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EXPORT CHARACTERISTICS OF IRISH MANUFACTURING ENTERPRISES

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Thesis submitted to Trinity College, University of Dublin in fulfilment of the requirements for the degree of Doctor of Philosophy (Ph.D.)

December 2003

Declaration

I declare that this thesis has not been submitted as an exercise for the degree of Doctor of Philosophy (Ph.D.) at this or any other university. All research contained herein that is not entirely my own but is based on research that has been carried out jointly with others is duly acknowledged in the text wherever included.

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Summary

The aim of this thesis is to investigate the export characteristics of enterprises, using the manufacturing sector of Ireland between 1991 and 1998 as a case study.

The growth of Irish merchandise exports is considered to be a major factor contributing to Ireland's remarkable economic performance during the 1990s. However, aggregate trade data reveals that most of the increase in manufactured exports in this period was due to the presence of export-orientated foreign-owned enterprises in Irish manufacturing. Moreover, the export propensity of indigenous-owned enterprises remained relatively constant during the 1990s, creating doubt about the international competitiveness of indigenous enterprises. This thesis uses micro-level data to conduct three empirical studies of the export characteristics of enterprises in Irish manufacturing in an attempt to explain the export patterns of indigenous-owned enterprises between 1991 and 1998.

Chapter 2 reflects upon possible macroeconomic explanations of Irish export trends in the 1990s, and notes that such traditional explanations do not fully account for the changes that occurred in manufactured export patterns during this time period. The strength and uniqueness of the three empirical studies included in this thesis derives from the use of micro-level data to reveal the individual enterprise features of exporters. Chapter 2 reviews the micro-level data set used throughout the thesis and finds evidence that foreign-owned enterprises have superior enterprise and exporting features relative to indigenous-owned enterprises. The data set also reveals that the destination pattern of

Irish manufactured exports is strongly correlated with enterprise-ownership; indigenous enterprises export primarily to the United Kingdom and the European Union, whilst foreign-owned enterprises increasingly exported more to the United States during the time period reviewed. An econometric analysis of all enterprises in chapter 3 confirms the superior performance characteristics of foreign-owned enterprises relative to indigenous enterprises in Irish manufacturing.

Focusing solely on indigenous enterprises, we find those that export are larger in terms of employment and turnover, and are more productive relative to indigenous non-exporters. Moreover, indigenous enterprises that are more productive are more likely to enter the export market. However, once in the export market, indigenous exporters do not appear to become any more productive relative to non-exporters. Chapter 3 also introduces the concept of export destination as a feature of Irish export patterns. Because of the traditional economic and institutional links between Ireland and the UK, we consider exports to the UK to be 'regional' shipments rather than exports, and compare the features of Irish enterprises that export to the UK with enterprises that export to Non-UK destinations. We find that UK-exporters are not as productive as Irish enterprises that export to Non-UK destinations. Chapter 3 is the first enterprise-level study of the exporting characteristics of indigenous enterprises in Irish manufacturing, and our evidence concerning enterprise productivity both before and after exporting, and for UK and Non-UK exporters, has significant implications for policy measures designed to improve the export propensity of indigenous enterprises.

Chapter 4 presents a dynamic model of the determinants of exporting enterprises in Irish manufacturing between 1991 and 1998, focusing on the influence of sunk costs on the export characteristics of indigenous enterprises. When making the decision to become an exporter or not, we hypothesise that enterprises face fixed costs to enter the export marketplace, and that these fixed or sunk costs are not recoverable. Because expected future profits must exceed any fixed costs associated with entering the export market, sunk costs will thus influence the decision of the enterprise to become an exporter or not. Moreover, export status in the previous period is likely to be a determinant of the current export status of the enterprise because exporters that have already incurred sunk start-up costs are more likely to continue to export relative to previous non-exporters.

Using a range of model specifications we find that sunk costs are an important determinant of the decision by Irish manufacturers to export or not, and costs incurred to enter the export market do not fully depreciate when an enterprise exits the export market. Given the differences in enterprise characteristics of Irish enterprises that export to different destinations established in chapter 3, we also test for possible differences in the nature of sunk costs faced by Irish exporters to UK and Non-UK destinations. Sunk costs associated with exporting to the UK are found to be significantly lower than sunk costs associated with exporting to other destinations, a result that may help to explain the stable export propensity of indigenous enterprises to Non-UK destinations such as the EU during the 1990s.

A feature of Irish manufacturing during the 1990s was an increase in the number and influence of export-orientated, foreign-owned enterprises using Ireland as a manufacturing base. However, there is little empirical evidence indicating whether or not these foreign-owned enterprises have in some way influenced the export characteristics of indigenous enterprises in Irish manufacturing. Chapter 5 examines whether *export spillovers* were generated by foreign-owned enterprises to indigenous enterprises in Irish manufacturing between 1991 and 1998. In particular, we examine the influence of export spillovers from foreign enterprises on both the decision of indigenous enterprises to enter the export market, as well as their propensity to export more when they are exporters. Our results confirm that export spillovers from foreign to indigenous-owned enterprises have a positive association with the decision by indigenous enterprises to enter the export market. However, the proportion of turnover exported by indigenous enterprises is negatively associated with export spillovers from foreign-owned enterprises in Irish manufacturing, a result contrary to that found in similar previous empirical studies.

Our study of export spillovers in Irish manufacturing extends the empirical basis of similar previous studies by including the nationality of foreign-owned enterprises into the analysis, as well as a breakdown of foreign versus indigenous ownership within each Irish manufacturing sector. We find that most export spillovers are generated by US-owned foreign enterprises located in Irish manufacturing. Additionally, indigenous enterprises located in sectors overwhelmingly dominated by export-orientated foreign enterprises appear to benefit little from export spillovers. Our results suggest that both the nationality of foreign enterprise ownership and the level of dominance by export-

orientated foreign enterprises in individual Irish manufacturing sectors are both important determinants of the size and nature of export spillovers generated by foreign-owned enterprises to indigenous enterprises.

The thesis thus incorporates three empirical studies that attempt to explain the features of exporters relative to non-exporters using a data set of all individual enterprises that comprise Irish manufacturing between 1991 and 1998. As well as being the first enterprise-level study explaining the export determinants of Irish manufacturing enterprises, the thesis emphasizes the importance of export destination patterns in our understanding of the characteristics of exporting enterprises, a feature not extensively examined in similar previous empirical studies of manufacturing for other developed countries. Additionally, our study of export spillovers highlights the need to consider the ownership nationality of foreign direct investment in Irish manufacturing when determining the export-related benefits to indigenous enterprises from hosting foreign enterprises.

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CHAPTER 1

INTRODUCTION TO THE THESIS

1.1 Setting the Context

The exceptional economic performance of the Irish economy during the 1990s has been attributed to many factors, one of the most important of which is the remarkable growth of merchandise exports.[1] Real exports of goods and services from Ireland in this period grew on average by almost 14 per cent per annum, well above the export growth rates of other EU and OECD countries during the 1990s (Figure 1.1). Irish GDP growth over the same period averaged approximately seven per cent per annum, between two and three times the average GDP growth of other EU and OECD countries (Figure 1.2). Irish export growth was thus double the average rate of Irish GDP growth during the 1990s, and well above that of comparable OECD countries.[2]

Forfás[3] (2002) attributes Ireland's export performance to a number of factors, including: the introduction of export sales relief in 1956[4]; Ireland's entry to the European Union (EEC) in 1973; breaking the currency link with the pound sterling and the subsequent entry of the Irish pound to the European Economic Monetary Union in 1992; and ongoing participation in trade and investment liberalisation under the auspices of the World Trade Organisation. Moreover, Krugman (1997) suggests that export growth has partly been a result of how the "balance of geographical advantage" has tilted in Ireland's favour due to the decreasing importance of

[1] See Gray (1997), Murphy (1998), Sweeney (1998), and Barry (1999) for discussion of the causes of the "Celtic Tiger".
[2] See Ruane and Sutherland (2002) for a comparison of OECD manufactured trade growth.
[3] Forfás is the policy and advisory board for industrial development in Ireland.
[4] The introduction of export sales relief followed an extended period of import-substituting industrialisation from 1932. From the early 1930s to the late 1950s high tariff barriers and a strict

transportation costs relative to other factors such as delivery time, communication, and personal contact, making Ireland's relative geographic isolation irrelevant in the new economic geography.[5]

More directly, export growth during the 1990s has been attributed to the competitiveness of the Irish economy, the result of a combination of the depreciation of the real effective exchange rate, wage restraint, and productivity gains by the Irish workforce (Barry, 1999). Whilst such factors have undoubtedly contributed to Irish export growth, there is a general consensus that the rapid growth of *manufacturing* exports is the result of an industrial strategy based on large inflows of foreign direct investment (FDI) that has encouraged foreign-owned enterprises (FOEs)[6] to establish manufacturing plants in Ireland, usually wholly-owned subsidiaries or "green-field" investment, to produce specifically for export markets.[7] FDI inflows to Ireland exhibit an uninterrupted upward trend during the 1990s, with Ireland being the highest per capita destination of US investment in the European Union during this time (Barrell and Pain, 1997).[8]

The impact of this industrial strategy of hosting foreign-owned enterprises in Irish manufacturing that produce almost exclusively for the export market has been

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prohibition on the foreign ownership of enterprises operating in Ireland were the main features of industrial policy. See McAleese (1971) for a review of Irish industrial policy prior to the 1990s.

[5] Ireland is traditionally classified as a "peripheral" economy because of its geographical distance from Europe's markets (European Commission, 1990).

[6] For the purpose of this thesis we define foreign-owned enterprises as those that are majority-owned by foreign shareholders, a definition based on that used in the *Census of Industrial Enterprises* compiled by the *Central Statistics Office* of Ireland (See chapter 2). Additionally, although we acknowledge the strict definitions of the terms "firm", "company", "plant", and "enterprise", the term enterprise is used synonymously throughout this thesis.

[7] An extensive literature seeks to explain the reasons for FOEs establishing a presence overseas rather than exporting directly. See Markusen (1995) and Caves (1996) for a survey of the literature.

[8] See Krugman (1997), Leddin and Walsh (1997), Barry and Bradley (1997), McAleese (1998), and Ruane and Görg (1999) for discussion of the determinants of FDI in Irish manufacturing.

pronounced. Although manufactured exports by all enterprises increased by more than 250 per cent between 1991 and 1998, exports by foreign-owned enterprises accounted for 95 per cent of the total increase (Forfás, 2000, p. 24). As a result, the share of manufactured exports by Irish-owned enterprises in total manufactured exports fell from 26 per cent in 1991 to 12 per cent in 1998 (Forfás, 2000, p.9).

With the foreign-owned sector accounting for an increasing proportion of Irish manufactured exports in the 1990s, concern has been expressed about the international competitiveness of indigenous or Irish-owned enterprises (IOEs) in Irish manufacturing (Wrynn, 1997; Forfás, 2002). This concern is emphasized by the export performance of indigenous enterprises in the 1990s compared to previous time periods; between 1986 and 1991, the average annualised export growth rate of indigenous manufacturers was 12.3 per cent, but indigenous export growth fell to an average of 4.4 per cent per annum between 1991 and 1998 (Forfás, 2000, p.25). Thus although indigenous manufactured exports grew during the 1990s, the relatively slow export growth and declining share of indigenous exports in total Irish manufacturing exports during a decade of significant world economic growth has highlighted the issue of indigenous export competitiveness over the longer term. Promoting the export development of indigenous enterprises has become an important strand of Irish industrial policy, reflecting the view of policy makers that Irish manufacturing has perhaps become over-reliant on the export activities of FOEs (Bell, 1997).[9]

The relatively poor export performance of indigenous enterprises over the period is reinforced when Irish manufacturing is examined at the sectoral level. Rising export

levels during the 1990s were characteristic of a relatively small number of manufacturing sectors in Ireland in all of which FDI is a dominant force, and which reflect the shift in export sales from Irish manufacturing to goods with relatively high income elasticities.[10] The resulting changes meant that by 1998, the propensity to export was highest in the *Chemical* and *Electronics* sectors at 97 and 93 per cent respectively (Forfás, 2000; p.23), sectors in which FDI was dominant.[11] In contrast, traditional exporting sectors where indigenous-owned enterprises are dominant experienced a significant decline in exports relative to other sectors. For example, the *Food & Beverage* sector accounted for approximately 25 per cent of all manufactured exports in 1991, but only 10 per cent in 1998, and export sales in the *Textiles & Clothing* sector fell in both real terms and as a share of total export sales.

Aggregate and sectoral trade patterns of Irish manufacturing thus suggest that indigenous enterprises have shown relatively limited export growth during the 1990s, a period of exceptional Irish and world economic growth. However, entry and exit into foreign marketplaces by Irish enterprises is not directly observable at the level of aggregation for which trade and industry data are generally available. In order to understand fully the nature of individual manufacturing enterprises and their export responses, analysis should be at a micro-level. The availability of enterprise-level data allows us to analyse the unique characteristics and export profile of Irish manufacturing.

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[9] Direct export promotion of Irish indigenous enterprises between 1991 and 1998 was the primary responsibility of An Bord Tráchtála (ITB). In 1998, ITB merged with Forbairt to form Enterprise Ireland.

[10] Ruane and Görg (1997), McCarthy (1999), and Roper and Frenkel (2000) discuss the role of FDI and the growth of the foreign-owned high-tech sector in Ireland.

Empirical studies of the relationship between enterprise performance and exporting for manufacturing sectors in other developed countries have typically included all enterprises operating in the manufacturing sector, regardless of ownership. In the Irish context, however, it is vitally important not to amalgamate foreign-owned and indigenous enterprises for several reasons. Firstly, there are significant differences in characteristics, such as employment size, turnover, and capital intensity, between foreign-owned and indigenous enterprises. Secondly, and most importantly, foreign-owned enterprises located in Ireland ship almost all of their output to other destinations and do not produce in Ireland to serve the domestic Irish market. These differences are indicative of what can be described as a 'dualistic' manufacturing industry, with foreign-owned enterprises concentrated in high-technology, export-orientated sectors, and indigenous enterprises concentrated in low-technology sectors that are less export-orientated. Because foreign-owned enterprises locate in Ireland specifically to ship most of their output to other destination markets in the European Union, it is of little interest to us to investigate the nature of the export characteristics of foreign-owned enterprises. Instead, the use of enterprise-level data which distinguishes between foreign and indigenous-owned enterprises allows us to concentrate our analysis specifically on explaining the export performance of indigenous Irish enterprises.

Irish manufacturing is also characterised by the changing destination pattern of Irish manufactured exports during the 1990s. The historical dominance of the United Kingdom (UK) as an export destination continued to decline over the period, and other export destinations such as the European Union (EU) and the United States of

[11] *Chemicals* includes Pharmaceuticals. *Electronics* includes Office Machinery and Computers, Electrical Machinery, Radio, Television, and Communication Equipment, and Medical, Precision, and

America (US) became increasing important for Irish exporters. It is possible that the number of foreign marketplaces an Irish enterprise exports to, and that exporting beyond what could be considered the regional UK market, are indicators of the strength of the export activity of an enterprise. Throughout our analysis we explore the consequences of this changing pattern of export destination for the export performance of Irish-owned enterprises.

By incorporating enterprise ownership and export destination patterns into the analyses, this thesis explores enterprise-level reasons for the relatively poor export performance of Irish-owned enterprises during the 1990s. The thesis comprises three empirical studies that search for explanations of the export performance of Irish-owned manufacturing enterprises during the 1990s using *enterprise-level* data. We focus on the export performance of Irish enterprises for two reasons: firstly, because Irish industrial policy has placed strong emphasis on the export performance of the manufacturing sector as an engine of growth for the wider Irish economy (Culliton, 1992; Ruane and Görg, 1996); and secondly, because if Ireland is to grow successfully as a small open economy, it must be competitive in its export markets.

