-06	.000128	-1.00745	-1.00745	-2.0149	-2.9e-07
1.3	9.3e-07	.000174	-1.00745	-1.00745	-2.0149	-2.9e-07
1.35	5.7e-07	.000231	-1.00745	-1.00745	-2.0149	-2.9e-07
1.4	3.5e-07	.000301	-1.00745	-1.00745	-2.0149	-2.9e-07
1.45	2.2e-07	.000386	-1.00745	-1.00745	-2.0149	-2.9e-07
1.5	1.3e-07	.000486	-1.00745	-1.00745	-2.0149	-2.9e-07
1.55	8.2e-08	.000604	-1.4311	-1.00745	-2.0149	-2.9e-07
1.6	5.1e-08	.00074	-1.4311	-1.00745	-2.0149	-2.9e-07
1.65	3.1e-08	.000897	-1.4311	-1.00745	-2.0149	-2.9e-07
1.7	1.9e-08	.001075	-1.4311	-1.00745	-2.0149	-2.9e-07
1.75	1.2e-08	.001276	-1.4311	-1.00745	-2.04717	-2.9e-07
1.8	7.3e-09	.0015	-1.4311	-1.00745	-2.04717	-2.9e-07
1.85	4.5e-09	.001749	-1.4311	-1.00745	-2.04717	-2.9e-07
1.9	2.8e-09	.002023	-1.81217	-1.00745	-2.04717	-2.9e-07
1.95	1.7e-09	.002324	-1.81217	-1.00745	-2.04717	-2.9e-07
2	1.1e-09	.002652	-1.81217	-1.00745	-2.04717	-2.9e-07

Table F.5: Rosenbaum Bounds Analysis on the effects on EBITDA with experience in an incubator or accelerator programme as the treatment group (model 3)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.001188	.001188	-1.00745	-1.00745	-1.00745	-3.5e-07
1.05	.000855	.001627	-1.00745	-.804719	-1.00745	-3.5e-07
1.1	.000616	.002166	-1.00745	-.804719	-1.00745	-3.5e-07
1.15	.000444	.002816	-1.00745	-.804719	-1.00745	-3.5e-07
1.2	.00032	.003584	-1.00745	-.423649	-1.00745	-3.5e-07
1.25	.000231	.004478	-1.00745	-3.5e-07	-1.4311	-3.5e-07
1.3	.000167	.005502	-1.00745	-3.5e-07	-1.4311	-3.5e-07
1.35	.000121	.006662	-1.00745	-3.5e-07	-1.4311	-3.5e-07
1.4	.000087	.00796	-1.00745	-3.5e-07	-1.4311	-3.5e-07
1.45	.000063	.0094	-1.00745	-3.5e-07	-1.4311	-3.5e-07
1.5	.000046	.010983	-1.00745	-3.5e-07	-1.4311	-3.5e-07
1.55	.000033	.012709	-1.00745	-3.5e-07	-1.4311	-3.5e-07
1.6	.000024	.014577	-1.00745	-3.5e-07	-1.4311	-3.5e-07
1.65	.000017	.016588	-1.00745	-3.5e-07	-1.4311	-3.5e-07
1.7	.000013	.018738	-1.00745	-3.5e-07	-1.4311	-3.5e-07
1.75	9.2e-06	.021026	-1.00745	-3.5e-07	-1.4311	-3.5e-07
1.8	6.7e-06	.02345	-1.00745	-3.5e-07	-1.4311	-3.5e-07
1.85	4.8e-06	.026005	-1.00745	-3.5e-07	-1.81217	-3.5e-07
1.9	3.5e-06	.028689	-1.00745	-3.5e-07	-1.81217	-3.5e-07
1.95	2.6e-06	.031498	-1.00745	-3.5e-07	-1.81217	-3.5e-07
2	1.9e-06	.034428	-1.00745	-3.5e-07	-1.81217	-3.5e-07

Table F.6: Rosenbaum Bounds Analysis on the effects on the percentage of revenue from domestic sales, where the treatment group consists of the possession of a target debt ratio (model 1)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.391432	.391432	-3.3e-07	-3.3e-07	-35	30
1.05	.367521	.415696	-3.3e-07	-3.3e-07	-35	30
1.1	.345121	.439089	-3.3e-07	-3.3e-07	-35	30
1.15	.32414	.461613	-9.8e-07	-3.3e-07	-35	30
1.2	.304486	.483277	-5	-3.3e-07	-35	30
1.25	.286077	.504097	-10	-3.3e-07	-35	40
1.3	.26883	.524092	-10	-3.3e-07	-40	40
1.35	.252671	.543284	-10	-3.3e-07	-40	40
1.4	.237529	.561699	-10	-3.3e-07	-40	40
1.45	.223336	.57936	-10	-3.3e-07	-40	40
1.5	.210031	.596295	-10	-3.3e-07	-45	40
1.55	.197555	.612531	-10	-3.3e-07	-45	40
1.6	.185855	.628094	-10	-3.3e-07	-45	40
1.65	.174878	.64301	-10	9.8e-07	-45	40
1.7	.164579	.657306	-10	9.8e-07	-45	40
1.75	.154913	.671006	-10	2.5	-60	50
1.8	.145839	.684135	-10	5	-60	50
1.85	.137319	.696718	-10	5	-60	50
1.9	.129317	.708777	-10	10	-65	60
1.95	.121801	.720335	-10	10	-65	60
2	.114739	.731413	-10	10	-65	60

Table F.7: Rosenbaum Bounds Analysis on the effects on the percentage of revenue from total exports, where the treatment group consists of the possessing a target debt ratio (model 2)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.221249	.221249	5	5	-20	40
1.05	.241315	.202045	5	5	-20	40
1.1	.261205	.184573	5	10	-20	45
1.15	.28086	.168672	5	10	-20	45
1.2	.30023	.154194	5	10	-20	45
1.25	.319277	.141006	5	10	-25	45
1.3	.337971	.128987	5	10	-25	45
1.35	.356289	.11803	5	10	-25	45
1.4	.374214	.108037	8.9e-07	10	-30	60
1.45	.391733	.098918	-3.8e-07	20	-30	60
1.5	.408838	.090595	-3.8e-07	20	-30	70
1.55	.425525	.082994	-3.8e-07	20	-30	70
1.6	.441792	.076051	-3.8e-07	20	-30	70
1.65	.457638	.069707	-3.8e-07	30	-30	70
1.7	.473067	.063907	-3.8e-07	30	-30	70
1.75	.488081	.058604	-3.8e-07	30	-40	80
1.8	.502687	.053752	-3.8e-07	30	-40	80
1.85	.516889	.049313	-3.8e-07	30	-40	80
1.9	.530695	.045251	-3.8e-07	30	-40	80
1.95	.544113	.041531	-3.8e-07	30	-40	80
2	.55715	.038124	-3.8e-07	30	-40	80

Table F.8: Rosenbaum Bounds Analysis on the effects on the percentage of revenue from US exports, where the treatment group consists of the possessing a target debt ratio (model 4)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.35547	.35547	-4.3e-07	-4.3e-07	-5	15
1.05	.379265	.332146	-4.3e-07	-4.3e-07	-5	15
1.1	.402322	.310411	-4.3e-07	4.3e-07	-10	20
1.15	.424628	.290157	-4.3e-07	4.3e-07	-10	20
1.2	.446179	.27128	-4.3e-07	4.3e-07	-10	20
1.25	.466979	.253686	-4.3e-07	4.3e-07	-10	25
1.3	.487035	.237283	-4.3e-07	5	-10	25
1.35	.506362	.221989	-4.3e-07	5	-10	25
1.4	.524974	.207725	-4.3e-07	5	-10	25
1.45	.54289	.194418	-4.3e-07	5	-10	25
1.5	.560128	.182002	-4.3e-07	5	-10	25
1.55	.57671	.170413	-4.3e-07	5	-10	25
1.6	.592656	.159594	-4.3e-07	5	-10	30
1.65	.607989	.14949	-4.3e-07	5	-10	30
1.7	.622729	.140053	-4.3e-07	5	-10	30
1.75	.636897	.131236	-4.3e-07	5	-15	30
1.8	.650516	.122996	-4.3e-07	5	-15	30
1.85	.663605	.115294	-4.3e-07	5	-15	30
1.9	.676184	.108092	-4.3e-07	5	-15	30
1.95	.688275	.101357	-4.3e-07	5	-15	30
2	.699895	.095057	-4.3e-07	5	-15	30

Table F.9 Rosenbaum Bounds Analysis on the effects on the percentage of revenue from UK exports, where the treatment group consists of the possessing a target debt ratio (model 5)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.042703	.042703	15	15	-3.8e-07	80
1.05	.046606	.038982	10	20	-3.8e-07	80
1.1	.050493	.035607	10	20	-3.8e-07	80
1.15	.054352	.032544	10	20	-3.8e-07	80
1.2	.058176	.02976	10	40	-3.8e-07	80
1.25	.061958	.027229	10	40	-3.8e-07	80
1.3	.065692	.024924	10	40	-3.8e-07	80
1.35	.069374	.022824	10	40	-3.8e-07	80
1.4	.073002	.02091	10	40	-3.8e-07	80
1.45	.076573	.019164	10	40	-3.8e-07	80
1.5	.080086	.01757	10	40	-99	99
1.55	.083539	.016114	10	40	-99	99
1.6	.086932	.014784	10	40	-99	99
1.65	.090264	.013568	10	40	-99	99
1.7	.093536	.012455	10	40	-99	99
1.75	.096748	.011437	10	40	-99	99
1.8	.0999	.010505	5	40	-99	99
1.85	.102994	.009651	-3.8e-07	40	-99	99
1.9	.106029	.008869	-3.8e-07	40	-99	99
1.95	.109008	.008152	-3.8e-07	40	-99	99
2	.11193	.007494	-3.8e-07	40	-99	99