The first empirical study in the thesis concentrates on explaining the characteristics of Irish enterprises by posing a series of questions relating the characteristics of indigenous enterprises to their export performance. For example, are there enterprise characteristics, such as employment size and employee skill intensity, that differ between exporters and non-exporters? Do eventual exporters exhibit superior performance characteristics relative to continuing non-exporters prior to their entry

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Optical Instruments.

into the export market? Furthermore, what specific factors determine whether an enterprise will enter the export market or not? Little is known about the enterprise-level determinants of exporting, although theoretical papers which develop the *sunk cost hypothesis* provide a basis for empirical research. It is possible that entry and export to the export market is constrained by the start-up or sunk costs that each enterprise must incur in order to become an exporter, so that an enterprise may need to be more productive in order to meet these start-up costs and thus enter the export market. We investigate the determinants of exporting in chapter 4.

In studying differences in export patterns across sectors, the question arises of whether or not the dominance of export-orientated foreign-owned enterprises in Irish manufacturing have some influence on the export performance of indigenous enterprises. If foreign-owned enterprises do have some positive influence on the export performance of indigenous enterprises, how does this influence *spill-over* to indigenous enterprises? We investigate this issue in chapter 5.

The availability of enterprise-level annual *Census of Industrial Enterprises* data for Irish manufacturing between 1991 and 1998 allows us a unique opportunity to seek empirical evidence to each of these issues. Better understanding of the characteristics of Irish manufacturers at the enterprise-level will permit the development of appropriate policy responses that improve the export performance of indigenous Irish enterprises which, in turn, will enhance the contribution of manufactured exports to Irish economic growth.

1.2 Structure of the Thesis

The thesis comprises three empirical essays that focus on the export features of indigenous enterprises in Irish manufacturing by utilizing a data set of Irish manufacturing enterprises that is described in chapter 2. We disaggregate the data in chapter 2 in order to review the characteristics of foreign and indigenous-owned enterprises, noting the differences in the export propensity of both enterprise types, the changing geographic destination of Irish exports based on ownership, and the sectoral pattern of ownership and exports.

The first empirical study in chapter 3 follows the growing literature developed by Bernard and Jensen (1997) and searches for performance differences between exporting and non-exporting enterprises. We use econometric analysis to establish evidence of any premium that the enterprise characteristics of exporters exhibit relative to the enterprise characteristics of non-exporters. Our initial econometric results confirm the superior performance of exporters relative to non-exporters before they begin exporting. Additionally, we examine the export propensity and destination patterns of exporters and confirm the superior performance characteristics of enterprises that export predominantly to Non-UK destinations relative to those who export predominantly to the UK (referred to henceforth as 'UK exporters').

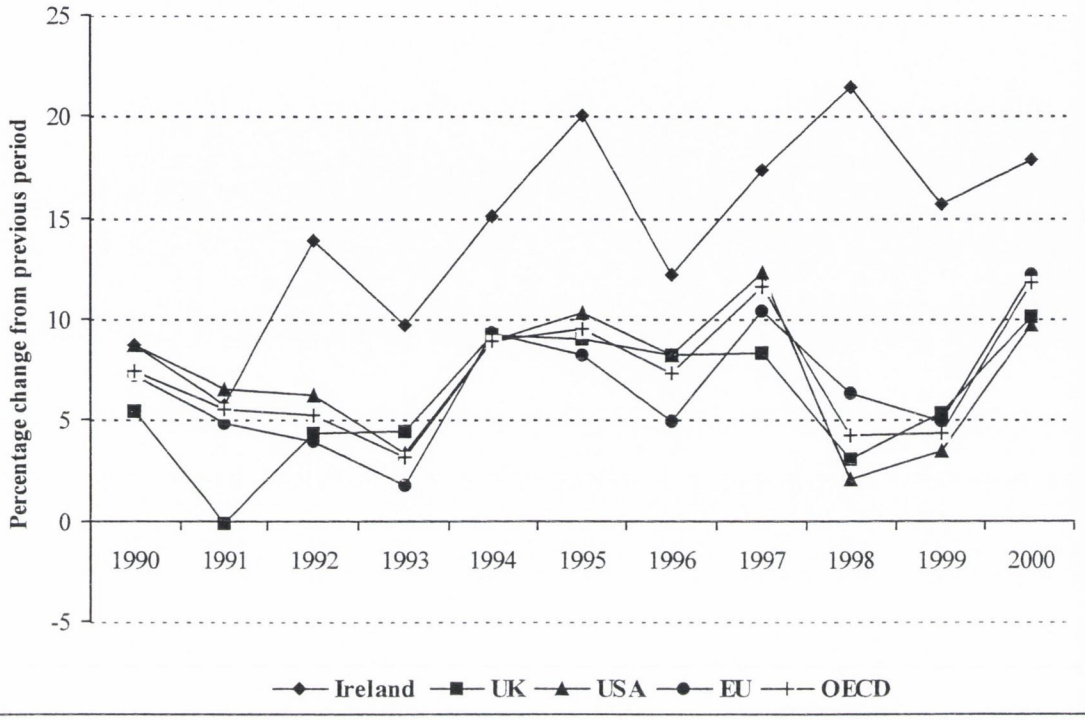
In chapter 4 we extend the analysis of chapter 3 to search for evidence of the determinants of exporting in the context of the sunk cost hypothesis. Based on an empirical model by Roberts and Tybout (1997), we conduct an econometric study which attempts to explain the movement of Irish enterprises into and out of the export market on the premise that an enterprise must incur start-up costs in order to begin

exporting. In addition to characteristics such as enterprise size and average wages, sunk costs are shown to be a significant determinant of the decision to enter the export market. Moreover, sunk costs appear to be higher for enterprises exporting to Non-UK destinations, so that exporters to Non-UK markets are less likely to enter and exit these markets as frequently as Irish enterprises exporting into the UK marketplace.

The third empirical study in chapter 5 searches for evidence that foreign enterprises have some influence on the export performance of indigenous enterprises; that is, we search for evidence that the presence of foreign-owned enterprises in Irish manufacturing creates 'export spillovers' for indigenous enterprises. Given the importance of foreign-owned enterprises in terms of output, employment, and exporting in Irish manufacturing, we investigate the impact of the presence of foreign-owned enterprises located in Irish manufacturing on both the decision to export and the export propensity of Irish-owned enterprises. Following a review of the concentration of foreign-owned enterprises across Irish manufacturing sectors, we use econometric analysis to examine whether or not foreign-owned enterprises enhance the export performance of indigenous enterprises. We find significant but mixed evidence of export spillovers from foreign-owned enterprises to indigenous enterprises; foreign presence appears to have a positive association with the decision by Irish enterprises to enter the export market, but a negative association with the export intensity of Irish enterprises. Moreover, export spillovers appear to be generated mainly by US-owned enterprises, and differ with the sectoral concentration of foreign-owned enterprises.

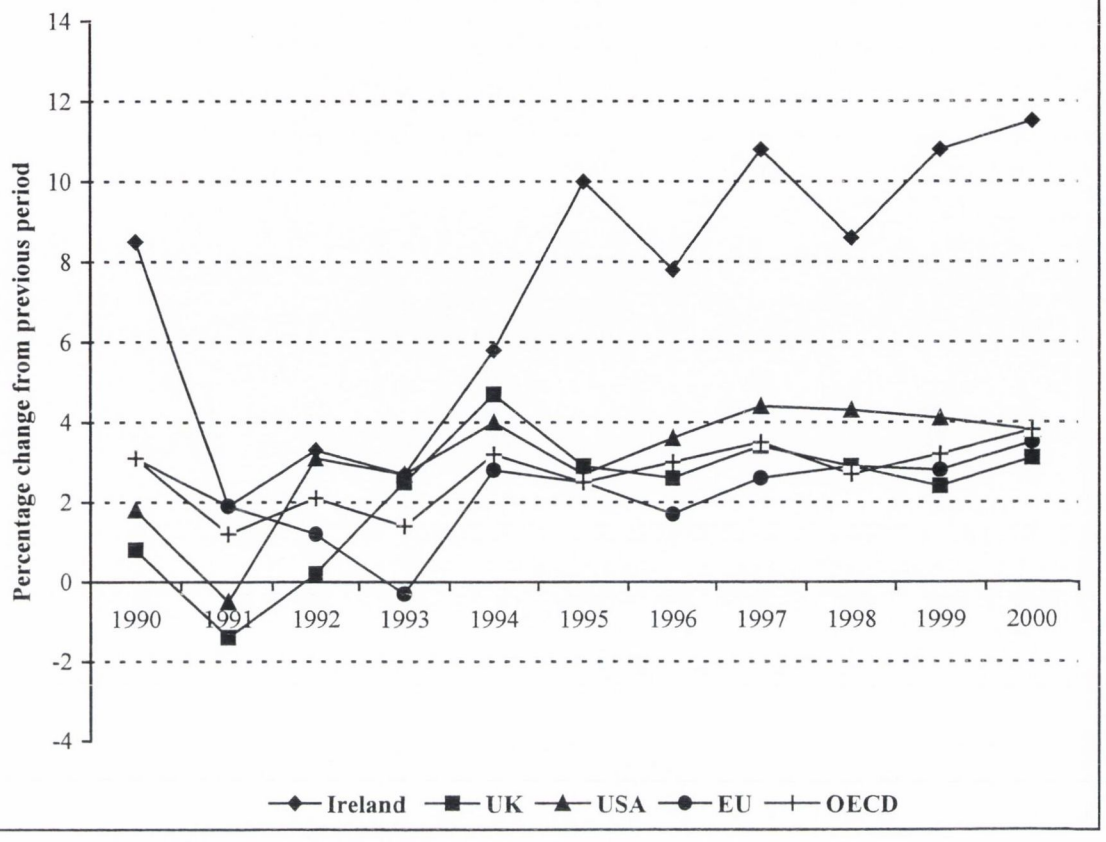
Each individual chapter in the thesis contains an appendix incorporating tables, graphs, and other appendices referred to in the respective chapter. Each chapter contains a concluding section and thus only a brief summary of each chapter is presented to form the overall conclusion of the thesis in chapter 6, where some policy implications and issues for further research arising from this thesis are discussed.

Figure 1.1: Real Exports of Goods and Services in Selected OECD Countries



Source: OECD (2002). *Economic Outlook.*

Figure 1.2: Real GDP in Selected OECD Countries



Source: OECD (2002). *Economic Outlook.*

CHAPTER 2

EXAMINING IRISH MANUFACTURING EXPORTS

2.1 Macroeconomic Explanations of Irish Manufactured Exports

The changing nature of Irish manufacturing during the 1990s is reflected in macroeconomic and industry data, with the export patterns of Irish enterprises generally attributed to macroeconomic shocks affecting both domestic and foreign economies. Such shocks include changes in real exchange rates, fluctuations in economic activity, reductions in trade barriers, and expansion of the European Union. Each of these factors could be expected to affect the export trends of Irish manufacturers during the 1990s.

Explanations for trade flow changes traditionally centre on variations in the real exchange rate. Figure 2.1 compares changes in the export volume of Irish manufactures and the Irish trade weighted exchange rate index during the 1990s. The correlation between real exchange rate changes and manufactured export growth shows mixed results. Exchange rate depreciation toward the end of 1992 is possibly associated with a lagged rise in export volume between 1994 and 1995, whilst significant depreciations between 1996/1997 and 1997/1998 are correlated with large increases in export volumes.

The economic conditions of Ireland's major trading partners could be expected to directly influence their demand for Irish exports. Figure 1.2 (chapter 1) contrasts the GDP growth rates of Ireland's major trading partners, the EU, the UK, and the US. Although real GDP growth in Ireland's major trading partners was positive during the

1990s, Irish GDP growth was substantially greater, with possible implications for total demand growth for domestically produced manufactured goods.

Forfás (2000, p. 11) attributes the relatively poor performance of Irish indigenous exporters to the possibility "...that indigenous firms have substituted domestic for foreign export sales to exploit faster demand growth in the home market." As Figure 2.2 illustrates, real total domestic demand in Ireland grew at an annual average rate of 3.4 per cent between 1991 and 1998, far higher than both EU and OECD averages (OECD, 2002). It is possible that this exceptional growth in domestic demand made it more attractive for indigenous enterprises to sell into the Irish marketplace rather than export in order to exploit faster demand growth in the domestic market.

Another factor that may explain Irish export trade patterns during the 1990s is the improved competitiveness of Irish manufacturers. Changes in relative unit wage costs provide a proxy for competitiveness between Ireland and its major trading partners. The *Index of Relative Wage Costs in Manufacturing Industry* for the 1990s is shown in Figure 2.3, and reflects slower Irish manufacturing wage growth relative to that of trading partners. This improvement in Irish competitiveness over the 1990s does not, however, account for the constant export propensity of indigenous manufacturers over the period.

Thus the relatively slow growth of Irish manufactured exports during the 1990s is not fully explained by generally positive macroeconomic conditions such as exchange rate movements, increased demand in export markets, and improved Irish competitiveness described above. In order to understand both the relatively slow

export growth and declining share of indigenous exports in total Irish manufacturing exports we use *enterprise-level* data throughout the thesis to examine the determinants of exporting, with a particular focus on the role of sunk costs and FOE export spillovers in the export decisions of IOEs. Micro-level data will allow us to search for enterprise-level explanations of export trends that hopefully provide greater insight than more traditional macro-level explanations of trade noted above.

2.2 The Micro-level Data Set of Irish Manufacturers

2.2.1 The Census of Industrial Enterprises

The empirical analyses in this thesis are based on annual *enterprise-level* data collected as part of the *Census of Industrial Production* (CIP) conducted annually by the Central Statistics Office (CSO) of Ireland. The Census of Industrial Production incorporates the *Census of Industrial Enterprises* (CIE) which is an annual census of enterprises that are wholly or primarily engaged in industrial production in Ireland.[12] An enterprise is defined as the smallest combination of legal units that is an organisational unit producing goods or services, which benefits from a certain degree of autonomy in decision making (for example, a company, partnership, or individual proprietorship).[13]

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[12] The *Census of Industrial Enterprises* is required under Council regulation (EC, Euratom) No. 58/97 and covers those enterprises that are wholly or primarily engaged in industrial production and have three or more persons engaged. The statistical summaries of CIE data reported in the thesis do not correspond to published CIE data because of the use of alternative deflators in the thesis. In keeping with the confidentiality requirements of the Central Statistics Office of Ireland the data were accessed under "safe-setting" conditions at the offices of the CSO.

[13] An enterprise may be a sole legal unit (CSO, 1998a, p.11). Although most previous empirical studies at the micro-level have used the plant as the unit of study, data limitations restrict our analysis to the enterprise. However, this is of relatively little consequence as Irish manufacturing enterprises are overwhelmingly single plant operations.

The annual Census data of Irish manufacturing enterprises available to us covers the years 1991 to 1998 inclusive and is categorised at a sectoral level using the 4-digit NACE Rev. 1 nomenclature.[14] The Census data are released with individual enterprise codes, permitting identification of each enterprise between years, and includes expenditure data on inputs such as labour and materials used, the value of turnover, the value of turnover exported, and the proportion of exports shipped to four primary destinations, the United Kingdom (UK), the European Union (EU), the USA (USA), and the Rest of the World (ROW).

The Census contains data for all enterprises with three or more persons engaged; 'small' enterprises are defined as those with 13 or fewer persons engaged. These smaller enterprises are given a shorter census form which does not include certain questions asked of larger enterprises. In particular, with regard to exporting, small enterprises are asked how much of their output is exported. However, they are not asked any question regarding the destination of those exports, and in the CSO published data an estimation procedure is used to extrapolate values for small enterprises based on the destination of exports to the four export regions (UK, EU, USA, ROW) by enterprises with 14 or more employees. Because we incorporate export destination patterns into our empirical analyses in this thesis, small enterprises, being those with less than 14 employees, are omitted from the final data set used throughout the thesis. The exclusion of small enterprises has relatively little impact on the final data set used; enterprises with 14 or more employees employ 92 per cent of

[14] See Appendix 2.B for a description of Irish manufacturing sectors defined by the NACE Rev.1 industrial classification system.

all enterprise employees and produce more than 96 per cent of all enterprise turnover in Irish manufacturing, on average, between 1991 and 1998.[15]

The data set used in the thesis consists of 18,733 observations relating to 3,561 enterprises. Although the data are based on a full census they do not form a balanced panel as some enterprises commenced production after 1991 whilst others ceased production during the period considered and are thus not included in the Census. All monetary values of variables are measured in Irish pounds and deflated to 1985 constant prices using sectoral price indices.[16]

The Census of Industrial Enterprises (1991-1998) is thus a rich data source that allows examination of the micro-level relationship between enterprises and exporting. Being constructed as a panel of census rather than sample data, we are able to take account of more information than available from a sample or a single cross-section. In particular, we are able to control for individual enterprise heterogeneity and test more advanced econometric models under less restrictive assumptions. The Census also allows us to distinguish enterprises on the basis of ownership, foreign or indigenous, a feature vital to our understanding of the nature of exporting by Irish manufacturers.

2.2.2 Enterprise Ownership: IOEs versus FOEs

Perhaps the most distinctive feature of Irish manufacturing during the 1990s was the increased presence of foreign-owned enterprises, in terms of employment, turnover, and exports, which was the direct result of industrial policy initiatives designed to

[15] Own estimates derived from the Census of Industrial Enterprises (1991-1998).
[16] All variables with the exception of capital intensity are deflated using Table 2: Industrial Producer Price Index, *Economic Series*, CSO (1991b-1998b) at the two and three-digit level. The capital

attract export-orientated foreign direct investment (Ruane and Görg, 1996). The success of this industrial strategy has created, in some respects, a 'dualistic' manufacturing sector, with foreign and indigenous enterprises exhibiting distinctive characteristics and trade patterns. Thus any analysis of Irish manufacturing must distinguish clearly between enterprises on the basis of ownership. The Census of Industrial Enterprises defines Irish-owned enterprises (IOEs) and foreign-owned enterprises (FOEs) using a classification that is determined by the nationality of the owners of 50 per cent or more of the share capital, so that an enterprise is classified by majority ownership (CSO, 1998a).[17]

Table 2.1 provides a summary of the annual changes in Irish manufacturing enterprises between 1991 and 1998. The significant growth of Irish manufacturing during this time period is reflected in enterprise growth (14 per cent) and employment growth (25 per cent), but most significantly, in turnover growth of 130 per cent. However, growth during the 1990s is due primarily to the increased presence of foreign-owned enterprises in Irish manufacturing. The dualistic nature of Irish manufacturing based on ownership patterns is evident in the relative importance of Irish and foreign-owned enterprises presented in Table 2.1. Although the actual number of FOEs was stable between 1991 and 1998, employment in FOEs increased by more than 31 per cent, and turnover rose by more than 30 per cent during this time period. The result of this exceptional turnover growth was that the proportion of total Irish manufacturing turnover produced by FOEs grew from 59 per cent in 1991 to 77

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intensity variable is deflated using Table 5: Wholesale Price Indices for Energy Products, *Statistical Bulletin*, CSO (1991c-1998c).

[17] Irish FDI policy does not require minimum local equity participation. The *Census* does not detail the extent of foreign ownership of each enterprise. Because there are no recorded details on the extent of foreign ownership within an enterprise it is not possible to determine the impact of different shares of

per cent in 1998. Thus despite a rise in the value of turnover produced by indigenous enterprises, the corresponding proportion of total Irish manufacturing turnover produced by indigenous enterprises fell over the period. Similarly, the number of persons employed in Irish manufacturing increased between 1991 and 1998, but the proportion of indigenous enterprise employment relative to foreign enterprise employment declined slightly.

FOEs have also had a significant influence on sectoral adjustment within Irish manufacturing. Industrial policy implemented since the 1970s has transformed Irish manufacturing, especially through inflows of foreign direct investment mainly to the chemicals, computers, and high-tech engineering sectors. Whilst it is argued that this has led to the emergence of a dualistic industrial structure, where IOEs are heavily concentrated in the lower-tech sectors (Stewart, 1976; O'Malley, 1989), the presence of high-tech FOEs is also seen to encourage the establishment of spin-off indigenous enterprises in such sectors (Barry and Bradley, 1997). Such arguments are beyond the focus of this thesis, but they do highlight the exceptional sectoral differences that exist within Irish manufacturing based upon enterprise ownership, and may partly explain the production and exporting patterns of IOEs and FOEs.

Table 2.2 shows the importance of FOEs in Irish manufacturing in 1998 when the FOE-dominated sectors of *Chemicals* and *Electronics* are distinguished from other lower-tech, IOE-dominated manufacturing sectors.[18] FOEs are majority employers in

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foreign ownership in the analysis of the thesis. However, most FDI in Ireland is traditionally in the form of green-field investment with 100 per cent foreign ownership share.

[18] We use the share of employment of FOEs in various sectors to reflect their relative importance as turnover figures reported by FOEs in Ireland may be artificially inflated to the extent that FOEs engage in profit-switching transfer pricing. See Murphy (1998) for discussion of FOEs in Ireland using transfer pricing as a mechanism to avail of low corporate tax rates.

the Chemicals and Electronics sectors, and more than 90 per cent of total turnover in both Chemicals and Electronics sectors is produced by FOEs. The proportions of FOE employment and turnover in the low-technology sectors are lower than the corresponding proportions in the Chemicals and Electronics sectors, although the absolute levels of employment and turnover by FOEs are significantly large in the low-tech sectors. Table 2.2 features the importance of FOEs across all Irish manufacturing sectors, but emphasises their dominance of the Chemicals and Electronic sectors in particular.

FOEs located in Irish manufacturing are distinguished from IOEs by their export intensity. Between 1991 and 1998 FOEs exported more than 90 per cent of their manufactured turnover produced in Ireland, reflecting their focus of producing for export markets and not the domestic Irish market. In contrast, IOEs exported approximately 36 per cent of their turnover, a proportion that remained constant between 1991 and 1998 (although the volume and value of exports by IOEs did grow over the period). The relatively low export intensity of IOEs is also evident at the sectoral level. Table 2.2 shows that in the low-tech *Other Manufacturing* sector where IOEs dominate, approximately one-third of IOE turnover was exported. Even in the highly export-orientated Chemicals sector, IOEs exported less than 30 per cent of their turnover, reflecting the domestic orientation of IOEs.

The differences between IOEs and FOEs make it vitally important not to amalgamate foreign-owned and indigenous enterprises when analysing Irish manufacturing. Because FOEs located in Ireland ship almost all of their output to other destinations and do not produce in Ireland to serve the domestic market, there is little interest in

investigating the nature of FOEs and their export decisions. Rather, we concentrate our analysis on IOEs throughout the thesis, incorporating foreign enterprises only where they are believed to impact or influence the export decisions of indigenous enterprises.[19]

2.2.3 Export Features of IOEs

This thesis focuses on explaining the enterprise and export features of indigenous enterprises in Irish manufacturing using the micro-level data available in the Census of Industrial Enterprises between 1991 and 1998. As noted in chapter 1, export growth of IOEs between 1991 and 1998, which averaged 4.4 per cent per annum, was less than half of the average per annum export growth rate of IOEs between 1985 and 1990, and compared unfavourably with the export growth of foreign enterprises located in Irish manufacturing during the 1990s. The relatively poor export performance by IOEs during a period of exceptional economic growth in most OECD countries has raised doubt about the export ability of IOEs. The use of the micro-level data set allows us to examine the enterprise and export features of IOEs in a more detailed manner than macroeconomic data would permit.

Table 2.3 shows the number of exporting enterprises and the export intensity patterns of IOEs. The proportion of IOEs that export remained constant at approximately 60 per cent throughout the 1991 to 1998 period. The export intensity of enterprises, defined as the proportion of total turnover exported by all IOEs (both exporting and non-exporting), was also static at approximately 36 per cent during this relatively favourable period for exporting. Thus, whilst the volume of exports from IOEs grew

[19] Roper and Love (2001) distinguish between the different export features of indigenous and foreign owned enterprises in their study of the determinants of the export propensity of Irish manufacturing

over the period, the export intensity of IOEs did not change significantly, so that concerns expressed about the international competitiveness of IOEs by Forfás (2002), amongst others, seem justified.

Although the export propensity of IOEs did not increase to any significant degree during the 1990s, there are a number of explanations other than changing export competitiveness that may account for this. Most notably, IOEs may have substituted domestic sales for export sales in order to exploit the exceptional increase in real total domestic demand in Ireland (Figure 2.2). Furthermore, the growth of FDI during the 1990s that brought about significant changes in the composition of Irish manufacturing, with export-orientated FOEs concentrated in the high-tech Chemicals and Electronic sectors, may have altered the supply patterns of IOEs. It is possible that IOEs found it more attractive to supply manufactured goods to FOEs rather than export, so that IOEs became intermediate good suppliers to FOEs located in Ireland.

Whilst there may be a number of explanations for the lack of growth in IOE export propensity during the 1990s, UNCTAD (2002) notes that successful exporting involves more than just increasing international market shares. Greater export diversification, reflected by changing export destinations, could be an indication of the improved export propensity of Irish manufacturers.

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enterprises.

2.2.4 IOE Export Destinations

> *"The most striking consequence of the FDI inflow was that it facilitated the decoupling of the Irish economy from an almost total dependence of the United Kingdom as an export destination."*
>
> Barry F, J Bradley, and E O'Malley (1999, p. 1,780).

A feature of the empirical studies in this thesis is the introduction of *export destination* as an explanatory factor in the various analyses examining the export features of IOEs. It is possible that the destination of IOE exports may be correlated with the features of IOEs and their propensity to export. Moreover, changing export destination patterns may be a reflection of the changing export competitiveness of IOEs. The data set of Irish manufacturers available to us suggests various patterns of exporting by IOEs that are unobservable in macro-level data.

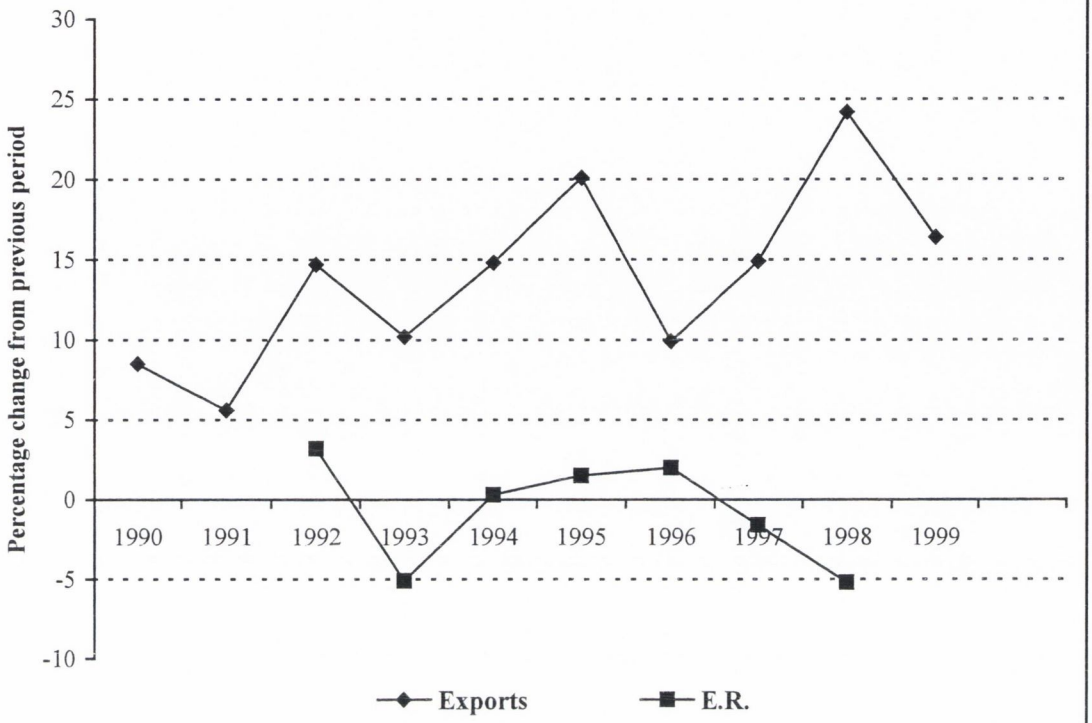
The Census data allow us to distinguish turnover produced for the domestic Irish market, as well as four export destinations: Great Britain and Northern Ireland (UK), the European Union (EU), the United States (USA), and the Rest of the World (ROW). Table 2.4 details the proportion of exports by IOEs to the four export destinations for 1991 and 1998. The UK and EU are the dominant destinations for IOE exports, with approximately 75 per cent of all IOE exports being shipped to these locations. Despite government policy designed to encourage IOEs to focus their exports toward the EU, exports to the EU remained relatively constant between 1991 and 1998.[20] However, these patterns are changing, with Non-EU markets growing in importance. A feature of the destination patterns is an almost doubling of the proportion of turnover exported to the USA by IOEs, although this remains a small proportion of total IOE exports.

Despite changes in the destination of exports during the 1990s, the UK remains the most important export market for IOEs. Historical economic, institutional, and social ties, along with trade agreements during previous decades, have given IOEs relatively greater trade access to the UK. Additionally, various transaction costs related to trade with the UK are significantly lower than the costs associated with exporting to more distant markets such as the US and ROW. Thus low transportation costs, cultural heritage, and economic and social ties associated with exporting to the UK suggests that the UK could be considered a 'regional' domestic marketplace for IOEs rather than a traditional export market, with Non-UK destinations being part of the 'global' market for IOEs.

The destination pattern of IOE exporters is important because the geographical direction of exporters may provide an indication of the changing export propensity and nature of IOEs. The number and type of export destination markets to which IOEs ship their output can be seen as proxies for the strength of IOE export activity; IOEs that export to the UK may not have to be as competitive as those that export beyond the UK to less traditional markets, where distribution networks are less well established and higher transport costs and institutional barriers to exporting must be overcome. Thus a reduced dependence on the UK as an export market could be interpreted as an improvement in the export performance of IOEs. As noted above, the proportion of IOE exports to the UK between 1991 and 1998 remained stable. Throughout our analysis we explore the consequences of export destination patterns for the export features of Irish enterprises.

[20] See, for example, Forfás, 2002.