Table F.10: Rosenbaum Bounds Analysis on the effects on the percentage of revenue from rest of the world exports, where the treatment group consists of the possessing a target debt ratio (model 6)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.458256	.458256	-4.3e-07	-4.3e-07	-5	5
1.05	.43902	.477565	-4.3e-07	-4.3e-07	-5	5
1.1	.420779	.496013	-4.3e-07	-4.3e-07	-10	5
1.15	.403467	.513647	-4.3e-07	-4.3e-07	-10	5
1.2	.387024	.530512	-4.3e-07	-4.3e-07	-10	5
1.25	.371393	.54665	-4.3e-07	-4.3e-07	-10	5
1.3	.356525	.562101	-4.3e-07	-4.3e-07	-10	5
1.35	.342372	.576903	-4.3e-07	-4.3e-07	-10	5
1.4	.32889	.59109	-4.3e-07	-4.3e-07	-10	5
1.45	.316039	.604695	-4.3e-07	-4.3e-07	-10	5
1.5	.303782	.617748	-4.3e-07	-4.3e-07	-10	5
1.55	.292086	.630278	-4.3e-07	-4.3e-07	-10	5
1.6	.280917	.642312	-4.3e-07	-4.3e-07	-10	5
1.65	.270247	.653875	-4.3e-07	-4.3e-07	-10	5
1.7	.260048	.664989	-4.3e-07	-4.3e-07	-10	5
1.75	.250294	.675678	-4.3e-07	-4.3e-07	-10	10
1.8	.240962	.685961	-4.3e-07	-4.3e-07	-10	10
1.85	.23203	.695858	-4.3e-07	-4.3e-07	-10	10
1.9	.223476	.705387	-4.3e-07	-4.3e-07	-15	10
1.95	.215282	.714566	-4.3e-07	-4.3e-07	-15	10
2	.207429	.723409	-4.3e-07	-4.3e-07	-15	10

Table F.11: Rosenbaum Bounds Analysis on the effects of financing sources and characteristics on the percentage of revenue from domestic sales, where the treatment group consists of whether the firm is profitable (model 1)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	4.4e-06	4.4e-06	35	35	20	45
1.05	8.3e-06	2.3e-06	35	35	20	45
1.1	.000015	1.2e-06	35	35	20	45
1.15	.000025	5.9e-07	35	35	15	45
1.2	.000041	3.1e-07	35	40	15	45
1.25	.000064	1.6e-07	30	40	15	50
1.3	.000096	8.1e-08	30	40	10	50
1.35	.000141	4.2e-08	30	40	10	50
1.4	.000201	2.1e-08	30	40	10	50
1.45	.00028	1.1e-08	25	40	10	50
1.5	.000382	5.7e-09	25	40	10	50
1.55	.00051	2.9e-09	25	40	5	55
1.6	.000669	1.5e-09	25	40	5	55
1.65	.000863	7.8e-10	25	45	5	55
1.7	.001097	4.1e-10	25	45	5	55
1.75	.001377	2.1e-10	25	45	5	60
1.8	.001705	1.1e-10	25	45	5	60
1.85	.002089	5.6e-11	25	45	5	60
1.9	.002531	2.9e-11	25	45	5	60
1.95	.003037	1.5e-11	20	45	5	60
2	.003611	7.7e-12	20	45	5	60

Table F.14: Rosenbaum Bounds Analysis on the effects on the percentage of revenue from total exports, where the treatment group consists of whether the firm is profitable (model 2)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.000077	.000077	-25	-25	-40	-15
1.05	.000042	.000135	-25	-25	-40	-15
1.1	.000023	.000227	-30	-25	-40	-15
1.15	.000013	.000363	-30	-25	-40	-10
1.2	7.0e-06	.000559	-30	-25	-40	-10
1.25	3.9e-06	.000831	-30	-25	-45	-10
1.3	2.1e-06	.001197	-30	-20	-45	-10
1.35	1.2e-06	.001676	-30	-20	-45	-10
1.4	6.4e-07	.002291	-30	-20	-45	-5
1.45	3.5e-07	.003063	-30	-20	-45	-5
1.5	1.9e-07	.004014	-35	-20	-50	-5
1.55	1.1e-07	.005166	-35	-20	-50	-5
1.6	5.8e-08	.006541	-35	-20	-50	-5
1.65	3.2e-08	.008159	-35	-20	-50	-5
1.7	1.8e-08	.010041	-35	-20	-50	-5
1.75	9.6e-09	.012204	-35	-15	-50	-1.2e-06
1.8	5.3e-09	.014666	-35	-15	-50	-4.0e-07
1.85	2.9e-09	.01744	-35	-15	-55	-4.0e-07
1.9	1.6e-09	.02054	-35	-15	-55	-4.0e-07
1.95	8.8e-10	.023977	-35	-15	-55	-4.0e-07
2	4.8e-10	.027759	-40	-15	-55	-4.0e-07

Table F.12: Rosenbaum Bounds Analysis on the effects of financing sources and characteristics on the percentage of revenue from EMEA exports; the treatment group is whether the firm is profitable (model 3)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.795693	.795693	-3.5e-07	-3.5e-07	-3.5e-07	10
1.05	.771165	.818714	-3.5e-07	-3.5e-07	-3.5e-07	10
1.1	.746445	.839207	-3.5e-07	-3.5e-07	-3.5e-07	10
1.15	.721688	.85743	-3.5e-07	-3.5e-07	-1.1e-06	10
1.2	.697027	.873621	-3.5e-07	-3.5e-07	-10	10
1.25	.672575	.887995	-3.5e-07	-3.5e-07	-10	10
1.3	.648426	.90075	-3.5e-07	-3.5e-07	-10	10
1.35	.624661	.912063	-3.5e-07	-3.5e-07	-10	10
1.4	.601343	.922093	-3.5e-07	1.1e-06	-10	10
1.45	.578525	.930983	-3.5e-07	10	-10	10
1.5	.55625	.938861	-3.5e-07	10	-10	10
1.55	.53455	.945841	-3.5e-07	10	-10	10
1.6	.513449	.952024	-3.5e-07	10	-10	10
1.65	.492963	.9575	-3.5e-07	10	-10	10
1.7	.473105	.962351	-3.5e-07	10	-20	10
1.75	.453881	.966647	-3.5e-07	10	-20	10
1.8	.435291	.970452	-3.5e-07	10	-20	10
1.85	.417334	.973822	-3.5e-07	10	-20	10
1.9	.400006	.976806	-3.5e-07	10	-20	10
1.95	.383298	.979449	-3.5e-07	10	-20	10
2	.367201	.98179	-3.5e-07	10	-20	10

Table F.13: Rosenbaum Bounds Analysis on the effects of financing sources and characteristics on the percentage of revenue from US exports, where the treatment group consists of whether the firm is profitable (model 4)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.000176	.000176	-15	-15	-20	-10
1.05	.000102	.000294	-15	-15	-20	-10
1.1	.00006	.000468	-15	-10	-20	-5
1.15	.000035	.000717	-15	-10	-25	-5
1.2	.00002	.001059	-15	-10	-25	-5
1.25	.000012	.001516	-15	-10	-25	-5
1.3	6.8e-06	.002109	-15	-10	-25	-5
1.35	4.0e-06	.002862	-15	-10	-25	-5
1.4	2.3e-06	.003799	-15	-10	-25	-2.0e-06
1.45	1.3e-06	.004942	-15	-10	-25	-1.2e-06
1.5	7.9e-07	.006315	-15	-10	-25	-3.9e-07
1.55	4.6e-07	.007938	-15	-10	-25	-3.9e-07
1.6	2.7e-07	.009832	-15	-10	-25	-3.9e-07
1.65	1.5e-07	.012016	-15	-10	-25	-3.9e-07
1.7	9.0e-08	.014506	-15	-10	-25	-3.9e-07
1.75	5.3e-08	.017317	-20	-10	-25	-3.9e-07
1.8	3.1e-08	.020461	-20	-10	-25	-3.9e-07
1.85	1.8e-08	.023948	-20	-10	-25	-3.9e-07
1.9	1.0e-08	.027785	-20	-10	-25	-3.9e-07
1.95	6.0e-09	.03198	-20	-10	-25	-3.9e-07
2	3.5e-09	.036534	-20	-10	-25	-3.9e-07

Table F.15: Rosenbaum Bounds Analysis on the effects of financing sources and characteristics on the percentage of revenue from UK exports, where the treatment group consists of whether the firm is profitable (model 5)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.240214	.240214	-4.2e-07	-4.2e-07	-4.2e-07	-4.2e-07
1.05	.262074	.219263	-4.2e-07	-4.2e-07	-4.2e-07	-4.2e-07
1.1	.283708	.200182	-4.2e-07	-4.2e-07	-4.2e-07	-4.2e-07
1.15	.305046	.182803	-4.2e-07	-4.2e-07	-4.2e-07	-4.2e-07
1.2	.326033	.166971	-4.2e-07	-4.2e-07	-4.2e-07	-4.2e-07
1.25	.346624	.152547	-4.2e-07	-4.2e-07	-4.2e-07	1.3e-06
1.3	.366787	.139401	-4.2e-07	-4.2e-07	-4.2e-07	10
1.35	.386495	.127418	-4.2e-07	-4.2e-07	-4.2e-07	10
1.4	.405731	.116492	-4.2e-07	-4.2e-07	-4.2e-07	10
1.45	.424481	.106527	-4.2e-07	-4.2e-07	-4.2e-07	10
1.5	.442737	.097436	-4.2e-07	-4.2e-07	-4.2e-07	10
1.55	.460496	.089141	-4.2e-07	-4.2e-07	-4.2e-07	10
1.6	.477757	.081569	-4.2e-07	-4.2e-07	-4.2e-07	10
1.65	.494521	.074656	-4.2e-07	-4.2e-07	-4.2e-07	10
1.7	.510794	.068342	-4.2e-07	-4.2e-07	-4.2e-07	10
1.75	.526579	.062575	-4.2e-07	-4.2e-07	-4.2e-07	10
1.8	.541886	.057305	-4.2e-07	-4.2e-07	-4.2e-07	10
1.85	.556722	.052489	-4.2e-07	-4.2e-07	-4.2e-07	10
1.9	.571097	.048086	-4.2e-07	-4.2e-07	-4.2e-07	10
1.95	.58502	.044061	-4.2e-07	-4.2e-07	-4.2e-07	10
2	.598502	.040379	-4.2e-07	-4.2e-07	-1.3e-06	10