Figure 2.1: Irish Exports and Exchange Rate Changes

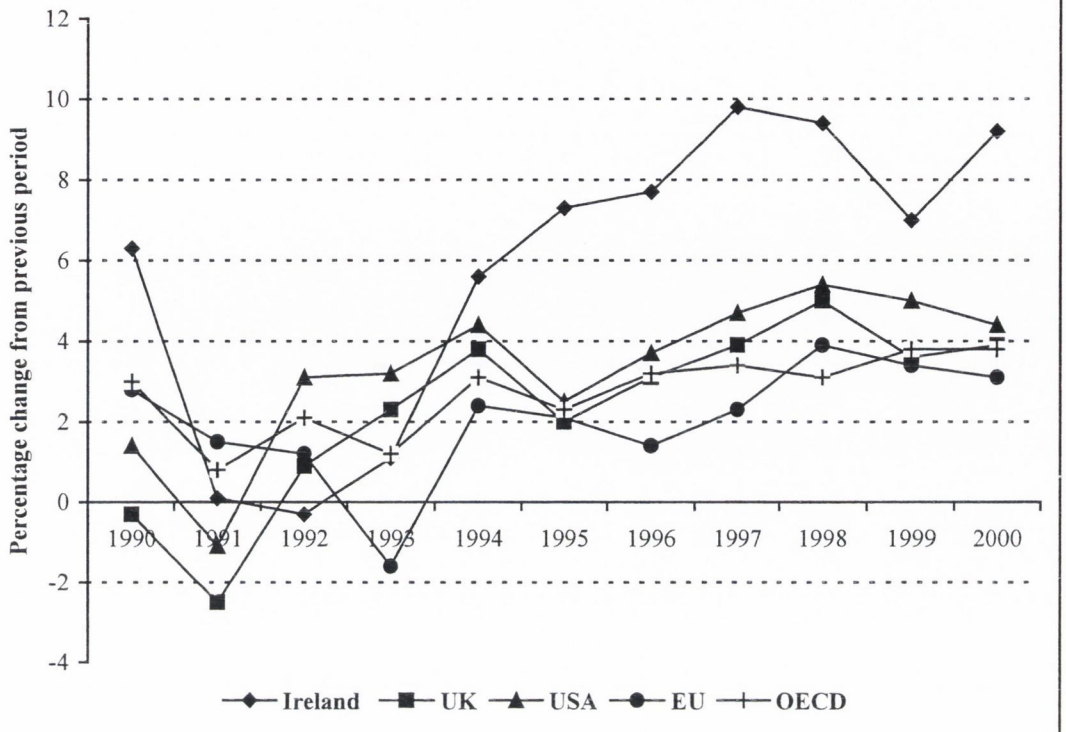


Note: All series graphed on an annual basis represent the year-to-year growth rate shifted left by one year to account for the transformation from levels to annual growth rates. That is, a growth rate attributed to 1992 refers to the year-to-year growth between 1992 and 1993.

Trade weighted exchange rate index for the Irish pound (Base: December 1971=100) is based on the mid closing rate. Source: Central Bank of Ireland, *Bulletin*, Winter 2000, Section 3, Statistical Appendix, p.125.

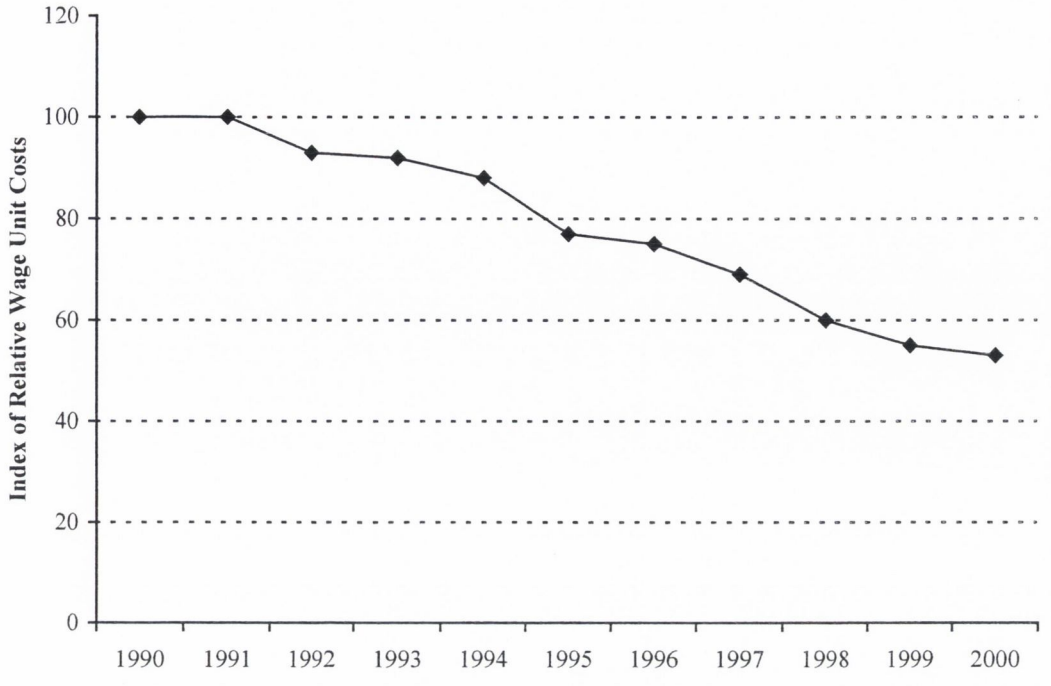
Export Volume Index. Source: CSO (2002). *External Trade*, Table 1, Summary of Trade, Export Volume Index (Base year 1990=100).

Figure 2.2: Real Total Domestic Demand



Source: OECD (2002). *Economic Outlook.*

Figure 2.3: Index of Relative Wage Costs in Irish Manufacturing



Source: Central Bank of Ireland (Spring, 2000). *Index of Relative Wage Costs in Manufacturing Industry* (Base: 1990=100, Common Currency (IR£)), p.87. A fall in the index implies an improvement in competitiveness.

Table 2.1 Annual Features of Irish Manufacturing, 1991-1998

	Enterprises Total	Enterprises Foreign (%)	Employment Total	Employment Foreign (%)	Turnover Total (IR£m)*	Turnover Foreign (%)
1991	2,209	26.6	181,690	47.6	20,500	58.5
1992	2,214	26.2	184,208	47.4	22,100	62.0
1993	2,217	25.1	185,464	47.4	23,400	63.7
1994	2,292	25.2	191,607	48.3	25,700	65.4
1995	2,390	25.2	206,713	49.2	30,400	68.7
1996	2,409	24.6	211,616	49.6	33,200	70.8
1997	2,476	23.8	224,959	49.5	38,900	73.3
1998	2,526	23.0	227,831	49.6	47,200	76.9
1991-1998 Change (%)	14.4	-1.0	25.4	31.0	130.2	31.4

Source: Own estimates derived from the *Census of Industrial Enterprises*.
* All monetary values in constant 1985 £IR.

Table 2.2 Sectoral Patterns of IOEs and FOEs, 1998

Nace Rev.1	Employment Total	Employment Foreign (%)	Turnover Total (IR£m)*	Turnover Foreign (%)	Export Intensity [d] IOEs (%)	Export Intensity [d] FOEs (%)
Chemicals [a]	19,994	80.1	15,700	94.9	29.0	98.4
Electronics [b]	58,896	81.5	11,800	92.4	56.2	93.9
Other Mfg [c]	148,941	32.9	19,700	53.3	34.2	75.7
Total	227,831	49.6	47,200	76.9	35.7	90.6

Source: Own estimates derived from the *Census of Industrial Enterprise.*

[a] Nace Rev. 1 Sector (24).

[b] Nace Rev 1 Sectors (30+31+32+33).

[c] Nace Rev 1 Sectors (15-37) less (a) and (b).

[d] Export intensity is defined as turnover exported as a proportion of total turnover.

* All monetary values in constant 1985 £IR.

Table 2.3 Export Features of IOEs, 1991-1998

IOEs	1991	1992	1993	1994	1995	1996	1997	1998
Number of Enterprises	1,620	1,634	1,661	1,714	1,787	1,817	1,887	1,945
Proportion of Exporters (%)	61.2	59.9	59.7	61.7	59.6	59.3	60.6	60.1
Export Intensity (%)	35.0	33.5	35.0	35.9	35.6	34.5	36.0	35.7

Source: Own estimates derived from the *Census of Industrial Enterprises*.

Table 2.4 IOE Export Destination Patterns, 1991- 1998

Export Destination	Percent of total IOE exports by destination		1991-1998 Volume Change (%)
	1991	1998	
UK	43.1	42.2	23.8
EU	33.5	32.4	22.8
USA	6.9	12.1	123.1
ELS	16.5	13.2	0.8
UK	***43.1***	***42.2***	***23.8***
Non-UK	***56.9***	***57.8***	***28.5***

Source: Own estimates derived from the *Census of Industrial Enterprises*.

2.A APPENDIX

Table 2.A **Census of Industrial Production, Ireland: NACE Rev. 1 Codes and Corresponding Industrial Sectors**

NACE Rev. 1	Description
15	Manufacture of food products and beverages
16	Manufacture of tobacco products
17	Manufacture of textiles
18	Manufacture of wearing apparel; dressing and dyeing of fur
19	Manufacture of leather and leather products
20	Manufacture of wood and wood products
21	Manufacture of pulp, paper and paper products
22	Publishing, printing and reproduction of recorded media
23	Manufacture of coke, refined petroleum products and nuclear fuel
24	Manufacture of chemicals and chemical products
25	Manufacture of rubber and plastic products
26	Manufacture of other non-metallic mineral products
27	Manufacture of basic metals
28	Manufacture of fabricated metal products, except machinery and equipment
29	Manufacture of machinery and equipment n.e.c.
30	Manufacture of office machinery and computers
31	Manufacture of electrical machinery and apparatus n.e.c.
32	Manufacture of radio, television and communication equipment and apparatus
33	Manufacture of medical, precision and optical instruments, watches and clocks
34	Manufacture of motor vehicles, trailers, and semi-trailers
35	Manufacture of other transport equipment
36	Manufacture of furniture; manufacturing n.e.c
37	Recycling

Source: CSO (1998a). *Census of Industrial Production*, Government Publications: Dublin.

CHAPTER 3

ENTERPRISE CHARACTERISTICS AND EXPORT PERFORMANCE

3.1 Introduction

The aim of this chapter is to examine the performance gap, if any, measured by specific enterprise characteristics, between exporting and non-exporting enterprises in Irish manufacturing. An increasing number of empirical studies have documented the superior performance of exporters relative to non-exporters in the manufacturing sectors of Germany (Bernard and Wagner, 1997), the US (Bernard and Jensen, 1999), and the UK (Girma, Greenaway, and Kneller, 2002). Such studies have shown that exporting enterprises tend to be larger and have, amongst other characteristics, higher labour productivity than non-exporters. In this chapter we use our panel-data set of Irish manufacturing enterprises to investigate the performance of exporting IOEs relative to non-exporters, as well as the characteristics of IOEs before they enter the export market and following a period of exporting, relative to those manufacturers who remain domestic suppliers.

3.1.1 Export-led Growth

The macroeconomic significance of exporting in the promotion of economic growth has been well documented.[21] However, there has been little micro-level investigation of the links between exporting and enterprise performance despite policymakers engaging and investing significantly in export promotion.

[21] For example, see Ahmad and Kwan, 1991; Edwards, 1993; and Greenaway and Sapsford, 1994a,b.

Policymakers have encouraged exporting based on the general belief that it promotes greater productivity at the enterprise level because the decision to actively participate in foreign markets is thought to expose the enterprise to further competition.[22] Consequently, the share of total sales generated by exports reflects the ability of the enterprise to cope with increased competition, evidenced by improved efficiency and productivity. Enterprises may benefit from greater capacity utilisation, economies of scale, diversification of risk, incentives for technological improvements, and increased management efficiency due to competition abroad. Thus determining the factors responsible for export success corresponds to establishing indicators for overall enterprise performance.

Previous empirical studies on Taiwan (Aw and Hwang, 1995), Germany (Bernard and Wagner, 1997), the US (Bernard and Jensen; 1995, 1999), Colombia, Mexico, and Morocco (Clerides, Lach and Tybout, 1998), and the UK (Girma, Greenaway, and Kneller, 2002) provide evidence that exporting enterprises have superior productivity to non-exporters. However, the nature of this superior performance is not clear; the better than average performance of exporters may be simply due to exporters *self-selecting* into export markets precisely because they are more efficient. Conversely, it is also possible that enterprises might learn from exporting through a variety of channels. For example, exporters may benefit from a range of trade-related linkages such as production and managerial advice, factors that enhance the competitiveness and efficiency of the exporting enterprise.

[22] For a survey of empirical studies focusing on productivity and exporting see Bartelsman and Doms (2000). The potential benefits of exporting are discussed in Richardson and Rindal (1995).

Thus we are faced with three areas of investigation. Firstly, do exporting enterprises at any particular point in time exhibit evidence of superior performance characteristics relative to non-exporters? Secondly, are exporters more efficient before they enter the export market; that is, do higher productivity enterprises *self-select* into selling to international markets? Thirdly, do exporters learn to be relatively more efficient than non-exporters as a consequence of selling into export markets? These questions are investigated in this chapter using the data set of Irish manufacturing enterprises between 1991 and 1998.

3.1.2 Chapter Outline

Section 3.2 discusses the methodology and results of recent empirical studies that search for micro-level evidence of the relationship between exporting and performance characteristics. Section 3.3 emphasises the need to distinguish IOEs from FOEs within Irish manufacturing because of their differences in terms of enterprise characteristics, export intensity, and export destination patterns. Section 3.4 examines IOEs for evidence of a premium to exporters relative to non-exporters. Section 3.4.1 confirms the superior performance characteristics of exporters by evaluating the premium accruing to relatively intensive exporters and Section 3.4.2 introduces the concept of export destination as a significant factor in the premium that accrues to exporters. Section 3.5 examines whether or not 'good' enterprises become exporters and Section 3.6 considers whether or not exporters become 'good' enterprises once they enter the export market. Section 3.7 concludes the chapter.

3.2 Literature Review

The increasing availability of detailed microeconomic data sets during the 1990s has led to extensive empirical research focusing on the relationship between exporting and enterprise performance. Many of these studies have simultaneously incorporated several aspects of enterprise characteristics that relate to exporting, such as the direct effect of exporting on productivity, the determinants of exporting, and the influence of other enterprises on the decision to export. In this chapter we focus solely on the relationship between *exporting* and *enterprise performance*.

Table 3.1 summarizes a number of previous empirical studies on the relative performance of exporters and non-exporters that utilize enterprise-level data sets. Although these studies use data from various countries, different methodologies, and emphasise various aspects of the exporting nature of enterprises, they generally focus on *three* principal issues.

Firstly, do exporters exhibit superior performance characteristics compared to non-exporting enterprises at a point in time? Bernard and Wagner (1997) and a series of papers by Bernard and Jensen (1995, 1997a,b,c, and 1999) pioneered a literature on the microeconomics of the enterprise performance of manufacturers and exporting.[23] In all cases the authors document superior performance characteristics of exporters relative to non-exporters in German and US manufacturing plants respectively. The enterprise performance characteristics examined include input measures such as employment, wages, and capital intensity, and output measures such as turnover and productivity. Using a panel data set, Bernard and Wagner (1997) find that exporters in

Germany are larger, more capital-intensive, and more productive than non-exporters. Similarly, US manufacturing exporters are found to be considerably larger, more productive, and pay higher wages than non-exporters.

Several studies have examined the issue of exporter performance in lesser-developed countries, specifically focusing on the productivity performance of exporters relative to non-exporters. Without exception, exporters are found to be more productive than non-exporters at every point in time. Aw and Hwang (1995) use cross-sectional data for the Taiwanese electronics industry and find that exporters have higher levels of productivity relative to enterprises that sell similar products in the domestic market. Clerides, Lach, and Tybout (1998), using panel data for manufacturing industries in Colombia, Mexico, and Morocco, also find that relatively more efficient enterprises are exporters. Girma, Greenaway, and Kneller (2002) examine a micro-data set for UK manufacturing and obtain results similar to earlier findings for the US and Germany where exporters have superior performance characteristics relative to non-exporters. Thus regardless of the data examined and methodology used, all empirical studies of enterprises in countries such as China, Colombia, Germany, Italy, Mexico, Morocco, Spain, Taiwan, the USA and the UK find that, on average, exporters are typically larger, pay higher wages, and are more capital intensive.[24]

A second feature of previous empirical studies focuses on whether exporters are more productive *before* they enter the export market relative to enterprises that remain non-exporters. That is, is 'good' performance a prerequisite for enterprises to become

[23] An earlier study by Bernard (1995), using the same German regional data set as used in Bernard and Wagner (1997), found a positive relationship between export participation and firm size.

exporters? Additional costs associated with exporting such as transportation, marketing, and distribution expenses would suggest that greater productivity is required of enterprises that become exporters. Similarly, enterprises that are looking to enter a more competitive export market may be forced to lower costs prior to becoming an exporter (Bernard and Wagner, 1997). Thus it could be expected that enterprises *self-select* into export markets if the returns to doing so are relatively high for them.[25] If enterprises are successful before they begin exporting, then future exporters should exhibit relatively higher levels of productivity and superior characteristics relative to non-exporters in the years leading up to entering the foreign marketplace.