Table F.16: Rosenbaum Bounds Analysis on the effects of financing sources and characteristics on the percentage of revenue from ROW exports; the treatment group is whether the firm is profitable (model 6)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	.000252	.000252	-10	-10	-15	-5
1.05	.000149	.000416	-15	-10	-15	-5
1.1	.000088	.000657	-15	-10	-15	-5
1.15	.000052	.000996	-15	-10	-15	-5
1.2	.00003	.001457	-15	-10	-20	-5
1.25	.000018	.002067	-15	-10	-20	-5
1.3	.000011	.002853	-15	-10	-20	-5
1.35	6.2e-06	.003842	-15	-10	-20	-9.5e-07
1.4	3.7e-06	.005062	-15	-10	-20	-3.2e-07
1.45	2.2e-06	.00654	-15	-10	-20	-3.2e-07
1.5	1.3e-06	.008302	-15	-10	-20	-3.2e-07
1.55	7.5e-07	.010371	-15	-10	-20	-3.2e-07
1.6	4.4e-07	.01277	-15	-10	-25	-3.2e-07
1.65	2.6e-07	.015518	-15	-10	-25	-3.2e-07
1.7	1.5e-07	.018633	-15	-10	-25	-3.2e-07
1.75	9.0e-08	.022127	-15	-10	-25	-3.2e-07
1.8	5.3e-08	.026013	-15	-5	-25	-3.2e-07
1.85	3.1e-08	.030299	-15	-5	-25	-3.2e-07
1.9	1.8e-08	.034992	-15	-5	-25	-3.2e-07
1.95	1.1e-08	.040093	-15	-5	-25	-3.2e-07
2	6.3e-09	.045604	-15	-5	-25	-3.2e-07

Appendix F.2 Mantel-Haenszel Analysis

When the outcome is binary, the Mantel-Haenszel test statistic is used instead of Rosenbaum Bounds (Aakvik, 2003). It follows a similar technique, testing for the presence of hidden selection bias and the use of a treatment variable (Caliendo & Becker, 2010).

Table F.17: Mantel-Haenszel Analysis on being profitable, where treatment group consists of target debt ratio possession (model 1)

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	-.267261	-.267261	.605366	.605366
1.05	-.256112	-.310925	.601068	.622071
1.1	-.230102	-.337191	.590994	.632014
1.15	-.205313	-.362379	.581336	.641466
1.2	-.181633	-.386581	.572065	.650467
1.25	-.158964	-.409878	.563151	.659052
1.3	-.13722	-.432342	.554572	.667254
1.35	-.116326	-.454037	.546303	.675099
1.4	-.096216	-.475018	.538325	.682613
1.45	-.076829	-.495335	.53062	.689818
1.5	-.058114	-.515034	.523171	.696735
1.55	-.040022	-.534153	.515962	.703382
1.6	-.022511	-.552731	.50898	.709776
1.65	-.005542	-.570799	.502211	.715932
1.7	.010919	-.588388	.495644	.721864
1.75	.026905	-.605526	.489268	.727585
1.8	.042444	-.622237	.483072	.733107
1.85	.057562	-.638544	.477049	.73844
1.9	.072284	-.654469	.471188	.743595
1.95	.086632	-.670031	.465482	.748581
2	.100625	-.685247	.459924	.753406

Table F.18: Mantel-Haenszel Analysis on being profitable, treatment group consists of incubator or accelerator experience (model 2)

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	.	.	.	.
1.05	-.178152	-.176777	.570698	.570158
1.1	-.176777	-.176777	.570158	.570158
1.15	-.176777	-.176777	.570158	.570158
1.2	-.176777	-.176777	.570158	.570158
1.25	.	-.176777	.	.570158
1.3	.	-.176777	.	.570158
1.35	-.176777	-.176777	.570158	.570158
1.4	-.176777	-.176777	.570158	.570158
1.45	-.176777	-.176777	.570158	.570158
1.5	-.176777	-.176777	.570158	.570158
1.55	-.176777	-.176777	.570158	.570158
1.6	-.176777	-.176777	.570158	.570158
1.65	-.176777	-.176777	.570158	.570158
1.7	-.176777	-.176777	.570158	.570158
1.75	-.176777	-.176777	.570158	.570158
1.8	-.176777	-.176777	.570158	.570158
1.85	-.176777	-.176777	.570158	.570158
1.9	-.176777	-.176777	.570158	.570158
1.95	-.176777	-.176777	.570158	.570158
2	-.176777	-.176777	.570158	.570158

Table F.19: Mantel-Naenszel Analysis on whether high-tech SMEs will export, where the treatment group consists of the possession of a target debt ratio (model 1)

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	.	.	.	.
1.05	-.522913	-.522913	.699482	.699482
1.1	-.522913	-.522913	.699482	.699482
1.15	-.522913	-.522913	.699482	.699482
1.2	-.53033	-.515388	.702058	.696859
1.25	-.515388	-.522913	.696859	.699482
1.3	-.5	.	.691462	.
1.35	-.522913	-.522913	.699482	.699482
1.4	-.515388	-.5	.696859	.691462
1.45	-.53033	-.53033	.702058	.702058
1.5	-.515388	-.53033	.696859	.702058
1.55	-.522913	-.53033	.699482	.702058
1.6	-.522913	-.53033	.699482	.702058
1.65	-.522913	-.53033	.699482	.702058
1.7	-.53033	-.515388	.702058	.696859
1.75	-.515388	-.5	.696859	.691462
1.8	-.515388	-.5	.696859	.691462
1.85	-.53033	-.5	.702058	.691462
1.9	-.5	-.5	.691462	.691462
1.95	-.53033	-.5	.702058	.691462
2	.	-.5	.	.691462

Table F.20: Mantel-Naenszel Analysis on whether high-tech SMEs will export, where the treatment group consists of whether the firm is profitable (model 1)

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	.	.	.	.
1.05	.	.	.	.
1.1	.	-2.5e+06	.	1
1.15	.	.	.	.
1.2	-3.8e+06	-3.4e+06	1	1
1.25	.	.	.	.
1.3	-3.2e+06	.	1	.
1.35	.	.	.	.
1.4	-2.7e+06	.	1	.
1.45	-4.0e+06	.	1	.
1.5	-4.2e+06	-4.8e+06	1	1
1.55	.	-5.0e+06	.	1
1.6	.	.	.	.
1.65	-2.8e+06	.	1	.
1.7	.	-7.6e+06	.	1
1.75	.	.	.	.
1.8	-5.3e+06	.	1	.
1.85	-3.2e+06	.	1	.
1.9	-5.6e+06	.	1	.
1.95	.	.	.	.
2	-3.4e+06	.	1	.

Appendix F.3 Propensity Score Matching Analysis

Propensity score matching (PSM) was produced by Rosenbaum & Rubin (1983), and uses balancing scores to match firms by implementing a treatment group variable into the analysis. In order to assess these propensity scores, there is matching between firms from the control group and the treatment group (Spyros Arvanitis & Stucki, 2013). Statistical techniques such as PSM can remove some selection bias and strengthen the match of comparison and project groups, but it does not clear all challenges such as important missing information (Bamberger, Rao, & Woolcock, 2010).

Table F.21: Propensity Score Matching Analysis on EBITDA, the treatment group is possession of a target debt ratio (model 1)

```
Treatment-effects estimation                    Number of obs      =        83
Estimator      : propensity-score matching      Matches: requested =         1
Outcome model  : matching                                      min =         1
Treatment model: logit                                         max =        29
```

ebitda2014_log	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
targetdebtratio (yes vs No)	.886736	.3703649	2.39	0.017	.1608341	1.612638

.

Table F.22: Propensity Score Matching Analysis on EBITDA, the treatment group is the possession of a target debt ratio (model 2)

```
Treatment-effects estimation                    Number of obs      =        83
Estimator      : propensity-score matching      Matches: requested =         1
Outcome model  : matching                                      min =         1
Treatment model: logit                                         max =        18
```

ebitda2014_log	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
targetdebtratio (yes vs No)	.762401	.2990324	2.55	0.011	.1763082	1.348494

Table F.23: Propensity Score Matching Analysis on EBITDA, the treatment group is the possession of a target debt ratio (model 3)

```
Treatment-effects estimation                    Number of obs      =        83
Estimator      : propensity-score matching      Matches: requested =         1
Outcome model  : matching                                      min =         1
Treatment model: logit                                         max =         6
```

ebitda2014_log	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
targetdebtratio (yes vs No)	.5985681	.2116106	2.83	0.005	.1838188	1.013317

Table F.24: Propensity Score Matching Analysis on EBITDA with experience in an incubator or accelerator programme as the treatment group (model 2)

```
Treatment-effects estimation                    Number of obs      =        83
Estimator      : propensity-score matching      Matches: requested =         1
Outcome model  : matching                                      min =         1
Treatment model: logit                                         max =        18
```

ebitda2014_~g	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
incubaccel_yn (Yes vs No)	-.7760898	.2299536	-3.37	0.001	-1.226791	-.325389

Table F.25: Propensity Score Matching Analysis on EBITDA with experience in an incubator or accelerator programme as the treatment group (model 3)

```
Treatment-effects estimation                    Number of obs      =         83
Estimator      : propensity-score matching      Matches: requested =          1
Outcome model  : matching                                      min =          1
Treatment model: logit                                         max =          6
```

ebitda2014_~g	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
incubaccel_yn (Yes vs No)	-.7336669	.2277925	-3.22	0.001	-1.180132	-.2872018

Table F.26: Propensity Score Matching Analysis on being profitable, where the treatment group consists of the possession of a target debt ratio (model 1)

```
Treatment-effects estimation                    Number of obs      =         84
Estimator      : propensity-score matching      Matches: requested =          1
Outcome model  : matching                                      min =          1
Treatment model: logit                                         max =         19
```

profitable	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
targetdebtratio (yes vs No)	.1287594	.1397124	0.92	0.357	-.1450719	.4025907

Table F.27: Propensity Score Matching Analysis on being profitable, the treatment group consists of experience in an incubator or accelerator programme (model 2)

```
Treatment-effects estimation                    Number of obs      =         84
Estimator      : propensity-score matching      Matches: requested =          1
Outcome model  : matching                                      min =          1
Treatment model: logit                                         max =         19
```

profitable	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
incubaccel_yn (Yes vs No)	-.2249943	.1056886	-2.13	0.033	-.4321402	-.0178484

Table F.28: Propensity Score Matching Analysis on the percentage of revenue from domestic sales, where the treatment group consists of the possession of a target debt ratio (model 1)

```
Treatment-effects estimation                    Number of obs      =         76
Estimator      : propensity-score matching      Matches: requested =          1
Outcome model  : matching                                      min =          1
Treatment model: logit                                         max =          1
```

ireland	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
targetdebtratio (yes vs No)	31.84211	3.65268	8.72	0.000	24.68298	39.00123

Table F.29: Propensity Score Matching Analysis on the percentage of revenue from total exports, the treatment group consists of the possession of a target debt ratio (model 2)

```
Treatment-effects estimation                    Number of obs      =         76
Estimator      : propensity-score matching      Matches: requested =          1
Outcome model  : matching                                      min =          1
Treatment model: logit                                         max =          1
```

exports	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
targetdebtratio (yes vs No)	-35.78947	10.37767	-3.45	0.001	-56.12934	-15.44961

Table F.30: Propensity Score Matching Analysis on the percentage of revenue from US exports, the treatment group consists of the possession of a target debt ratio (model 4)

```
Treatment-effects estimation                    Number of obs      =         76
Estimator      : propensity-score matching      Matches: requested =          1
Outcome model  : matching                                      min =          1
Treatment model: logit                                         max =          1
```

usa	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
targetdebtratio (yes vs No)	-9.473684	3.704654	-2.56	0.011	-16.73467	-2.212696

Table F.31: Propensity Score Matching Analysis on the percentage of revenue from rest of the world exports, the treatment group consists of the possession of a target debt ratio (model 6)

```
Treatment-effects estimation                    Number of obs      =         76
Estimator      : propensity-score matching      Matches: requested =          1
Outcome model  : matching                                      min =          1
Treatment model: logit                                         max =          1
```

restofworld	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
targetdebtratio (yes vs No)	-7.631579	2.168614	-3.52	0.000	-11.88199	-3.381173

Table F.32: Propensity Score Matching Analysis on the percentage of revenue from domestic sales, the treatment group consists of whether the firm is profitable (model 1)

```
Treatment-effects estimation                    Number of obs      =         76
Estimator      : propensity-score matching      Matches: requested =          1
Outcome model  : matching                                      min =          1
Treatment model: logit                                         max =          1
```

ireland	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
profitable (Yes vs No)	33.42105	5.224886	6.40	0.000	23.18047	43.66164

Table F.33: Propensity Score Matching Analysis on the percentage of revenue from total exports, the treatment group consists of whether the firm is profitable (model 2)

Treatment-effects estimation	Number of obs = 76
Estimator : propensity-score matching	Matches: requested = 1
Outcome model : matching	min = 1
Treatment model: logit	max = 1

exports	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
profitable (Yes vs No)	-28.42105	5.737989	-4.95	0.000	-39.66731	-17.1748

Table F.34: Propensity Score Matching Analysis on the percentage of revenue from EMEA exports, the treatment group consists of whether the firm is profitable (model 3)

Treatment-effects estimation	Number of obs = 39
Estimator : propensity-score matching	Matches: requested = 1
Outcome model : matching	min = 1
Treatment model: logit	max = 1

emea	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
profitable (Yes vs No)	-5.641026	5.777402	-0.98	0.329	-16.96452	5.682473

Table F.35: Propensity Score Matching Analysis on the percentage of revenue from US exports, the treatment group consists of whether the firm is profitable (model 4)

Treatment-effects estimation	Number of obs = 76
Estimator : propensity-score matching	Matches: requested = 1
Outcome model : matching	min = 1
Treatment model: logit	max = 1

usa	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
profitable (Yes vs No)	-15.78947	3.154923	-5.00	0.000	-21.97301	-9.605939

Table F.36: Propensity Score Matching Analysis on the percentage of revenue from UK exports, the treatment group consists of whether the firm is profitable (model 5)

Treatment-effects estimation	Number of obs = 54
Estimator : propensity-score matching	Matches: requested = 1
Outcome model : matching	min = 1
Treatment model: logit	max = 1

uk	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
profitable (Yes vs No)	.3703704	14.40638	0.03	0.979	-27.86561	28.60635

Table F.37: Propensity Score Matching Analysis on the effects on the percentage of revenue from rest of the world exports, where the treatment group consists of whether the firm is profitable (model 6)

Treatment-effects estimation	Number of obs = 76
Estimator : propensity-score matching	Matches: requested = 1
Outcome model : matching	min = 1
Treatment model: logit	max = 1

restofworld	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
profitable (Yes vs No)	-8.684211	5.435804	-1.60	0.110	-19.33819	1.969769

Table F.38: Propensity Score Matching Analysis on the effects on whether high-tech SMEs will export, the treatment group is the possession of a target debt ratio (model 1)

Treatment-effects estimation	Number of obs = 84
Estimator : propensity-score matching	Matches: requested = 1
Outcome model : matching	min = 1
Treatment model: logit	max = 1

exporty_n	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
targetdebtratio (yes vs No)	.047619	.0631391	0.75	0.451	-.0761314	.1713695

Table F.39: Propensity Score Matching Analysis on the effects on whether high-tech SMEs will export, where the treatment group is if the firm is profitable (model 1)

Treatment-effects estimation	Number of obs = 84
Estimator : propensity-score matching	Matches: requested = 1
Outcome model : matching	min = 1
Treatment model: logit	max = 1

exporty_n	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ATE						
profitable (Yes vs No)	-.0952381	.047399	-2.01	0.045	-.1881385	-.0023377

Appendix F.4 Heckman 2 Step Analysis

The issue of sample selection bias can be controlled by a two-step procedure first proposed by Heckman (1979) by implementing a control function. The first step entailed producing a probit model and the second estimated the order probit model for the determinants of the dependent variable (Brooks, 2008). The econometric techniques proposed by Heckman can be used to account for sample selectivity issues (Angus, 1995).

Table F.40: Heckman 2 Step Analysis on EBITDA with possessing a target debt ratio as the treatment group (model 1)

Heckman selection model -- two-step estimates	Number of obs	=	84
(regression model with sample selection)	Selected	=	12
	Nonselected	=	72
	Wald chi2(3)	=	0.32
	Prob > chi2	=	0.9560

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ebitda2014_log						
internal	.0350089	.1142914	0.31	0.759	-.1889981	.259016
extdebt	-.0340003	.255118	-0.13	0.894	-.5340223	.4660217
extequity	-.0170026	.1055647	-0.16	0.872	-.2239056	.1899005
_cons	23.52042	34.80353	0.68	0.499	-44.69326	91.73409
targetdebtratio						
internal	-.0031972	.0089233	-0.36	0.720	-.0206866	.0142921
extdebt	.0126452	.0117027	1.08	0.280	-.0102917	.0355821
extequity	.0018234	.0098964	0.18	0.854	-.0175732	.0212199
years_log	.1169104	.23107	0.51	0.613	-.3359784	.5697992
intangibleassets	.0016634	.0056962	0.29	0.770	-.009501	.0128278
_cons	-1.282927	.8254342	-1.55	0.120	-2.900748	.3348945
/mills						
lambda	-7.904202	22.63126	-0.35	0.727	-52.26066	36.45226
rho	-1.00000					
sigma	7.9042018					

Table F.41: Heckman 2 Step Analysis on EBITDA with possessing a target debt ratio as the treatment group (model 2)

Heckman selection model -- two-step estimates	Number of obs	=	84
(regression model with sample selection)	Selected	=	12
	Nonselected	=	72
	Wald chi2(4)	=	48.04
	Prob > chi2	=	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ebitda2014_log						
internal	-8.70e-06	.0145029	-0.00	1.000	-.0284338	.0284164
extdebt	.0548209	.0268743	2.04	0.041	.0021482	.1074935
extequity	-.0226218	.0151288	-1.50	0.135	-.0522737	.0070302
incubaccel_yn	-2.273331	.5470365	-4.16	0.000	-3.345502	-1.201159
_cons	12.94749	4.166502	3.11	0.002	4.781299	21.11369
targetdebtratio						
internal	-.001855	.0090418	-0.21	0.837	-.0195765	.0158665
extdebt	.0147692	.0120541	1.23	0.220	-.0088564	.0383948
extequity	.0020036	.009905	0.20	0.840	-.0174098	.021417
incubaccel_yn	.3664263	.4120829	0.89	0.374	-.4412413	1.174094
years_log	.1496535	.2414464	0.62	0.535	-.3235728	.6228798
intangibleassets	-.0004328	.0062912	-0.07	0.945	-.0127634	.0118977
_cons	-1.54331	.8922938	-1.73	0.084	-3.292174	.2055535
/mills						
lambda	.5889768	2.407826	0.24	0.807	-4.130276	5.30823
rho	0.71459					
sigma	.82421711					

Table F.42: Heckman 2 Step Analysis on EBITDA with possessing a target debt ratio as the treatment group (model 3)

Heckman selection model -- two-step estimates	Number of obs	=	84
(regression model with sample selection)	Selected	=	12
	Nonselected	=	72
	Wald chi2(5)	=	7.56
	Prob > chi2	=	0.1822