Results of previous empirical studies are unanimous, showing that relatively more productive enterprises enter export markets. In the years before exporting both US (Bernard and Jensen, 1999) and German (Bernard and Wagner, 1997b) manufacturing exporters show significantly faster employment, shipment, and productivity growth relative to continuing non-exporters. Girma *et al* (2002) also find that UK exporters are more productive than UK non-exporters before they become exporters. Such results lend support to the hypothesis that exporters self-select, with the most productive enterprises becoming exporters.

The third major area of empirical analysis examines the question of whether exporting itself enhances the performance characteristics of enterprises. That is, is there a *learning-by-doing* effect achieved by exporters, so that enterprises become 'good'

[24] Such studies do not test for the causal relationship between performance characteristics and propensity to export. Rather, they simply test for the existence of significantly superior performance characteristics of exporters.

through exporting? There may be several reasons why exporting can improve enterprise performance, including improved productivity through economies of scale in production as a result of serving a larger marketplace, and the possibility of more intense competition from servicing the foreign marketplace.[26]

Studies that examine the learning-by-exporting hypothesis exhibit varying results. Castellani (2001) finds some evidence that the productivity of Italian exporting enterprises increases as export intensity rises, but most other studies tend to be inconclusive or exhibit negative results. Aw and Hwang (1995), Bernard and Wagner (1997), Bernard and Jensen (1995; 1999), and Clerides *et al* (1998) fail to find evidence to support the learning-by-exporting hypothesis. The study by Girma *et al* (2002) contrasts with these studies by finding that exporting may actually boost the productivity of the UK exporters examined. However, as the authors themselves note, this result could be the consequence of the matching analysis methodology used in their study.

In summary, previous empirical studies find that exporters have superior input and output performance characteristics relative to non-exporters. Although such studies do not test for any causal relationship, they nevertheless provide initial support to the hypothesis that exporters are in some respects superior to non-exporters. Consistent evidence that exporters are more productive before they enter foreign markets compared to continuing non-exporters also suggests that there is a *self-selection* procedure for exporters. However, the relative productivity of exporters does not

[25] See Richardson and Rindal (1995) and Bernard and Jensen (1999) for theoretical and practical explanations of why enterprises *self-select*.

appear to increase once enterprises enter the export market, providing little support for the *learning-by-doing* hypothesis.[27] Thus although 'good' enterprises appear to become exporters, the exporting process itself does not enhance productivity of enterprises.

Most of the empirical studies outlined above follow a methodology introduced by Bernard and Wagner (1997) and Bernard and Jensen (1999). The general model searches for an export premium, being a measure of the superiority of exporters relative to non-exporters, in terms of export characteristics and performance. Using enterprise-level data, the export premia are estimated using a regression of the general form

$$\ln X_{it} = \alpha + \beta_1 Export_{it} + \beta_2 Size_{it} + \beta_3 Industry'_{it} + \beta_4 Year'_t + \varepsilon_{it} \qquad (3.1)$$

where X_{it} is the enterprise characteristic being examined for premia between exporting and non-exporting enterprises (i), usually on an annual basis (t). The premia is captured by including a dummy variable $Export_{it}$ that reflects the current export status of the enterprise. The export premium (β_1) thus captures the average percentage difference between exporters and non-exporters in the same sector (industry) for a number of enterprise-level characteristics such as employment, turnover, labour skill intensity, and productivity measures. Although standard trade theory suggests that the composition of industry accounts for differences between exporters and non-exporters, it may be that within-industry differences are greater

[26] Clerides *et al* (1998) provide a theoretical model of learning-by-doing. Feder (1992) and Bernard and Wagner (1997a) provide a range of practical reasons for improvements in enterprise performance following exporting.

[27] The exception is the study by Girma *et al* (2002), which finds that UK enterprises become more productive once they enter the export market relative to enterprises that remain non-exporters.

than variations across industries.[28] The model controls for industry differences by including a vector of industry dummies ($Industry_{it}$) and controls for enterprise size in terms of employment ($Size_{it}$). Additionally, a vector of year dummies is usually included to control for general business cycle effects ($Year_t$). Our study for the export premia accruing to exporters versus non-exporters in Irish manufacturing for the period 1991 to 1998 follows this methodology.[29]

3.2.1 Application to Ireland

The Bernard and Jensen (1999) study of US manufacturers provides the impetus for our examination of Irish enterprises. We extend the focus of previous empirical studies by incorporating several distinctive features of the Irish manufacturing sector, specifically enterprise *ownership* patterns and the possible influence of the geographic *destination* of exports.

The data description of chapter 2 highlights the dualistic nature of Irish manufacturing by noting the wide disparities in enterprise and exporting characteristics between FOEs and IOEs. Most previous empirical studies do not explicitly distinguish between indigenous and foreign-owned enterprises, despite the fact that many countries probably experience similar disparities based on ownership in their own manufacturing sectors. Some studies, for example, Girma *et. al* (2002, p.6), omit foreign companies on the basis that *"...they arguably have different export motives*

[28] It is possible that differences are mostly the result of industry composition variation. However, studies on the USA (Bernard, 1995) suggest that differences between exporters and non-exporters within industries are larger than across-industry variations. Accordingly, the model calculates and reports differences between exporters and non-exporters (export premia) whilst controlling for industry classification.

[29] This methodology searches for evidence of a premium that exporters may have over non-exporters in terms of a number of enterprise characteristics. It does not provide evidence of causation between

(e.g. intra-firm trade) to domestically owned companies." However, no empirical analysis is undertaken to justify this omission. In contrast, we begin our examination of Irish manufacturing by confirming the significant differences between FOEs and IOEs by measuring the premia accruing to FOEs relative to IOEs for a number of enterprise characteristics. The remainder of the analysis focuses on IOEs only.[30]

A feature of exporting not addressed in previous studies is the role of *export destination* in explaining the characteristics of exporters.[31] That is, exporters that ship the majority of their output to any particular destination may exhibit different characteristics from exporters who ship mainly to another destination. Table 2.4 highlights the stability in the pattern of exports by IOEs during the 1990s, with the UK being the major recipient of exports despite policymakers promoting the EU as a preferred destination for Irish exports. Throughout the chapter we examine whether or not enterprises which export to the UK exhibit characteristics similar to non-exporters, given the historic economic, social, and institutional ties between Ireland and the UK. In effect, we define the UK as akin to a 'regional' marketplace rather than a foreign market and search for empirical justification of this classification of exporters and non-exporters.

The export destination patterns of IOEs are incorporated within the three areas of IOE performance and exporting examined. Firstly, we search for evidence that exporting IOEs have superior performance characteristics relative to non-exporting IOEs, and

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exporting and performance characteristics. See chapter 4 for causation analysis of exporting and enterprise performance in Irish manufacturing.

[30] In their study of the determinants of the export propensity of Irish manufacturing enterprises Roper and Love (2001) distinguish between IOEs and FOEs, and find that export determinants are dependent upon enterprise ownership.

measure whether performance characteristics improve as exporters increase their proportion of turnover exported. Next, the exporting self-selection hypothesis is examined by testing whether or not 'good' enterprises become exporters. Lastly, the performance of IOEs after they enter the export market is examined in light of evidence suggesting that US and German exporters perform no better relative to continuing non-exporters, whilst UK enterprises do appear to become more productive when exporting.

We begin our analysis in Section 3.3 by distinguishing between the enterprise characteristics of FOEs and IOEs.

3.3 Measuring the Ownership Premium

The growth and importance of FOEs has played a significant role in changing the overall output and export patterns of Irish manufacturing during the 1990s. The data presented in chapter 2 suggest that there are significant differences in the enterprise characteristics, export intensity, and export destination patterns of FOEs and IOEs. In Section 3.3 we search for evidence of a premium to FOEs relative to IOEs in terms of specific enterprise characteristics in Irish manufacturing during the period 1991 to 1998.

We follow the approach of Bernard and Jensen (1999) and measure seven characteristics for evidence of any premium accruing to FOEs relative to IOEs. The

[31] Feinberg (1992) introduces the concept of export targeting in the context of hysteresis in exporting. (See chapter 4 for a review of the literature.) However, export targeting has not featured in the empirical studies of enterprise characteristics and exporting performance.

enterprise characteristics include both input and output measures. To capture the influence of the size of the enterprise we include two measures, namely the number of employees (*Employment*), and the value of the turnover of the enterprise (*Turnover*). Two measures of labour characteristics are included in the analysis: the skill intensity of labour (*Skilled labour*) and average wages (*Wages*). The value of turnover produced by each employee (*Labour turnover*) is incorporated as a measure of labour productivity, and the gross value added (GVA) produced by each employee (*Labour GVA*) reflects the profitability of the enterprise. Finally, a proxy measure of capital used by each employee (*Capital intensity*) is included to capture the capital intensity proxy of the enterprise. All monetary values are measured in Irish pounds and converted to 1985 constant prices using appropriate deflators.[32] Table 3.A below defines each of the seven enterprise characteristics.

In order to measure ownership premium we use a data set of 18,733 observations, of which 14,065 are IOEs and 4,668 are FOEs. There are a maximum of 3,561 enterprises in the data set. The *Census* data do not form a balanced panel as some enterprises commenced production after 1991 whilst others ceased production during the 1991 to 1998 period.[33] The dualistic nature of FOEs and IOEs within Irish manufacturing is evident from the statistical summary of IOE and FOE characteristics provided in Table 3.2. FOEs are, on average, larger in terms of employment and turnover, more productive (as measured by turnover and GVA per employee), and

[32] All variables with the exception of capital intensity are deflated using Table 2: Industrial Producer Price Index, *Economic Series*, CSO (1991b-1998b) at the two and three-digit level. The capital intensity variable is deflated using Table 5: Wholesale Price Indices for Energy Products, *Statistical Bulletin*, CSO (199c-1998c).

[33] The data set includes a small number of observations that have a value of zero. (For example, Gross Value Added = 0.) For the purposes of the econometric analysis undertaken these observations are omitted, resulting in variations in the number of observations detailed in the tables presented.

more capital intensive compared to IOEs. FOEs also pay higher wages, on average, than IOEs.

Table 3.A Definitions of Enterprise Characteristics

VARIABLE	DEFINITION
1. Employment	The total number of persons employed includes managerial, technical, clerical, and industrial employees, as well as apprentices.[34]
2. Skilled labour	Following the nomenclature of the *CIE*, skilled labour is defined as the sum of managerial, technical, and clerical employees. Skilled labour intensity is thus defined as managerial, technical, and clerical employees as a proportion of total employment.
3. Wages	Average wages are measured as the gross earnings of employees divided by the total number of employees.
4. Turnover	Turnover comprises the net selling value of goods manufactured by the enterprise, of industrial services provided by the enterprise for others, of goods sold without further processing and the value of miscellaneous items of turnover (such as rents, licence fees, royalties, etc) (CSO, *CIP*, 1998a).
5. Labour turnover	Labour turnover is defined as the average value of turnover produced by each employee.
6. Labour GVA	Gross value added is defined as production value less intermediate consumption. Labour GVA is the average value of GVA produced by each employee.
7. Capital intensity	The absence of a capital stock variable in the *CIE* necessitates the use of a proxy. Following Jenkins (1990) we proxy capital stock with 'Purchases of fuel and power' per employee.[35]

Our objective is to measure the ownership premium, if any, associated with being a FOE relative to an IOE for each of the seven enterprise characteristics. Equation (3.2) is estimated,

$$V_{it} = \alpha + \beta_1 FOE_{it} + \beta_2 Size_{it} + \beta_3 Nace_{it}^{'} + \beta_4 Year_{t}^{'} + \varepsilon_{it} \qquad (3.2)$$

[34] The employment data of the *Census* does not represent full-time equivalents. Rather, individuals who are employed in the activities of the enterprise are included without accounting for the unit of employment (the number of hours worked) for which they are employed.

[35] We recognise that this measure is subject to several imperfections; we are unable to distinguish the purchase of fuel from the purchase of power and, as noted by Jenkins (1990), such a proxy measure does not take into account the efficiency of machinery used in the enterprise, or the level of capacity utilisation.

where V_{it} is the enterprise characteristic measured in logarithms. FOE_{it} is a dummy variable for ownership status, being equal to one if the enterprise is foreign-owned (FOE) and zero otherwise (IOE). $Size_{it}$ is a dummy variable distinguishing between enterprises with employee levels above and below the median number of employees across all enterprises in the given year. The dummy variable takes the value of one if the number of employees in the enterprise is above the median employment number across all enterprises in the given year. Table 3.B details the median number of employees in years 1991 to 1998 for this data set. $Nace_{it}'$ is a vector of up to 220 NACE Rev.1 four-digit sector dummy variables and $Year_t'$ is a vector of year dummies. The ownership premium coefficient β_1 shows the average difference, measured in logarithms, between FOEs and IOEs within the same 4-digit NACE Rev. 1 sector for the period 1991 to 1998.

Equation 3.2 is estimated separately for each of the seven enterprise characteristics on the *Census* data. We use panel data regression techniques to estimate the equation, where such a model can be estimated using random effects (RE) or fixed effects (FE) techniques.[36] In our case we estimate the equation using the RE technique.[37] All

[36] That is, instead of imposing constant coefficients over sectors the intercept term is allowed to differ for each sector, capturing sector-specific time invariant effects. We thus assume that the error term in the regression of equation (3.2) is composed of two components, namely $\varepsilon_{it} = \mu_i + \nu_{it}$ with μ_i capturing an enterprise-specific permanent and unobservable effect, and ν_{it} being the remaining period-specific error term, assumed to be independent across enterprises and over time. See, for example, Maddala (1993) and Baltagi (1995) for detailed discussions.

[37] We use the RE technique for three reasons. First, as Baltagi (1995) points out, the FE model is appropriate if one looks at the same enterprises in each period. In our case, the *Census* does not include the same enterprises in each year as the number of enterprises changes over time due to enterprises starting or stopping production. Second, the estimation of FE is less efficient than RE since FE uses only variations *within* each enterprise over time, whilst RE also takes into account variations *between* enterprises in the same year. Third, we wish to include, *inter alia*, the effect of time invariant variables, namely sectoral dummies. The nature of the FE technique does not allow the estimation of such time invariant variables. Thus we estimate equation 3.2 using a random effects panel data technique and confirm our choice with a Hausman test for each estimation.

estimations are performed in Stata (StataCorp, 2001) and the results of equation 3.2 estimated for each enterprise characteristic are presented in Table 3.3.

We find positive and significant coefficients for the FOE ownership premium variable for each enterprise characteristic, giving support to our hypothesis that FOEs exhibit superior performance characteristics compared to IOEs. FOEs, on average, are larger in terms of employment and pay higher average wages. FOEs are also more productive: turnover and GVA per employee are both higher for FOEs relative to IOEs. Furthermore, FOEs are more capital intensive than IOEs.

The regression also controls for enterprise size (in terms of employees). Large IOEs appear to employ relatively fewer skilled employees, are less capital intensive, and produce slightly less turnover per employee than smaller enterprises. There is no distinction between large and small enterprises in terms of average wages.