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ebitda2014_log						
internal	-.0220572	.040967	-0.54	0.590	-.102351	.0582366
extdebt	.0715313	.0751066	0.95	0.341	-.075675	.2187376
extequity	-.0241041	.04156	-0.58	0.562	-.1055603	.0573521
incubaccel_yn	-1.478487	1.814673	-0.81	0.415	-5.03518	2.078206
assetpref	-.9313123	.9260456	-1.01	0.315	-2.746328	.8837037
_cons	12.28585	11.11222	1.11	0.269	-9.493701	34.0654
targetdebtratio						
internal	-.001855	.0090418	-0.21	0.837	-.0195765	.0158665
extdebt	.0147692	.0120541	1.23	0.220	-.0088564	.0383948
extequity	.0020036	.009905	0.20	0.840	-.0174098	.021417
incubaccel_yn	.3664263	.4120829	0.89	0.374	-.4412413	1.174094
years_log	.1496535	.2414464	0.62	0.535	-.3235728	.6228798
intangibleassets	-.0004328	.0062912	-0.07	0.945	-.0127634	.0118977
_cons	-1.54331	.8922938	-1.73	0.084	-3.292174	.2055535
/mills						
lambda	2.966333	6.668448	0.44	0.656	-10.10358	16.03625
rho	1.00000					
sigma	2.9663331					

Table F.43: Heckman 2 Step Analysis on EBITDA with experience in an incubator or accelerator programme as the treatment group (model 2)

```
Heckman selection model -- two-step estimates   Number of obs     =         84
(regression model with sample selection)              Selected    =         40
                                                      Nonselected =         44

                                                Wald chi2(4)      =      10.22
                                                Prob > chi2       =     0.0370
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ebitda2014_log						
internal	.0093419	.0041389	2.26	0.024	.0012298	.017454
extdebt	.019352	.0072591	2.67	0.008	.0051245	.0335795
extequity	.0056303	.0044761	1.26	0.208	-.0031427	.0144033
targetdebtratio	-.0242339	.2338857	-0.10	0.917	-.4826415	.4341736
_cons	11.04544	.3108388	35.53	0.000	10.43621	11.65468
incubaccel_yn						
internal	-.0136598	.0079725	-1.71	0.087	-.0292856	.0019659
extdebt	-.0181616	.0132579	-1.37	0.171	-.0441466	.0078234
extequity	-.0019074	.0091646	-0.21	0.835	-.0198697	.0160549
targetdebtratio	.3481259	.4462603	0.78	0.435	-.5265281	1.22278
years_log	-.0976846	.1961059	-0.50	0.618	-.4820451	.286676
intangibleassets	.0181427	.005084	3.57	0.000	.0081783	.0281071
_cons	.2762086	.7231759	0.38	0.703	-1.14119	1.693607
/mills						
lambda	-.0969475	.2411642	-0.40	0.688	-.5696207	.3757257
rho	-0.17876					
sigma	.54232336					

Table F.44: Heckman 2 Step Analysis on EBITDA with experience in an incubator or accelerator programme as the treatment group (model 3)

```
Heckman selection model -- two-step estimates   Number of obs     =         84
(regression model with sample selection)              Selected    =         40
                                                      Nonselected =         44

                                                Wald chi2(5)      =      12.44
                                                Prob > chi2       =     0.0292
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ebitda2014_log						
internal	.0100701	.004074	2.47	0.013	.0020851	.0180551
extdebt	.0221486	.0074007	2.99	0.003	.0076435	.0366538
extequity	.0062654	.0043894	1.43	0.153	-.0023377	.0148685
targetdebtratio	-.087686	.2332102	-0.38	0.707	-.5447695	.3693976
assetpref	.1636776	.1257917	1.30	0.193	-.0828697	.4102249
_cons	10.54323	.4906016	21.49	0.000	9.581671	11.50479
incubaccel_yn						
internal	-.0136598	.0079725	-1.71	0.087	-.0292856	.0019659
extdebt	-.0181616	.0132579	-1.37	0.171	-.0441466	.0078234
extequity	-.0019074	.0091646	-0.21	0.835	-.0198697	.0160549
targetdebtratio	.3481259	.4462603	0.78	0.435	-.5265281	1.22278
years_log	-.0976846	.1961059	-0.50	0.618	-.4820451	.286676
intangibleassets	.0181427	.005084	3.57	0.000	.0081783	.0281071
_cons	.2762086	.7231759	0.38	0.703	-1.14119	1.693607
/mills						
lambda	-.0223907	.2424578	-0.09	0.926	-.4975993	.4528179
rho	-0.04249					
sigma	.52693591					

Table F.45: Heckman 2 Step Analysis on being profitable, where the treatment group consists of the possession of a target debt ratio (model 1)

```
Heckman selection model -- two-step estimates   Number of obs     =         84
(regression model with sample selection)              Selected    =         12
                                                      Nonselected =         72

                                                Wald chi2(3)      =       0.15
                                                Prob > chi2       =     0.9854
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
profitable						
internal	.0232032	.0875653	0.26	0.791	-.1484216	.194828
extdebt	-.0614663	.1954606	-0.31	0.753	-.4445621	.3216295
extequity	-.0052996	.0808792	-0.07	0.948	-.16382	.1532209
_cons	9.404044	26.665	0.35	0.724	-42.8584	61.66649
targetdebtratio						
internal	-.0031972	.0089233	-0.36	0.720	-.0206866	.0142921
extdebt	.0126452	.0117027	1.08	0.280	-.0102917	.0355821
extequity	.0018234	.0098964	0.18	0.854	-.0175732	.0212199
years_log	.1169104	.23107	0.51	0.613	-.3359784	.5697992
intangibleassets	.0016634	.0056962	0.29	0.770	-.009501	.0128278
_cons	-1.282927	.8254342	-1.55	0.120	-2.900748	.3348945
/mills						
lambda	-6.055866	17.33912	-0.35	0.727	-40.03992	27.92819
rho	-1.00000					
sigma	6.0558664					

Table F.46: Heckman 2 Step Analysis on being profitable, where the treatment group consists of experience in an incubator or accelerator programme (model 2)

```
Heckman selection model -- two-step estimates   Number of obs     =         84
(regression model with sample selection)               Selected    =         40
                                                       Nonselected =         44

                                                Wald chi2(3)      =       1.82
                                                Prob > chi2       =     0.6115
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
profitable						
internal	-.0011699	.0040707	-0.29	0.774	-.0091484	.0068085
extdebt	-.0049852	.0067419	-0.74	0.460	-.018199	.0082287
extequity	-.0044066	.0044813	-0.98	0.325	-.0131899	.0043766
_cons	.236732	.3118144	0.76	0.448	-.3744131	.847877
incubaccel_yn						
internal	-.0136936	.0079664	-1.72	0.086	-.0293075	.0019203
extdebt	-.0159506	.0126245	-1.26	0.206	-.0406941	.008793
extequity	-.0013456	.0091536	-0.15	0.883	-.0192863	.0165951
years_log	-.0879894	.1943103	-0.45	0.651	-.4688306	.2928518
intangibleassets	.0181158	.0050434	3.59	0.000	.0082308	.0280008
_cons	.2924253	.7198957	0.41	0.685	-1.118544	1.703395
/mills						
lambda	.595241	.2199901	2.71	0.007	.1640682	1.026414
rho	0.98858					
sigma	.60211559					

Table F.47: Heckman 2 Step Analysis on the percentage of revenue from domestic sales, where the treatment group consists of the possession of a target debt ratio (model 1)

```
Heckman selection model -- two-step estimates   Number of obs     =         76
(regression model with sample selection)               Selected    =         11
                                                       Nonselected =         65

                                                Wald chi2(7)      =       0.54
                                                Prob > chi2       =     0.9993
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ireland						
profitable	-13.2089	257.4133	-0.05	0.959	-517.7297	491.3119
internal	.1576399	2.005893	0.08	0.937	-3.773839	4.089119
extdebt	-.803688	3.832237	-0.21	0.834	-8.314734	6.707358
logsize	50.76415	121.2578	0.42	0.675	-186.8968	288.4251
lastappliedbankcredit	11.60761	80.30896	0.14	0.885	-145.7951	169.0103
randdev2014	1.64545	3.882025	0.42	0.672	-5.96318	9.25408
salesmkt2014	1.961933	7.638318	0.26	0.797	-13.0089	16.93276
_cons	-959.2308	2162.483	-0.44	0.657	-5197.619	3279.157
targetdebtratio						
profitable	.2547269	.6366075	0.40	0.689	-.9930008	1.502455
internal	-.0090098	.0077264	-1.17	0.244	-.0241533	.0061337
extdebt	-.008876	.0160018	-0.55	0.579	-.0402389	.0224869
logsize	.1715941	.193897	0.88	0.376	-.2084371	.5516253
lastappliedbankcredit	.2284546	.2892579	0.79	0.430	-.3384803	.7953896
businesssetup_log	.6183226	.2843989	2.17	0.030	.060911	1.175734
randdev2014	-.01009	.0126435	-0.80	0.425	-.0348709	.0146909
salesmkt2014	.0044089	.0207949	0.21	0.832	-.0363484	.0451661
years_log	-.2938607	.3838129	-0.77	0.444	-1.04612	.4583987
intangibleassets	.0014272	.0068436	0.21	0.835	-.011986	.0148405
_cons	-3.278501	2.391142	-1.37	0.170	-7.965053	1.408051
/mills						
lambda	158.3772	247.9791	0.64	0.523	-327.6528	644.4072
rho	1.00000					
sigma	158.37719					

Table F.48: Heckman 2 Step Analysis on the percentage of revenue from total exports, where the treatment group consists of the possession of a target debt ratio (model 2)

```
Heckman selection model -- two-step estimates   Number of obs     =         76
(regression model with sample selection)               Selected    =         11
                                                       Nonselected =         65

                                                Wald chi2(7)      =       1.26
                                                Prob > chi2       =     0.9895
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
exports						
profitable	-45.34507	212.1502	-0.21	0.831	-461.1519	370.4617
internal	-.0228146	1.653181	-0.01	0.989	-3.26299	3.21736
extdebt	.1835793	3.158384	0.06	0.954	-6.006739	6.373897
logsize	-28.57483	99.93606	-0.29	0.775	-224.4459	167.2963
lastappliedbankcredit	13.09718	66.18759	0.20	0.843	-116.6281	142.8225
randdev2014	-.7315682	3.199417	-0.23	0.819	-7.002311	5.539175
salesmkt2014	-1.010091	6.295211	-0.16	0.873	-13.34848	11.3283
_cons	655.5571	1782.236	0.37	0.713	-2837.561	4148.675
targetdebtratio						
profitable	.2547269	.6366075	0.40	0.689	-.9930008	1.502455
internal	-.0090098	.0077264	-1.17	0.244	-.0241533	.0061337
extdebt	-.008876	.0160018	-0.55	0.579	-.0402389	.0224869
logsize	.1715941	.193897	0.88	0.376	-.2084371	.5516253
lastappliedbankcredit	.2284546	.2892579	0.79	0.430	-.3384803	.7953896
businesssetup_log	.6183226	.2843989	2.17	0.030	.060911	1.175734
randdev2014	-.01009	.0126435	-0.80	0.425	-.0348709	.0146909
salesmkt2014	.0044089	.0207949	0.21	0.832	-.0363484	.0451661
years_log	-.2938607	.3838129	-0.77	0.444	-1.04612	.4583987
intangibleassets	.0014272	.0068436	0.21	0.835	-.011986	.0148405
_cons	-3.278501	2.391142	-1.37	0.170	-7.965053	1.408051
/mills						
lambda	-130.5284	204.3749	-0.64	0.523	-531.0959	270.039
rho	-1.00000					
sigma	130.52845					

Table F.49: Heckman 2 Step Analysis on the percentage of revenue from US exports, where the treatment group consists of the possession of a target debt ratio (model 4)

Heckman selection model -- two-step estimates	Number of obs	=	76
(regression model with sample selection)	Selected	=	11
	Nonselected	=	65
	Wald chi2(7)	=	0.37
	Prob > chi2	=	0.9998

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
usa						
profitable	31.66007	150.0144	0.21	0.833	-262.3628	325.683
internal	-.0288393	1.168988	-0.02	0.980	-2.320013	2.262334
extdebt	.5538637	2.233338	0.25	0.804	-3.823398	4.931126
logsize	-37.87474	70.66621	-0.54	0.592	-176.378	100.6285
lastappliedbankcredit	-5.363089	46.80218	-0.11	0.909	-97.09368	86.3675
randdev2014	-1.256306	2.262354	-0.56	0.579	-5.690438	3.177825
salesmkt2014	-2.240619	4.451433	-0.50	0.615	-10.96527	6.48403
_cons	715.9661	1260.244	0.57	0.570	-1754.067	3185.999
targetdebtratio						
profitable	.2547269	.6366075	0.40	0.689	-.9930008	1.502455
internal	-.0090098	.0077264	-1.17	0.244	-.0241533	.0061337
extdebt	-.008876	.0160018	-0.55	0.579	-.0402389	.0224869
logsize	.1715941	.193897	0.88	0.376	-.2084371	.5516253
lastappliedbankcredit	.2284546	.2892579	0.79	0.430	-.3384803	.7953896
businesssetup_log	.6183226	.2843989	2.17	0.030	.060911	1.175734
randdev2014	-.01009	.0126435	-0.80	0.425	-.0348709	.0146909
salesmkt2014	.0044089	.0207949	0.21	0.832	-.0363484	.0451661
years_log	-.2938607	.3838129	-0.77	0.444	-1.04612	.4583987
intangibleassets	.0014272	.0068436	0.21	0.835	-.011986	.0148405
_cons	-3.278501	2.391142	-1.37	0.170	-7.965053	1.408051
/mills						
lambda	-92.29852	144.5164	-0.64	0.523	-375.5454	190.9484
rho	-1.00000					
sigma	92.29852					

Table F.50: Heckman 2 Step Analysis on the percentage of revenue from rest of the world exports, the treatment group consists of the possession of a target debt ratio (model 6)

Heckman selection model -- two-step estimates	Number of obs	=	76
(regression model with sample selection)	Selected	=	11
	Nonselected	=	65
	Wald chi2(7)	=	1.00
	Prob > chi2	=	0.9948

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
restofworld						
profitable	25.76744	32.06811	0.80	0.422	-37.0849	88.61978
internal	-.1789534	.2498908	-0.72	0.474	-.6687303	.3108235
extdebt	.0648549	.4774135	0.14	0.892	-.8708584	1.000568
logsize	-11.10713	15.10609	-0.74	0.462	-40.71452	18.50027
lastappliedbankcredit	-8.181988	10.00475	-0.82	0.413	-27.79094	11.42697
randdev2014	-.1921021	.4836161	-0.40	0.691	-1.139972	.7557681
salesmkt2014	-.6702064	.9515686	-0.70	0.481	-2.535247	1.194834
_cons	210.7353	269.3984	0.78	0.434	-317.2759	738.7464
targetdebtratio						
profitable	.2547269	.6366075	0.40	0.689	-.9930008	1.502455
internal	-.0090098	.0077264	-1.17	0.244	-.0241533	.0061337
extdebt	-.008876	.0160018	-0.55	0.579	-.0402389	.0224869
logsize	.1715941	.193897	0.88	0.376	-.2084371	.5516253
lastappliedbankcredit	.2284546	.2892579	0.79	0.430	-.3384803	.7953896
businesssetup_log	.6183226	.2843989	2.17	0.030	.060911	1.175734
randdev2014	-.01009	.0126435	-0.80	0.425	-.0348709	.0146909
salesmkt2014	.0044089	.0207949	0.21	0.832	-.0363484	.0451661
years_log	-.2938607	.3838129	-0.77	0.444	-1.04612	.4583987
intangibleassets	.0014272	.0068436	0.21	0.835	-.011986	.0148405
_cons	-3.278501	2.391142	-1.37	0.170	-7.965053	1.408051
/mills						
lambda	-19.73036	30.89281	-0.64	0.523	-80.27915	40.81843
rho	-1.00000					
sigma	19.730361					

Table F.51: Heckman 2 Step Analysis on the percentage of revenue from domestic sales, where the treatment group consists of whether the firm is profitable (model 1)

Heckman selection model -- two-step estimates	Number of obs	=	76
(regression model with sample selection)	Selected	=	48
	Nonselected	=	28
	Wald chi2(7)	=	13.82
	Prob > chi2	=	0.0546

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ireland						
targetdebtratio	1.865052	11.80782	0.16	0.874	-21.27786	25.00796
internal	.329286	.1873235	1.76	0.079	-.0378613	.6964333
extdebt	1.308113	.4983428	2.62	0.009	.3313789	2.284847
logsize	-2.790513	2.056388	-1.36	0.175	-6.820958	1.239933
lastappliedbankcredit	-11.63444	6.939095	-1.68	0.094	-25.23482	1.965938
randdev2014	-.0494913	.3841773	-0.13	0.897	-.802465	.7034824
salesmkt2014	-.0413417	.4629042	-0.09	0.929	-.9486173	.8659339
_cons	100.2896	43.92298	2.28	0.022	14.20216	186.3771
profitable						
targetdebtratio	.3794614	.6321635	0.60	0.548	-.8595562	1.618479
internal	.0099794	.0073727	1.35	0.176	-.0044709	.0244297
extdebt	-.0153096	.0191934	-0.80	0.425	-.0529279	.0223087
logsize	.123787	.0798239	1.55	0.121	-.0326651	.280239
lastappliedbankcredit	.486777	.2606329	1.87	0.062	-.024054	.9976081
businesssetup_log	-.1476935	.2775146	-0.53	0.595	-.6916121	.3962252
randdev2014	-.0165745	.0106025	-1.56	0.118	-.037355	.004206
salesmkt2014	.0100673	.01861	0.54	0.589	-.0264076	.0465422
years_log	.5695267	.262451	2.17	0.030	.0551323	1.083921
intangibleassets	-.0036955	.0060655	-0.61	0.542	-.0155836	.0081926
_cons	-3.37194	1.286778	-2.62	0.009	-5.893978	-.8499012
/mills						
lambda	-19.27086	18.68709	-1.03	0.302	-55.89688	17.35516
rho	-0.66390					
sigma	29.026698					

Table F.52: Heckman 2 Step Analysis on the percentage of revenue from total exports, where the treatment group consists of whether the firm is profitable (model 2)

Heckman selection model -- two-step estimates (regression model with sample selection)

Number of obs = 76
Selected = 48
Nonselected = 28

Wald chi2(7) = 10.53
Prob > chi2 = 0.1605

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
exports						
targetdebtratio	-6.204482	11.9704	-0.52	0.604	-29.66603	17.25706
internal	-.266855	.1930032	-1.38	0.167	-.6451342	.1114243
extdebt	-1.14707	.5141002	-2.23	0.026	-2.154688	-.1394527
logsize	1.372818	2.073893	0.66	0.508	-2.691938	5.437574
lastappliedbankcredit	11.23962	7.144363	1.57	0.116	-2.763079	25.24231
randdev2014	.2064652	.4106052	0.50	0.615	-.5983062	1.011237
salesmkt2014	.1057402	.4774066	0.22	0.825	-.8299595	1.04144
_cons	14.32616	44.98761	0.32	0.750	-73.84792	102.5003
profitable						
targetdebtratio	.3794614	.6321635	0.60	0.548	-.8595562	1.618479
internal	.0099794	.0073727	1.35	0.176	-.0044709	.0244297
extdebt	-.0153096	.0191934	-0.80	0.425	-.0529279	.0223087
logsize	.123787	.0798239	1.55	0.121	-.0326651	.280239
lastappliedbankcredit	.486777	.2606329	1.87	0.062	-.024054	.9976081
businesssetup_log	-.1476935	.2775146	-0.53	0.595	-.6916121	.3962252
randdev2014	-.0165745	.0106025	-1.56	0.118	-.037355	.004206
salesmkt2014	.0100673	.01861	0.54	0.589	-.0264076	.0465422
years_log	.5695267	.262451	2.17	0.030	.0551323	1.083921
intangibleassets	-.0036955	.0060655	-0.61	0.542	-.0155836	.0081926
_cons	-3.37194	1.286778	-2.62	0.009	-5.893978	-.8499012
/mills						
lambda	2.451557	20.16472	0.12	0.903	-37.07057	41.97369
rho	0.08546					
sigma	28.688037					