Our results thus confirm that FOEs and IOEs in Irish manufacturing are distinct enterprise types. Moreover, the export propensity of FOEs and IOEs differ markedly. Chapter 2 noted that FOEs use Ireland as an export platform to EU and other destinations, with little local production sold in the domestic Irish marketplace. Conversely, IOEs produce primarily for the domestic marketplace, despite considerable emphasis given by Irish policymakers to improving the export propensity of IOEs. It is the relationship between the characteristics and export performance of IOEs that is the focus of this thesis. If IOEs are to improve their export performance it is necessary to understand the individual enterprise

characteristics that allow them to do so. Thus we focus on the exporting characteristics of IOEs only throughout the remainder of this chapter.

3.4 Measuring the Export Premium

3.4.1 Introduction

Previous studies of manufacturing in the US, Germany, and the UK have shown exporters to be larger and more productive than their non-exporting counterparts. Section 3.4.2 is the first enterprise-level empirical investigation of the performance characteristics of IOEs in Irish manufacturing that export compared to those that do not.

We also investigate whether or not there are differences in the performance of IOEs that export to the UK relative to other destinations. The export promotion strategy of Irish industrial policy has emphasised the need to expand Irish exports beyond the traditional and primary export destination of the UK. However, Table 2.4 highlights that there was relatively little change in the destination pattern of Irish exports between 1991 and 1998. It may be that enterprises that export primarily to the UK exhibit different performance characteristics compared to enterprises that export primarily to Non-UK destinations, with UK exporters effectively behaving as 'domestic' suppliers rather than exporters. Section 3.4.3 incorporates this hypothesis into the examination of exporting enterprises.

The Irish-owned enterprise data set used in Section 3.4 contains 14,065 observations comprising 2,854 Irish-owned enterprises. Table 3.4 presents summary statistics of

characteristics for exporting and non-exporting IOEs. Exporting enterprises are larger in terms of average employment, turnover, and gross value added, and have higher productivity and profitability as measured by turnover and gross value added per employee. Our objective is to determine whether such apparent differences are significant.

3.4.2 Exporters versus Non-exporters

We search for evidence of any export premium that accrues to exporting IOEs relative to non-exporting IOEs. We use the econometric methodology introduced in Section 3.3, but in this case we proxy a performance gap or premium between IOE exporters and non-exporters for the same seven enterprise characteristics defined in Section 3.3. The equation estimated is

$$V_{it} = \alpha + \beta_1 Export_{it} + \beta_2 Size_{it} + \beta_3 Nace_{it}^{'} + \beta_4 Year_{it}^{'} + \varepsilon_{it} \qquad (3.3)$$

Equation 3.3 is estimated separately for each of the seven enterprise characteristics using a random effects panel data technique. The performance gap between IOE exporters and non-exporters is proxied by the dummy variable $Export_{it}$, which is equal to one if the IOE exports, and zero if the IOE does not export. Thus the export premium (β_1) measures the average difference, in logarithms, between exporters and non-exporters within the same 4-digit NACE Rev. 1 sector for the period 1991 to 1998. The dummy variable $Size_{it}$ takes the value of one when the number of employees is above the median employment level across all IOEs in each given year, zero otherwise. The annual median employment levels are reported in Table 3.B. All other variables are as defined in Section 3.3. Table 3.5 reports the regression results.

We find that exporting is positively and significantly related to all our measures of enterprise performance. After controlling for size, sector, and time effects we find that exporting enterprises, on average, are larger in terms of employment and turnover, pay higher average wages, and employ a higher share of skilled employees. Exporting enterprises are also more productive, with both turnover and GVA per employee higher for exporters relative to non-exporters. Furthermore, productive structures used by exporters are more capital intensive than those of non-exporters.

Our initial results for Irish manufacturing thus reflect those of previous studies for manufacturing sectors in the USA, Germany, and the UK, where exporting enterprises were also found to exhibit superior performance characteristics compared to non-exporters.

3.4.3 Export Intensity and Destination

We continue our analysis of the performance characteristics of IOEs by searching for evidence of differences in performance premium amongst *exporting enterprises only*. We wish to determine whether or not IOEs that export larger proportions of their turnover, that is, export more *intensively*, exhibit superior characteristics to those exporters that export less intensively. Despite government policies encouraging IOEs to expand their output beyond the domestic marketplace, both the proportion of IOEs exporting and their corresponding export intensity remained constant at 60 and 36 per cent respectively between 1991 and 1998.[38] The stability of IOE export intensity may reflect a lack of productivity improvement and the associated performance characteristics required for enterprises to overcome the extra costs associated with

[38] Although the volume of exports by IOEs did rise between 1991 and 1998.

exporting and entering new export markets.[39] Thus in order to ensure that the average effects determined in Section 3.4.2 are representative of IOEs we investigate whether or not there is significant variation in the premium of exporting that is related to export intensity.

In addition, we investigate whether or not the *destination* of IOE exports is correlated with the performance characteristics of exporters. The historic dominance and geographic proximity of the UK as Ireland's major exporting partner leads us to believe that IOEs that export predominantly to the UK may behave in a manner similar to non-exporters. That is, enterprises that export to the UK may have inferior performance characteristics relative to IOEs that export to Non-UK destinations because the UK is effectively a 'regional' marketplace for Irish producers. In effect, exporters to the UK may not face the same barriers to trade that 'international' exporter's must overcome. For example, exporters to destinations such as the EU and the USA may face higher entry costs to these export markets because of transportation costs, cultural differences, institutional constraints, and other similar barriers that exporters to the UK do not have to overcome. Thus Non-UK exporters are forced to be more competitive and efficient in order to break into these non-traditional markets, and this competitiveness should be reflected in enhanced performance attributes of Non-UK relative to UK exporters.[40]

Thus we incorporate two aspects into our model of exporters, being *export intensity* and *export destination.* The equation estimated is

[39] Chapter 4 examines the issue of sunk costs and the decision to export.
[40] The gravity model of trade incorporates both geographic and currency union explanations of trade. See for example Anderson (1979) and Deardorff (1998).

$$V_{it} = \alpha + \beta_1 ExpInt_{it} + \beta_2 NonUKInt_{it} + \beta_3 Size_{it} + \beta_4 Nace_{it} + \beta_5 Year_t + \varepsilon_{it} \quad (3.4)$$

where $ExpInt_{it}$ is the share of exports in enterprise turnover and is included in order to capture the expected premium accruing to enterprises that export more intensively than others. $NonUKInt_{it}$ is the proportion of exports by IOEs shipped to Non-UK destinations (USA, EU, and Other destinations combined)[41] and is intended to distinguish the influence of exporting primarily to Non-UK destinations from exporting to the UK. If Non-UK exporters have superior performance characteristics relative to UK exporters, then the expected sign of β_2 is positive. We also control for enterprise size by including a dummy variable equal to one if the size of the individual enterprise is larger than annual median employment, zero otherwise (see Table 3.B). Dummy variables for sector and time effects are included in the same manner as equations 3.2 and 3.3. Equation 3.4 is estimated using panel data random effects econometric techniques on Irish exporting enterprises only. The data set comprises a maximum of 8,363 observations containing 1,980 enterprises over the 1991 to 1998 period.[42] Table 3.6 presents the regression results.

Enterprises that export more intensively are, on average, larger in terms of employment and turnover; they also tend to pay slightly higher wages than less intensive exporters. However, there is little if any significant difference in productivity or capital intensity amongst exporters of differing intensities. Our measure of skill, being managerial and clerical employees as a proportion of total employees, is significant and negative, so that enterprises that export more intensively

[41] Being the sum of US, EU, and ROW turnover exported as a proportion of total turnover exported by IOEs.

[42] Table 3.4 details the characteristics of IOE exporters. Table 2.4 details the export destination pattern of Irish exporters.

use a smaller share of skilled labour. These results suggest that intensive exporters tend to be large enterprises that employ a higher proportion of lower-skilled workers.

The coefficient of the export destination variable confirms our hypothesis about enterprise performance and export destination. Enterprises that export proportionately more to Non-UK destinations are larger than UK-exporters in terms of employment and turnover, and pay increasingly higher wages. Non-UK exporters also tend to employ a higher proportion of skilled labour than UK-exporters and are more productive as measured by turnover per employee, but GVA per employee is not significant. These results give support to our hypothesis that Non-UK exporters are in fact slightly more productive than UK-exporters, and are certainly larger enterprises than the more traditional UK-exporters, employing a higher proportion of skilled labour to which they pay higher wages.

In summary, Section 3.4 has established that at every point in time IOE exporters appear to have more favourable performance characteristics than non-exporters. Furthermore, IOEs that export both more intensively and predominantly to Non-UK destinations exhibit superior characteristics to those that export less intensively and mainly to the UK. Such a result provides the first evidence of differences in the performance characteristics of IOEs based upon *export destination.* The superiority of Non-UK exporters supports our hypothesis that UK-exporters do not face the same barriers to trade as Non-UK exporters, nor the associated enhanced productivity performance required to enter the Non-UK market.

3.5 Enterprise Performance Before and After Exporting

3.5.1 Introduction

The export promotion emphasis of Irish industrial policy during the 1990s raises a number of issues about the relative performance of exporting and non-exporting IOEs both before and after entering the export market, with subsequent implications for Irish trade policy. In Section 3.5 we wish to determine whether exporting IOEs have superior performance characteristics prior to entering the international marketplace, or whether IOEs attain superior characteristics after they become exporters. If an enterprise must be more efficient and productive in order to become an exporter, policy measures should be directed toward enhancing enterprise performance prior to exporting. Alternatively, if enterprises become more efficient after they become exporters, policy measures may be more effective if directed at simply encouraging IOEs to become exporters, regardless of their pre-exporting performance characteristics. We address both these issues in the following sub-sections.

3.5.2 Do 'Good' Enterprises Become Exporters?

Do enterprises that enter the export market already possess superior performance characteristics prior to entry, relative to non-exporters? In this section we examine the proposition that enterprises *self-select* to become exporters, principally because of the extra costs imposed upon enterprises that wish to become exporters. The additional or 'sunk' costs associated with selling products in foreign markets can act as a barrier to entry to exporting for less successful and marginal enterprises.[43] As a result, more productive and efficient enterprises are expected to be able to sustain the additional

[43] Such 'sunk costs' can include transport, marketing, and localisation expenses. Baldwin (1989), Dixit (1989a), and Roberts and Tybout (1997) discuss the theory of sunk costs and their impact on trade performance. Chapter 4 investigates empirically the influence of sunk costs for Irish exporters.

expenses incurred when entering a foreign marketplace.[44] Further, should an enterprise need to introduce new products and productivity enhancements in order to be a successful exporter, such an improved performance should be observable prior to entry into the export market. Thus the intention to become an exporter promotes an improved performance by the enterprise and we would expect to find significant differences between exporters and non-exporters in our performance indicators in the years leading up to the enterprise becoming an exporter.[45]

To examine the *self-selection* hypothesis we select only those IOEs from the *Census* that were non-exporters in all the years prior to the final year, when the enterprise may or may not be an exporter. Given that we have data for the years 1991 to 1998, and in order to ensure that our choice of continuously operating enterprises did not switch export status at any point in this time period, we select continuously operating enterprises that did not export in 1992 through 1996, thus ensuring that enterprises did not switch export status between years 1991 to 1992 and 1997 to 1998. The resulting sample consists of 289 continuously operating and non-exporting IOEs between 1992 and 1996 that may or may not be an exporter in 1997. Of the 289 non-exporting enterprises, 17 (6.25 per cent) became exporters in 1997.

[44] Our intention is to investigate the simple proposition of whether or not enterprises have superior performance characteristics prior to entering the export market, relative to non-exporters. For causality analysis of the role of sunk costs in the performance of Irish manufacturing exporters see chapter 4.

[45] As Bernard and Jensen (1999) note, the absence of sunk costs associated with selling in export markets would result in exports at the industry and enterprise level being determined by unsystematic variation in product attributes and comparative advantage. Exporters and non-exporters alike would make different goods but could have similar productivity, size and wage levels, and growth rates. For evidence on the role of sunk costs in determining export status of the firm see Roberts and Tybout (1997).

Following Bernard and Jensen (1999) we regress the levels of our performance measures in the initial sample year (1992) on the export status of the enterprise in the final sample year (1997). Hence the model estimated is

$$V_{i92} = \alpha + \beta_1 Export_{i97} + \beta_2 Size_{i92} + \beta_3 Nace_{i92} + \varepsilon_{92} \quad (3.5)$$

where V_{i92} is the enterprise characteristic in 1992, measured in logarithms. $Export_{i97}$ is the dummy variable for export status in 1997, and is equal to one if the enterprise exports, zero otherwise. The export premium coefficient β_1 shows the average difference between enterprises that became exporters in 1997 relative to those enterprises that remained non-exporters in 1997, within the same NACE Rev. 1 sector. The dummy variable for size ($Size_{i92}$) again measures enterprise employment relative to median employment, and equals 1 if the enterprise has greater than 26 employees in 1992, zero otherwise. The equation is estimated separately for each of the seven enterprise characteristics using cross-sectional regression estimation.[46]

Table 3.7 reports the results of differences in initial performance levels between future exporters and non-exporters over the period 1992 to 1997. Our results indicate that future exporters are larger than continuing non-exporters in terms of turnover, and have slightly more employees. Most notable is the productivity premium that future exporters appear to have over continued non-exporters, with both turnover and GVA per employee being significantly greater for future exporters. Average wage levels for employees at future exporters also appear to be relatively higher than those at continuously non-exporting IOEs.

[46] It must be reemphasised that this model does not test for a causal relationship between performance characteristics and propensity to export.

Equation 3.5 was expanded to include dummy variables reflecting export intensity and export destination in the final year. Both variables were found to be insignificant across the seven characteristics. The small number of exporting enterprises in the final year (1997) prevents robust analysis of the export intensity and export destination concepts. Further, as a measure of general robustness we selected various time horizons other than 1992 to 1997 over which we conducted the same analysis; for example, we regressed data for years 1992 to 1996, and data for years 1992 to 1995. The results obtained and presented for years 1992 to 1997 provide the strongest evidence for the *self-selection* hypothesis. The small number of exporters in the final year of each of the various sample years chosen as a robust measure may explain the weaker evidence for self-selection obtained for periods other than 1992 to 1997.

To investigate further the proposition that only good enterprises become exporters we evaluate the growth performance of future exporters relative to future non-exporters for our seven performance characteristics by searching for any annual growth rate premium that may accrue to future exporters by measuring changes in the performance characteristics using the following regression

$$\Delta V_{i97} = \frac{\ln V_{i97} - \ln V_{i92}}{5} = \alpha + \beta_1 Export_{i97} + \beta_2 Size_{i92} + \beta_3 Nace_{i92} + \varepsilon_i \qquad (3.6)$$

The coefficient β_1 measures how much faster future exporters are growing per year over the preceding 5 years in the 1992 to 1997 period. $Size_{i92}$ is a dummy variable taking the value of one when the number of enterprise employees is greater than the sector median level of 26 employees, and zero otherwise. Equation 3.6 is estimated for each of the enterprise characteristics using cross-sectional regression estimation. However, all regressions examining the growth rate in our seven enterprise

characteristics proved insignificant, with extremely low *F*-values. Once again, the small number of observations in our data of continuously operating IOEs prevents robust analysis of changes in growth rates prior to exporting.

Despite these data issues, our results in levels suggest that even five years prior to entering the export market, future exporting IOEs are larger and more productive than those IOEs that remain non-exporters. These results are consistent with those obtained for both US and UK manufacturers, where exporters have a significant productivity premium to non-exporters at each point in time prior to entering the international marketplace.

3.5.3 Do Exporters Become 'Good' Enterprises?

The heavy promotion by policymakers of the need for enterprises to export has been partly the result of a view that the growth of exports and real output is correlated over time (Edwards, 1993; Greenaway *et al*, 2002). However, there has been little evidence, theoretical or empirical, of a direct link between exporting and growth performance at the enterprise level. Recent empirical studies using micro-data have search for a *learning-by-doing* process that exporting enterprises may undergo once they start exporting, whereby exporters actually become more productive and efficient because of their presence in the export market.