Table F.53: Heckman 2 Step Analysis on the percentage of revenue from EMEA exports, where the treatment group consists of whether the firm is profitable (model 3)

Heckman selection model -- two-step estimates (regression model with sample selection)

Number of obs = 55
Selected = 27
Nonselected = 28

Wald chi2(7) = 2.34
Prob > chi2 = 0.9384

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
emea						
targetdebtratio	3.691789	9.82171	0.38	0.707	-15.55841	22.94199
internal	.0878648	.1445586	0.61	0.543	-.1954649	.3711945
extdebt	.2652694	.3756775	0.71	0.480	-.4710449	1.001584
logsize	.1388803	1.12701	0.12	0.902	-2.070019	2.347779
lastappliedbankcredit	3.193357	5.811932	0.55	0.583	-8.197821	14.58453
randdev2014	.1856159	.2370262	0.78	0.434	-.278947	.6501788
salesmkt2014	-.061511	.3355909	-0.18	0.855	-.7192571	.5962352
_cons	-5.84875	33.85235	-0.17	0.863	-72.19814	60.50064
profitable						
targetdebtratio	.0164547	.8632156	0.02	0.985	-1.675417	1.708326
internal	.0081146	.008862	0.92	0.360	-.0092545	.0254838
extdebt	-.0230939	.0292884	-0.79	0.430	-.0804982	.0343104
logsize	.1047358	.0809766	1.29	0.196	-.0539755	.263447
lastappliedbankcredit	.5286767	.3201769	1.65	0.099	-.0988584	1.156212
businesssetup_log	-.1599092	.3183072	-0.50	0.615	-.7837798	.4639614
randdev2014	-.0166833	.0111981	-1.49	0.136	-.0386311	.0052645
salesmkt2014	.0045498	.022455	0.20	0.839	-.0394612	.0485608
years_log	.4404378	.3196291	1.38	0.168	-.1860236	1.066899
intangibleassets	-.0031799	.0070807	-0.45	0.653	-.0170579	.0106981
_cons	-3.034639	1.347804	-2.25	0.024	-5.676286	-.3929927
/mills						
lambda	8.453856	13.06257	0.65	0.518	-17.14831	34.05602
rho	0.60219					
sigma	14.038554					

Table F.54: Heckman 2 Step Analysis on the percentage of revenue from US exports, where the treatment group consists of whether the firm is profitable (model 4)

Heckman selection model -- two-step estimates (regression model with sample selection)

Number of obs = 76
Selected = 48
Nonselected = 28

Wald chi2(7) = 8.21
Prob > chi2 = 0.3147

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
usa						
targetdebtratio	2.721399	6.242511	0.44	0.663	-9.513698	14.9565
internal	-.0675145	.0989399	-0.68	0.495	-.2614331	.1264041
extdebt	-.6583842	.2631933	-2.50	0.012	-1.174234	-.1425349
logsize	.0955362	1.087485	0.09	0.930	-2.035895	2.226967
lastappliedbankcredit	7.085857	3.665223	1.93	0.053	-.0978477	14.26956
randdev2014	-.2192865	.2024548	-1.08	0.279	-.6160906	.1775176
salesmkt2014	-.06062	.2444809	-0.25	0.804	-.5397938	.4185538
_cons	-.31447	23.20719	-0.01	0.989	-45.79973	45.17079
profitable						
targetdebtratio	.3794614	.6321635	0.60	0.548	-.8595562	1.618479
internal	.0099794	.0073727	1.35	0.176	-.0044709	.0244297
extdebt	-.0153096	.0191934	-0.80	0.425	-.0529279	.0223087
logsize	.123787	.0798239	1.55	0.121	-.0326651	.280239
lastappliedbankcredit	.486777	.2606329	1.87	0.062	-.024054	.9976081
businesssetup_log	-.1476935	.2775146	-0.53	0.595	-.6916121	.3962252
randdev2014	-.0165745	.0106025	-1.56	0.118	-.037355	.004206
salesmkt2014	.0100673	.01861	0.54	0.589	-.0264076	.0465422
years_log	.5695267	.262451	2.17	0.030	.0551323	1.083921
intangibleassets	-.0036955	.0060655	-0.61	0.542	-.0155836	.0081926
_cons	-3.37194	1.286778	-2.62	0.009	-5.893978	-.8499012
/mills						
lambda	10.47166	9.841664	1.06	0.287	-8.817648	29.76097
rho	0.68142					
sigma	15.367505					

Table F.55: Heckman 2 Step Analysis on the percentage of revenue from UK exports, where the treatment group consists of whether the firm is profitable (model 5)

Heckman selection model -- two-step estimates (regression model with sample selection)

Number of obs	=	62
Selected	=	34
Nonselected	=	28
Wald chi2(7)	=	27.52
Prob > chi2	=	0.0003

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
uk						
targetdebtratio	1.675773	6.850768	0.24	0.807	-11.75149	15.10303
internal	-.2880944	.0992626	-2.90	0.004	-.4826456	-.0935433
extdebt	.4334359	.4110373	1.05	0.292	-.3721824	1.239054
logsize	-.1101162	1.061986	-0.10	0.917	-2.191571	1.971339
lastappliedbankcredit	-6.042081	3.981593	-1.52	0.129	-13.84586	1.761698
randdev2014	-.0235598	.1846626	-0.13	0.898	-.3854917	.3383722
salesmkt2014	.7380297	.2478826	2.98	0.003	.2521888	1.223871
_cons	45.40982	24.69793	1.84	0.066	-2.997233	93.81688
profitable						
targetdebtratio	.188936	.7293541	0.26	0.796	-1.240572	1.618444
internal	.0083089	.0081735	1.02	0.309	-.007711	.0243287
extdebt	-.0276217	.0300846	-0.92	0.359	-.0865865	.0313431
logsize	.1192461	.0786564	1.52	0.130	-.0349177	.2734098
lastappliedbankcredit	.5129446	.2827509	1.81	0.070	-.041237	1.067126
businesssetup_log	-.10086	.3060109	-0.33	0.742	-.7006303	.4989104
randdev2014	-.0122212	.0110632	-1.10	0.269	-.0339047	.0094623
salesmkt2014	.0150805	.0201227	0.75	0.454	-.0243592	.0545202
years_log	.570176	.2730859	2.09	0.037	.0349375	1.105415
intangibleassets	-.0030036	.0069846	-0.43	0.667	-.0166932	.0106859
_cons	-3.611432	1.31212	-2.75	0.006	-6.183141	-1.039724
/mills						
lambda	-10.75066	9.257783	-1.16	0.246	-28.89558	7.394265
rho	-0.78210					
sigma	13.745955					

Table F.56: Heckman 2 Step Analysis on the percentage of revenue from rest of the world exports, where the treatment group consists of whether the firm is profitable (model 6)

Heckman selection model -- two-step estimates (regression model with sample selection)

Number of obs	=	76
Selected	=	48
Nonselected	=	28
Wald chi2(7)	=	6.43
Prob > chi2	=	0.4900

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
restofworld						
targetdebtratio	-5.774795	5.886201	-0.98	0.327	-17.31154	5.761946
internal	-.0079868	.0939926	-0.08	0.932	-.192209	.1762354
extdebt	-.2940198	.2501802	-1.18	0.240	-.7843639	.1963243
logsize	.6196038	1.02299	0.61	0.545	-1.38542	2.624628
lastappliedbankcredit	2.405088	3.480789	0.69	0.490	-4.417133	9.227309
randdev2014	.2034874	.1957299	1.04	0.299	-.1801362	.587111
salesmkt2014	-.2061299	.2323625	-0.89	0.375	-.661552	.2492921
_cons	-1.205271	21.9862	-0.05	0.956	-44.29743	41.88689
profitable						
targetdebtratio	.3794614	.6321635	0.60	0.548	-.8595562	1.618479
internal	.0099794	.0073727	1.35	0.176	-.0044709	.0244297
extdebt	-.0153096	.0191934	-0.80	0.425	-.0529279	.0223087
logsize	.123787	.0798239	1.55	0.121	-.0326651	.280239
lastappliedbankcredit	.486777	.2606329	1.87	0.062	-.024054	.9976081
businesssetup_log	-.1476935	.2775146	-0.53	0.595	-.6916121	.3962252
randdev2014	-.0165745	.0106025	-1.56	0.118	-.037355	.004206
salesmkt2014	.0100673	.01861	0.54	0.589	-.0264076	.0465422
years_log	.5695267	.262451	2.17	0.030	.0551323	1.083921
intangibleassets	-.0036955	.0060655	-0.61	0.542	-.0155836	.0081926
_cons	-3.37194	1.286778	-2.62	0.009	-5.893978	-.8499012
/mills						
lambda	-7.483906	9.559693	-0.78	0.434	-26.22056	11.25275
rho	-0.52240					
sigma	14.32592					

Table F.57: Heckman 2 Step Analysis on whether high-tech SMEs will export, where the treatment group consists of possession of a target debt ratio (model 1)

Heckman selection model -- two-step estimates (regression model with sample selection)