Particularly in the context of the small domestic Irish market, serving a larger foreign marketplace might allow manufacturers to take advantage of economies of scale in production, leading to higher levels of output and turnover (Feder, 1982). Moreover, greater competition in international markets relative to the domestic market could

force enterprises to become more efficient in their methods of production in order to remain exporters. Thus we might expect the post-entry performance of exporters to be more efficient and productive than continuing non-exporters.

Previous empirical results for Germany, Taiwan, and the US have found no evidence of strong performance differences between enterprises that have begun exporting relative to those that remain non-exporters. This may be due to the methodological approaches taken, as Girma *et al* (2002), using a matching analysis that they suggest better represents the comparison between exporters and non-exporters, do find evidence of *learning-by-doing* for UK manufacturers. In this section we use our *Census* data set of IOEs to search for a premium to exporters once they are in the export market.

To examine the evidence on the relationship between the exporting and subsequent enterprise performance, and to maintain consistency with Section 3.5.2, we use a sample comprising 1,000 *continuously operating* IOEs between 1992 and 1997.[47] Of the 1,000 continuously operating enterprises, 45 per cent were continuous exporters over the period, 21 per cent were continuous non-exporters, and the remaining enterprises changed or *switched* export status at some stage between 1992 and 1997. That is, if the enterprise was an exporter in year (t) and became a non-exporter in year $(t+1)$, or was a non-exporter in year (t) and became an exporter in year $(t+1)$, then the IOE is defined as an enterprise that switched export status.

[47] In a similar manner to Section 3.5, we take a sample of continuously operating enterprises between 1991 and 1998 and remove those enterprises that switched export status in 1991 and/or 1998 to ensure that the sample of 1992 to 1997 enterprises are continuous exporters or non-exporters over the entire 1991 to 1998 period.

To understand the transformations that may occur in IOEs when they enter export markets and to identify more precisely any potential benefits from exporting we follow Bernard and Jensen (1999) and estimate growth rate equations for each of our seven performance characteristics of the form

$$\Delta V_{i92} = \frac{\ln V_{i97} - \ln V_{i92}}{6} = \alpha + \beta_1 ContExp_i + \beta_2 Switch_i + \beta_3 NonUKInt_{i92} + \beta_4 Z_{i92} + \beta_5 Nace_{i92} + \varepsilon_i \quad (3.7)$$

where $ContExp_i$ is a dummy variable equal to one if the enterprise exported continuously during the 1992 to 1997 period, zero otherwise. $Switch_i$ is a dummy variable equal to one if the enterprise switched export status at some point during the period, whether the enterprise entered the export market, or exited from it.[48] The coefficients β_1 and β_2 thus capture the increase in growth rates for exporting and switching IOEs respectively, relative to IOEs that remained non-exporters throughout the 1992 to 1997 period. $NonUKInt_{i92}$, defined as in Section 3.4.3, reflects the intensity of exports to Non-UK destinations and is intended to capture the influence of export destination on performance characteristics. Z'_{i92} is a vector of enterprise characteristics in 1992 that includes a dummy variable for the enterprise size[49], the average wage, and capital intensity. Equation 3.7 is estimated separately for each of the seven enterprise characteristics using cross-sectional regression estimation. Table 3.8 reports the results on the differences in growth rates between exporters, switchers, and non-exporters.

[48] The dummy variable takes the value of one if the enterprise either entered or exited the export market, and does not distinguish between the two, that is, entrants or those that exited. The dummy variable simply defines those enterprises that 'switched' export status.

[49] The variable for size is equal to one if the enterprise employment is greater than 34 in 1992.

Relative to continuous non-exporters, continuous exporters showed no difference in the growth rates of the seven characteristics considered. The same result extends to enterprises that switched export status between 1992 and 1997: switching enterprises showed no significant differences in their performance characteristic growth rates relative to continuous non-exporters.[50] Our export destination coefficient also showed little significance, with average wage growth for Non-UK exporters showing slightly lower growth than that for continuous non-exporters.

The lack of evidence found in Irish manufacturing to support the *learning-by-doing* hypothesis suggested by trade advocates is consistent with the results obtained for manufacturers in Germany and the US.[51] The method of analysis used in our Irish study may account for our results, but the strength of our evidence, or rather, lack of evidence, for export-enhancing growth, would suggest that Irish exporters do not necessarily perform better once they become exporters relative to those IOEs who serve the domestic marketplace exclusively.

3.6 Summary and Conclusion

The emphasis by Irish policymakers on the importance of manufacturing enterprises entering the export market has hitherto not been based upon significant evidence of the micro-level consequences of exporting and enterprise performance. This chapter

[50] As a measure of robustness, equation 3.5 was regressed separately with the inclusion of the continuous exporter dummy variable relative to continued non-exporters, and the switching dummy variable relative to continuous non-exporters. In both cases the same insignificant results as those obtained for equation 3.7 resulted.

[51] However, it is in contrast to that for the UK, where exporters were found to have enhanced productivity growth relative to non-exporters subsequent to their becoming exporters. See Greenaway *et al* (2002).

has attempted to empirically measure the relationship between various aspects of enterprise performance and exporting.

Our initial investigations find that Irish manufacturing can be justifiably described as 'dualistic'; FOEs exhibit superior performance characteristics relative to IOEs. The performance premium of FOEs established in this chapter, and their export focus evidenced in the trade patterns presented in chapter 2, strongly distinguish FOEs from IOEs within Irish manufacturing. The regression results presented in chapter 3 clearly indicate that it is meaningless to aggregate FOE and IOE exports in an analysis of Irish manufacturing. Thus the remainder of the chapter focuses on analysing the uncertain relationship between the performance and export characteristics of IOEs.

By following the methodological tradition established by Bernard and Wagner (1997) and Bernard and Jensen (1999), we explore our *Census* data set of IOEs between 1991 and 1998 and find that exporting IOEs exhibit superior performance characteristics relative to non-exporters at each point in time. Moreover, those IOEs that export more intensively have superior characteristics compared to IOEs that export relatively less. The performance of IOEs before and after exporting is also explored; we find that 'good' IOEs become exporters, but there is no evidence that IOEs improve their performance once they are in the export market. Thus our results are consistent with previous studies for other developed countries such as Germany, the US, and the UK.

Furthermore, the significance of enterprise size throughout our analysis of Irish manufacturers is consistent with previous empirical studies which indicate that relatively larger enterprises are more likely to be exporters. As Aitken *et al* (1997)

note, this finding reflects declining per unit foreign distribution costs, whereby larger enterprises are able to spread the fixed costs of producing over higher output. It is also possible that larger enterprises are low marginal cost producers and receive a higher return to exporting than other enterprises (Aitken *et al*, 1997, p. 120).

A feature of our analysis has been the introduction of the role of *export destination* in the relationship between enterprise performance and exporting. Given the unique trade relationship between Ireland and the UK, we hypothesise that the UK is effectively a 'regional' market for Irish manufacturers, so that IOE exporters to the UK display dissimilar enterprise characteristics to Non-UK exporters. Our results confirm this, showing that Non-UK exporters are larger and more productive than UK-exporters, giving support to our hypothesis that exporters to the EU, US, and ELS have superior performance characteristics compared to IOEs that export primarily to the UK.

The empirical questions addressed in this chapter are important for understanding the role of trade at the enterprise level, as well as for formulating policies that seek to promote growth through exporting. Our analysis gives greater insight into the possible effectiveness of export promotion policies in Ireland on enterprises both before and after they enter the export market. The analysis presented highlights the need for IOEs to be relatively more productive in order to enter the export market relative to continued non-exporters. Additionally, those IOEs that seek to export beyond the UK must be relatively more productive than those seeking to export to the UK only.

However, chapter 3 has not addressed the causal nature of exporting and the performance of IOEs; we have not established the reasons why IOEs become exporters. Thus in chapter 4 we examine the factors that influence the decision by IOEs to export or not, focusing on the influence of sunk costs on the export decision.

Table 3.1 Evidence for the Relationship between Exporting and Enterprise Performance: Previous Empirical Studies

Author	Data and Methodology	Results Obtained		
		Exporters Superior to Non-exporters	Exporters Self-select	Exporters undergo Learning-by-doing
Wagner (1995)	Germany: 1978 to 1992.	✓ (1)	..	..
Aw and Hwang (1995)	Taiwan: cross-section analyses on firm-level data of one year (1986); translog production function.	✓	✓	×
Bernard and Wagner (1997)	Germany: 1978-1992; panel data.	✓	✓	×
Clerides, Lach, Tybout (1998)	Colombia, Mexico, Morocco; various time periods 1981-91; FML of cost functions using panel data.	✓	✓	✓×
Bernard and Jensen (1999)	USA: 1984-1992; linear probability with fixed effects.	✓	✓	×
Kraay (1999)	China: 1988-1992; dynamic panel analysis.	✓	..	✓
Castellani (2001)	Italy: cross-section analyses on firm-level data of four years.	✓	✓	×
Delgado, Fariñas, Ruano (2002)	Spain: nonparametric analysis of productivity distributions for a 5 year period using firm-level data (1991-1996).	✓	✓	?
Girma, Greenaway, Kneller (2002)	UK: 1988-1999; matching analysis.	✓	✓	✓

(1) Positive relationship between export participation and firm size only.

✓ = positive result; × = negative result; ✓× = uncertain result; ? = uncertain result; .. = not analysed.

Table 3.2 Descriptive Statistics of Characteristics of IOEs and FOEs

1991 – 1998 Average	Mean	Standard Deviation
1. All Enterprises		
18,733 Observations		
3,561 Enterprises		
Employment	86	166
Skilled labour share	25.0%	17.2%
Average wages	£11,235	£5,691
Turnover	£12,900,000	£67,600,000
Turnover per employee	£95,573	£222,369
GVA per employee	£33,576	£139,346
Capital intensity proxy	£1,426	£2,614
2. IOE Enterprises		
14,065 Observations		
2,854 Enterprises		
Employment	59	114
Skilled labour share	23.9%	16.2%
Average wages	£10,073	£4,635
Turnover	£5,317,577	£16,400,000
Turnover per employee	£69,719	£97,115
GVA per employee	£19,176	£21,409
Capital intensity proxy	£1,326	£2,343
3. FOE Enterprises		
4,668 Observations		
847 Enterprises		
Employment	168	249
Skilled labour share	28.7%	19.4%
Average wages	£14,734	£6,998
Turnover	£35,700,000	£130,000,000
Turnover per employee	£173,471	£402,448
GVA per employee	£76,965	£272,115
Capital intensity proxy	£1,728	£3,282

Source: Own estimates derived from the *Census of Industrial Enterprises.*
All monetary values in 1985 constant £IR.

Table 3.3 **Regression Results for the Ownership Premium between FOEs and IOEs**

Measure of Ownership Premium	Emplt	Skilled Labour Share	Average Wages	Turnover	Labour Turnover	Labour GVA	Capital Intensity Proxy
FOE Premium	.234*** (.014)	-.008 (.017)	.116*** (.011)	.356*** (.023)	.184*** (.018)	.284*** (.024)	.226*** (.024)
Size	.676*** (.008)	-.173*** (.010)	.004 (.006)	.577*** (.012)	-.048*** (.010)	.038*** (.015)	-.135*** (.013)
Observations	18,733	18,565	18,731	18,733	18,733	18,324	18,657
Enterprises	3,561	3,535	3,561	3,561	3,561	3,543	3,555
R^2 overall	0.620	0.328	0.461	0.579	0.508	0.409	0.450
χ^2	12,390.96	2,464.89	5,283.73	9,802.64	5,099.76	2,942.17	3,545.18
Prob.>χ^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: Summary regression results derived from equation 3.2.
Standard errors in parentheses.
Statistically significant at *** 1 per cent.

Table 3.4 **Descriptive Statistics of Characteristics of Exporting and Non-exporting IOEs**

1991-98 Average	Mean	Standard Deviation
1. Non-exporting IOEs		
5,593 Observations		
Employees	38	53
Average wage	£9,545	£4,575
Skilled labour share	22.78%	15.03%
Turnover	£3,051,053	£8,234,967
Turnover per employee	£61,982	£91,687
GVA per employee	£18,303	£19,306
Capital intensity proxy	£1,235	£1,932
2. Exporting IOEs		
8,472 Observations		
Employees	73	139
Average wage	£10,422	£4,641
Skilled labour share	24.56%	16.92%
Turnover	£6,813,879	£20,000,000
Turnover per employee	£74,827	£100,216
GVA per employee	£19,751	£22,673
Capital intensity proxy	£1,386	£2,577

Source: Own estimates derived from the *Census of Industrial Enterprises.*
All monetary values in 1985 constant £IR.

Table 3.5 Regression Results for Characteristics of IOE Exporters v. Non-exporters

Export Premium	Emplt	Skilled Labour Share	Average wages	Turnover	Labour Turnover	Labour GVA	Capital Intensity Proxy
Export Premium	.069*** (.007)	.062*** (.009)	.057*** (.006)	.163*** (.009)	.105*** (.008)	.077*** (.014)	.121*** (.014)
Size	.571*** (.007)	-.181*** (.010)	-.014** (.007)	.447*** (.011)	-.082*** (.009)	.004 (.015)	-.136*** (.014)
Observations	14,065	13,902	14,063	14,065	14,065	13,785	14,017
Enterprises	2,854	2,828	2,854	2,854	2,854	2,837	2,849
R^2 overall	0.585	0.323	0.367	0.565	0.538	0.293	0.480
χ^2	10,118.61	1,974.56	3,372.67	8,103.94	4,405.53	1,707.54	3,222.99
Prob.>χ^2	0.000	0.0000	0.000	0.000	0.000	0.000	0.000

Note: Summary regression results derived from equation 3.3.
Standard errors in parentheses.
Statistically significant at *** 1 per cent, ** 5 per cent.

Table 3.6 **Regression Results for Characteristics of IOE Exporters: Export and Destination Intensity**

Exporters	Emplt	Skilled Labour Share	Average Wages	Turnover	Labour Turnover	Labour GVA	Capital Intensity Proxy
Export Intensity	.164*** (.019)	-.105*** (.024)	.043*** (.016)	.185*** (.027)	.036 (.023)	.052 (.035)	.010 (.034)
Destination Intensity	.033** (.015)	.033* (.018)	.033*** (.013)	.084*** (.020)	.046*** (.017)	-.009 (.028)	-.029 (.026)
Size	.633*** (.011)	-.173*** (.013)	-.008 (.009)	.505*** (.015)	-.068*** (.012)	.015 (.019)	-.125*** (.019)
Observations	8,363	8,301	8,363	8,363	8,363	8,172	8,344
Enterprises	1,980	1,968	1,980	1,980	1,980	1,964	1,977
R^2 overall	0.618	0.380	0.386	0.592	0.545	0.296	0.502
χ^2	6,316.61	1,535.87	2,271.90	5,393.93	2,926.12	1,146.14	2,253.46
Prob.>χ^2	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000

Note: Summary regression results derived from equation 3.4.
Standard errors in parentheses.
Statistically significant at *** 1 per cent, **5 per cent, *10 per cent.

Table 3.7 Regression Results for Export Premium of Future Exporters

Export Premium for Future Exporters	Emplt	Skilled Labour Share	Average Wages	Turnover	Labour Turnover	Labour GVA	Capital Intensity Proxy
1992-1997							
289 Enterprises							
Export	.264*	.230	.233***	.725***	.461***	.449***	-.323
	(.144)	(.141)	(.077)	(.224)	(.161)	(.136)	(.293)
Size	.863***	-.011	.235***	1.111***	.248***	.224**	.183
	(.075)	(.082)	(.054)	(.128)	(.084)	(.097)	(.129)
Observations	289	286	289	289	289	286	288
R^2	0.671	0.435	0.563	0.750	0.739	0.468	0.602

Note: Summary regression results derived from equation 3.5.
Standard errors in parentheses.
Statistically significant at ***1 per cent, *10 per cent.