Number of obs	=	84
Selected	=	12
Nonselected	=	72
Wald chi2(6)	=	73.61
Prob > chi2	=	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
exporty_n						
internal	.0040702	.0019837	2.05	0.040	.0001821	.0079582
extdebt	-.0124291	.0025526	-4.87	0.000	-.0174322	-.0074261
logsize	.3319389	.0598555	5.55	0.000	.2146243	.4492535
lastappliedbankcredit	-.1893126	.0629609	-3.01	0.003	-.3127136	-.0659115
targetdebtratio	0	(omitted)				
randdev2014	.0232347	.0035865	6.48	0.000	.0162052	.0302641
salesmkt2014	.0280949	.0044911	6.26	0.000	.0192925	.0368974
_cons	-4.494724	.9675645	-4.65	0.000	-6.391115	-2.598332
targetdebtratio						
internal	3.75e-06	52.22402	0.00	1.000	-102.3572	102.3572
extdebt	2.53e-06	73.76782	0.00	1.000	-144.5823	144.5823
logsize	.0000185	1665.539	0.00	1.000	-3264.397	3264.397
lastappliedbankcredit	.0000872	1594.05	0.00	1.000	-3124.28	3124.281
targetdebtratio	11.87479	23446.89	0.00	1.000	-45943.19	45966.94
randdev2014	4.75e-06	95.36899	0.00	1.000	-186.9198	186.9198
salesmkt2014	9.20e-06	114.4454	0.00	1.000	-224.3089	224.3089
years_log	.0001211	2527.447	0.00	1.000	-4953.706	4953.706
intangibleassets	2.62e-06	55.2239	0.00	1.000	-108.2369	108.2369
_cons	-6.037719	.	.	.	.	.
/mills						
lambda	0	(constrained)				
rho	0.00000					
sigma	.13952639					

Table F.58: Heckman 2 Step Analysis on the effects of financing sources and characteristics on whether high-tech SMEs will export, where the treatment group is if the firm is profitable (model 1)

```
Heckman selection model -- two-step estimates   Number of obs     =         84
(regression model with sample selection)               Selected     =         51
                                                       Nonselected =         33

                                                Wald chi2(7)      =      14.15
                                                Prob > chi2       =     0.0486
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
exporty_n						
internal	-.0008617	.0020401	-0.42	0.673	-.0048603	.0031368
extdebt	-.0151329	.0057324	-2.64	0.008	-.0263682	-.0038975
logsize	.0238032	.0233819	1.02	0.309	-.0220246	.069631
lastappliedbankcredit	.155576	.0683765	2.28	0.023	.0215605	.2895916
targetdebtratio	-.1058938	.1344072	-0.79	0.431	-.3693271	.1575394
randdev2014	.0031798	.0042939	0.74	0.459	-.0052361	.0115957
salesmkt2014	.0024771	.0053546	0.46	0.644	-.0080177	.0129718
_cons	.2014936	.4664744	0.43	0.666	-.7127794	1.115767
profitable						
internal	.0111677	.0066425	1.68	0.093	-.0018513	.0241868
extdebt	-.0168012	.0175069	-0.96	0.337	-.0511141	.0175118
logsize	.1360208	.0786514	1.73	0.084	-.0181332	.2901748
lastappliedbankcredit	.4448603	.2554085	1.74	0.082	-.0557311	.9454518
targetdebtratio	.2680004	.6093359	0.44	0.660	-.9262759	1.462277
randdev2014	-.0190323	.0096072	-1.98	0.048	-.037862	-.0002026
salesmkt2014	.0120877	.0187996	0.64	0.520	-.0247589	.0489342
years_log	.6382993	.2498095	2.56	0.011	.1486816	1.127917
intangibleassets	-.005086	.0057697	-0.88	0.378	-.0163944	.0062224
_cons	-3.633144	1.269651	-2.86	0.004	-6.121614	-1.144674
/mills						
lambda	.0974479	.195649	0.50	0.618	-.2860171	.4809129
rho	0.29903					
sigma	.32587905					

Table F.59: Heckman 2 Step Analysis on the determinants of internal finance, where the treatment group is the possession of a target debt ratio (model 1)

```
Heckman selection model -- two-step estimates   Number of obs     =         89
(regression model with sample selection)               Selected     =         11
                                                       Nonselected =         78

                                                Wald chi2(7)      =       0.01
                                                Prob > chi2       =     1.0000
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
internal						
peopleemployed_log	-98.58944	5496.96	-0.02	0.986	-10872.43	10675.25
years_log	185.1232	7565.068	0.02	0.980	-14642.14	15012.38
randdev2014	2.168921	182.3431	0.01	0.991	-355.217	359.5548
businesssetup_log	-443.8732	19989.82	-0.02	0.982	-39623.2	38735.45
roi	-47.0395	2254.209	-0.02	0.983	-4465.207	4371.128
sizerev_log	-209.0541	6208.13	-0.03	0.973	-12376.76	11958.66
intangibleassets	2.287013	88.29771	0.03	0.979	-170.7733	175.3473
_cons	6986.323	262894.9	0.03	0.979	-508278.3	522250.9
targetdebtratio						
peopleemployed_log	.1029039	.2662043	0.39	0.699	-.4188469	.6246548
years_log	-.1311894	.3352283	-0.39	0.696	-.7882249	.525846
randdev2014	-.0035595	.0091891	-0.39	0.698	-.0215699	.0144509
businesssetup_log	.3581704	.2520946	1.42	0.155	-.1359258	.8522667
roi	.0408485	.0380297	1.07	0.283	-.0336884	.1153854
sizerev_log	.0923874	.2683796	0.34	0.731	-.433627	.6184018
intangibleassets	-.0016378	.0060921	-0.27	0.788	-.0135781	.0103025
businesssetup_log	0	(omitted)				
_cons	-3.479064	2.881604	-1.21	0.227	-9.126904	2.168777
/mills						
lambda	-1770.718	73107.46	-0.02	0.981	-145058.7	141517.3
rho	-1.00000					
sigma	1770.7183					

Table F.60: Heckman 2 Step Analysis on the determinants of debt finance, where the treatment group is the possession of a target debt ratio (model 2)

```
Heckman selection model -- two-step estimates   Number of obs     =         90
(regression model with sample selection)               Selected     =         12
                                                       Nonselected =         78

                                                Wald chi2(7)      =      64.16
                                                Prob > chi2       =     0.0000
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
extdebt						
peopleemployed_log	.3277263	6.127068	0.05	0.957	-11.68111	12.33656
years_log	5.074127	6.503983	0.78	0.435	-7.673445	17.8217
randdev2014	.2952662	.2784408	1.06	0.289	-.2504677	.8410001
businesssetup_log	-13.18724	10.38952	-1.27	0.204	-33.55033	7.175847
roi	-2.338857	1.599203	-1.46	0.144	-5.473237	.7955239
sizerev_log	11.39513	5.055663	2.25	0.024	1.486212	21.30405
intangibleassets	.3847342	.0995134	3.87	0.000	.1896914	.5797769
_cons	-114.2697	86.37522	-1.32	0.186	-283.562	55.02265
targetdebtratio						
peopleemployed_log	.1377262	.2613731	0.53	0.598	-.3745557	.6500082
years_log	-.2331495	.3238225	-0.72	0.472	-.8678299	.4015308
randdev2014	-.0048809	.0088927	-0.55	0.583	-.0223103	.0125484
businesssetup_log	.2914984	.247027	1.18	0.238	-.1926657	.7756625
roi	.0521959	.0384693	1.36	0.175	-.0232026	.1275943
sizerev_log	.0289695	.2613791	0.11	0.912	-.483324	.541263
intangibleassets	-.0004465	.0059409	-0.08	0.940	-.0120905	.0111975
retainearningscrnt	.0027365	.0056387	0.49	0.627	-.0083151	.013788
_cons	-2.798569	2.753259	-1.02	0.309	-8.194858	2.59772
/mills						
lambda	-3.457484	32.62774	-0.11	0.916	-67.40667	60.4917
rho	-0.56493					
sigma	6.1202271					

Table F.61: Heckman 2 Step Analysis on the determinants of equity finance, where the treatment group is the possession of a target debt ratio (model 3)

```
Heckman selection model -- two-step estimates   Number of obs     =         90
(regression model with sample selection)              Selected    =         12
                                                      Nonselected =         78

                                                Wald chi2(7)      =       0.11
                                                Prob > chi2       =     1.0000
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
extequity						
peopleemployed_log	30.19007	213.0255	0.14	0.887	-387.3323	447.7124
years_log	-67.64278	246.4254	-0.27	0.784	-550.6276	415.3421
randdev2014	-1.591102	9.205012	-0.17	0.863	-19.63259	16.45039
businesssetup_log	73.7543	352.7208	0.21	0.834	-617.5658	765.0744
roi	13.05945	55.95292	0.23	0.815	-96.60627	122.7252
sizerev_log	19.80158	180.0352	0.11	0.912	-333.0609	372.6641
intangibleassets	-.3773176	3.466444	-0.11	0.913	-7.171424	6.416788
_cons	-1071.501	3526.019	-0.30	0.761	-7982.371	5839.368
targetdebtratio						
peopleemployed_log	.1377262	.2613731	0.53	0.598	-.3745557	.6500082
years_log	-.2331495	.3238225	-0.72	0.472	-.8678299	.4015308
randdev2014	-.0048809	.0088927	-0.55	0.583	-.0223103	.0125484
businesssetup_log	.2914984	.247027	1.18	0.238	-.1926657	.7756625
roi	.0521959	.0384693	1.36	0.175	-.0232026	.1275943
sizerev_log	.0289695	.2613791	0.11	0.912	-.483324	.541263
intangibleassets	-.0004465	.0059409	-0.08	0.940	-.0120905	.0111975
retainearningscrnt	.0027365	.0056387	0.49	0.627	-.0083151	.013788
_cons	-2.798569	2.753259	-1.02	0.309	-8.194858	2.59772
/mills						
lambda	356.2857	1205.451	0.30	0.768	-2006.354	2718.926
rho	1.00000					
sigma	356.28574					