Table 3.8 Regression Results for Growth Premium of Exporters

Growth Premium for after exporters	Emplt	Skilled Labour Share	Average Wages	Turnover	Labour Turnover	Labour GVA	Capital Intensity Proxy
1992-1997							
1,002 Enterprises							
ContExp	.004	-.006	.008	.007	.003	.013	.006
	(.007)	(.009)	(.005)	(.007)	(.006)	(.012)	(.012)
Switch	.004	.010	.002	.010	.006	.001	.011
	(.018)	(.008)	(.004)	(.006)	(.005)	(.009)	(.011)
NonUKint	-.007	.007	-.015**	-.017	-.009	-.036**	-.009
	(.008)	(.011)	(.007)	(.010)	(.007)	(.015)	(.016)
Size	-.017***	.017***	.007*	-.004	.014***	.006	.010
	(.005)	(.006)	(.004)	(.006)	(.004)	(.008)	(.009)
Observations	1,002	993	1,002	1,001	1,001	973	998
R^2	0.219	0.156	0.289	0.266	0.257	0.206	0.183

Note: Summary regression results derived from equation 3.7.
Standard errors in parentheses.
Statistically significant at ***1 per cent, **5 per cent, and *10 per cent.

Table 3.B **Annual Median Enterprise Employment**

Model	1991	1992	1993	1994	1995	1996	1997	1998
Equation 3.2	35	36	36	36	37	37	38	38
Equation 3.3	30	30	30	30	30	31	32	31
Equation 3.4	35	35	36	35	37	39	39	39

Note: The figures represent the annual median employment for the respective data sets derived from the *Census of Industrial Enterprises* and used in each regression equation.
Source: Own estimates derived from the *Census of Industrial Enterprises*.

CHAPTER 4

DETERMINANTS OF EXPORTING: THE SUNK COST HYPOTHESIS

4.1 Introduction [52]

4.1.1 Determinants of Irish Exporters

The analysis of chapter 3 has shown that Irish manufacturing exporters exhibit superior performance characteristics relative to non-exporters, but the analysis presented does not indicate the factors that influence the decision by an IOE to become an exporter or not. Chapter 4 considers the determinants of the export status of IOEs by examining (a) individual enterprise characteristics that possibly influence the export supply response of IOEs, (b) costs associated with entering the export market, and (c) possible cost variations involved in exporting to different geographic destinations.

Despite longstanding policy initiatives and significant government expenditure encouraging IOEs to become exporters, little is known about the characteristics of individual enterprises that determine their export status. In addition to examining individual enterprise characteristics, our approach to understanding the determinants of the export status of IOEs assumes that enterprises must incur start-up costs in order to enter the export market. The decision of the enterprise to export or not is *"...complicated by the presence of sunk start-up costs when they first sell abroad, since managers must research foreign demand and competition, establish marketing channels, and adjust their product characteristics and packaging to meet foreign tastes"* (Clerides, Lach and

[52] Part of this chapter reflects joint work with Frances Ruane.

Tybout, 1998, p. 905). The start-up costs are sunk in the sense that these costs cannot be recouped if the enterprise exits the export market. In our analysis of Irish enterprises we hypothesise that start-up or *sunk costs* are a principle determinant of the export status of IOEs.

Baldwin (1988, 1989) and Dixit (1989a,b) develop theoretical models where sunk costs are a prime determinant of exporting because profit maximising enterprises will only begin exporting if discounted future operating profits exceed the fixed costs of entering the export market.[53] The existence of sunk costs also makes the export decision in the current period dependent upon the export supply function in the previous period, as the payment of sunk costs is a once-only or non-recurring payment. Thus the export status of the enterprise in the previous period is thought to be a determinant of the decision to export in the current period because enterprises that have already incurred sunk start-up costs are relatively more likely to continue to export.

Moreover, patterns of export behaviour can be explained by the existence of sunk entry costs as well as costs associated with exiting the export market. The existence of entry and exit costs may make enterprises reluctant to frequently enter or exit export markets, effectively producing hysteresis in trade flows.[54] For example, policy changes or macroeconomic shocks such as exchange rate appreciations and depreciations could lead

[53] A further implication of assuming there are sunk costs associated with exporting is that the current-period export supply function depends on the number and type of producers who were exporting in previous periods (Roberts and Tybout, 1997). We investigate this implication directly in chapter 5 by searching for evidence of export 'spillovers' from FOEs on the export decisions of IOEs.

[54] Hysteresis is the failure of a property changed by an external agent to return to its original value when the cause of the change is removed (Baldwin, 1988, p.773).

to permanent changes in market structure, so that trade flows are not reversed when the initial stimulus to change is removed.

Theoretical models and empirical studies have sought to explain unexpected trade flows in response to exchange rate changes in particular by stressing that producers must incur sunk entry costs when moving into foreign markets. For example, devaluations that induce entry to the export market may lead to permanent increases in export flows, despite an eventual appreciation of the currency, because of the 'investment' made by enterprises in the form of sunk costs. Thus once in the export market enterprises will not exit unless an unexpected shock causes revenue to be less than variable costs.[55] Alternatively, exchange rate depreciations or other conditions favourable to increased export flows may not actually induce entry into the export market if such changes are regarded as transitory, whereby future operating profits are not expected to cover the required sunk costs of initially entering the export market. The combination of sunk costs and uncertain future export market conditions can create a value to waiting before entering the export marketplace, with only large favourable shocks likely to induce entry to export markets (Roberts and Tybout, 1997). Thus entry and exit responses can be asymmetrical, with export entry responses restricted by sunk costs and exit behaviour relatively unaffected (Feinberg, 1992).

Our empirical analysis of the search for sunk costs and other determinants of exporting will focus on the export market entry and exit rates of IOEs during the 1990s. Using data from the *Census of Industrial Enterprises*, Table 4.1 shows the number and proportion of

exporting IOEs, as well as the export intensity of IOEs between 1991 and 1998. From this short time-series it is evident that the exporting features of IOEs, in aggregate, changed little over the period. The proportion of IOEs in the export market remained constant at just over 60 per cent, despite the number of IOEs increasing by 20 per cent. Moreover, the proportion of turnover exported by all IOEs was stable at approximately 36 per cent. Such stability in the exporting trends of IOEs leads us to reflect upon the influence of sunk costs in the decision to begin exporting, raising the question of whether or not these export patterns provide initial evidence of the existence of sunk costs and hysteresis in Irish manufacturing trade flows. The existence of sunk costs possibly constrains export-market participation of IOEs by raising the costs of entry, or by creating uncertainty about the profitability of exporting, resulting in little movement or 'switching' of IOEs into and out of export markets, as evidenced in aggregate trade data.

Furthermore, patterns of export concentration may reflect different entry costs associated with different export destinations; that is, the cost of establishing trade links may be higher for more distant geographic export locations. Such a hypothesis is pertinent to Irish manufacturing because of traditional trade links and the close proximity of Ireland to the UK, which imply lower sunk costs for IOEs entering the UK market relative to other export markets. Moreover, there are a variety of reasons besides geographic distance for lower sunk costs, such as historic ties, common language, and similar economic, legal, and social institutions. Thus IOEs exporting to Non-UK destinations such as the EU, US, and ROW could be expected to incur higher sunk costs because of

[55] That is, discounted future operating profits are less than zero.

language, institutional, and legal barriers that must be overcome in order to establish trade linkages.

In addition to searching for evidence of the influence of sunk costs on the export decision of IOEs we also investigate the possibility that IOEs face different sunk costs between UK and Non-UK export destinations in chapter 4. The data survey of Table 4.1 shows IOE exports to the UK and Non-UK remained relatively constant between 1991 and 1998. However, there were changes in the distribution of IOE exports to specific Non-UK destinations; the proportion of total IOE exports shipped to the US rose between 1991 and 1998, but the proportion of IOE exports shipped to the ROW declined, despite encouragement by Irish policymakers for IOEs to export more to Non-UK destinations. We seek to explain these trade patterns by investigating whether or not there are differences in sunk costs between UK and Non-UK destinations, and investigate the implications of any differences for the decision by IOEs to export to various destinations.

4.1.2 Chapter Outline

The remainder of chapter 4 is organized as follows. Section 4.2 reviews recent literature that focuses on the determinants of exporting at the enterprise level. Section 4.3 proposes a theoretical model of the sunk cost hypothesis based on that developed by Bernard and Jensen (2001), adding the possibility that sunk costs vary between export destinations. Section 4.4 provides the data motivation for our analysis by reviewing entry and exit rates of IOEs to foreign markets and Section 4.5 outlines an empirical model of sunk costs. Section 4.6 reviews the econometric results and focuses on several robustness

issues. Section 4.7 concludes the chapter, noting the implications of the empirical results for future Irish trade policy.

4.2 Literature Review

A series of theoretical and empirical papers emerged in the late 1980s to explain the seemingly hysteretic effects of the extended swing in the value of the US dollar on US exports over the previous decade. Much of the early theoretical work on the nature of sunk costs and exporting thus focused on the response of trade flows to exchange rate appreciations relative to depreciations (Baldwin, 1988; Dixit, 1989b; Krugman, 1989).

Baldwin (1988) developed a 'beachhead' model showing that temporary exchange rate fluctuations could have hysteretic effects on trade prices and quantities.[56] Assuming that exporters to foreign marketplaces face sunk costs of market entry and fixed costs of serving the market in each period, enterprises will enter the export market if discounted future operating profits are greater than the sunk costs. However, once in the export market, enterprises will only exit if an unexpected shock, such as an exchange rate change, causes revenue to fall below variable costs.[57] Such a model implies that only large favourable shocks will entice firms to become exporters, so that hysteresis in trade is likely to result.

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[56] The term 'beachhead' is often used as a metaphor for hysteresis in exports: each enterprise has established a beachhead in the sense that export sales do not cease when market conditions change. The notion of a beachhead in exporting can also be applied to a group of enterprises, whereby initial entrants to the export market may facilitate the entry of other enterprises by reducing the sunk costs faced by subsequent exporters (Menzies and Heenan, 1993).

[57] That is, if operating profit is less than zero.

Baldwin (1988) also showed that high sunk entry costs induce asymmetric entry and exit responses to unanticipated shocks (such as exchange rate changes) as entry decisions are constrained by large sunk costs, with exit behaviour relatively unaffected. Using exchange rate movements as a potential source of permanent change in trade volumes for the USA during the early 1980s, Baldwin (1988) illustrated that if market entry costs are sunk, sufficiently large exchange rate shocks can potentially alter the domestic market structure and thus induce hysteresis.

Theoretical models that incorporate sunk costs are generally characterized by a 'band of inaction', whereby movements of a causal variable within some band fail to have an impact on export propensity. In the exchange rate example used by Baldwin (1988), a range of values of the exchange rate (the causal variable) will form a band of inaction within which firms are not motivated to commence or cease exporting. The lower (upper) level of the band of inaction is the value of the exchange rate at which firms will commence (cease) exporting.

The causal variable in most sunk costs models of trade performance is the price differential between the local price the enterprise receives for selling its product in the domestic market, and the world price it receives for exports, the difference being a sunk cost paid by the enterprise to commence exporting.[58] The difference between the two prices received represents the band of inaction with respect to exporting. Dixit (1989b)

[58] A high value of the differential (the upper bound) will entice enterprises to commence exporting, whilst a low value (the lower bound) will motivate exporting enterprises to exit the international market and instead sell their output domestically. Movements of the price differential between the upper and lower bounds of inaction will not change the number of exporting enterprises.

examines the factors that influence the width of this band of inaction by modelling the degree of variation in the causal variable (the sunk cost), and shows it to be an important determinant of the width of the band; the greater the variation in sunk costs, the wider the band of inaction. He stresses that variability in sunk costs can create a wide band of inaction even if the sunk costs are small.[59] If the size of sunk costs is exaggerated, Dixit (1989a) suggests that the combination of sunk costs and uncertainty means that large economic shocks may be necessary to change market structure, implying that the sunk cost model is more realistic than the standard model of trade.

An attempt to explain persistence in exporting by Australian manufacturers in the late 1980s was made by Menzies and Heenan (1993). These authors develop a theoretical model that allows both demand and exchange rate shocks to generate hysteresis, and tariff reductions are shown not to impact on exports until some threshold level is achieved. This model is applied to the performance of Australian manufactured exports for the period 1974 to 1992, during which the growth of manufactured exports was sustained despite a real appreciation of the Australian currency. The authors suggest that the sharp depreciation of the currency in the mid-1980s may have had a hysteretic effect in the late 1980s and early 1990s. Using the responses of a sample of Australian manufacturers conducted in 1992, there is some evidence of the influence of sunk costs in the export decision of enterprises and the existence of hysteretic episodes over the period. However, the small sample of 30 enterprises used in the study raises doubt about the robustness of the measure of sunk costs for individual exporters. Despite this, the study

[59] Sunk costs must be non-zero for a band of inaction to exist. See Dixit (1989b) for the issue of how the future variances and covariances of the causal variables affect the width of the band of inaction.

highlights the importance of sunk costs in the export decision and was a forerunner to studies using more extensive micro-level data.

Roberts and Tybout (1997) led the search for the determinants of exporting at the micro-level with an analysis of entry and exit patterns of enterprises in four major Colombian exporting industries between 1981 and 1989, a period of significant change in the Colombian real exchange rate. Using a dynamic probit model with random effects the authors conclude that Colombian manufacturers face large entry costs in their export markets; exporting in the previous year is found to increase the probability of exporting in the current year by as much as 60 percent. However, the authors find that the positive effects of prior export participation depreciate rapidly, so that by the time an enterprise has been a non-exporter for two years, its probability of exporting in the current period is little different from that of an enterprise that has never exported.

Bernard and Wagner (1998) found similar probabilities of the effect of sunk costs on exporting for manufacturing enterprises in the Lower Saxony region of Germany. In a sample of more than 6,400 enterprises operating between 1978 and 1992, enterprises that export in the previous period are 50 per cent more likely to export in the current time period, relative to those German enterprises that did not export in the previous period. However, as was the case for Colombian manufacturers, this advantage depreciates swiftly, with the probability of exporting in the current period falling by two-thirds if the German enterprise last exported two years previously.

The effects of sunk costs on exporting in the current period are significant, although lower, for US manufacturers. Using a panel of US enterprises operating continuously from 1984 to 1992, Bernard and Jensen (2001) examine the movement of enterprises into and out of export markets and the associated determinants of exporting. They find that the export entry and exit rates, or export 'switching' rates of US manufacturers, are higher than those of Colombian and German manufacturers and the impact of sunk costs on the probability of exporting appear correspondingly lower. Econometric issues surrounding the expected unobserved heterogeneity in the data set lead the authors to present several model specifications. Using both linear probability and probit models they find that US manufacturers face sunk costs when exporting; US manufacturers who exported in the previous period, relative to non-exporters in the previous period, are 25 to 40 per cent more likely to export in the current period, depending on the model specification estimated. Having last exported two years previously is also found to enhance the probability of exporting in the current period, although at a lesser rate. The effect of sunk costs on the probability of exporting in the current period can thus be likened to a depreciating investment, whereby the probability of exporting in the current period is enhanced if the enterprise has invested in exporting, via sunk costs, in previous periods.

Girma, Greenaway, and Kneller (2002), using data on UK manufacturers for the period 1988 to 1999, also find that the export experience of the firm is an important determinant of its current export status: relative to non-exporters in the previous period, UK enterprises that exported in the previous period are at least three times more likely to

export in the current period. The authors extend previous empirical analyses by examining the influence of *export intensity* on the export probability of UK enterprises. UK enterprises that export a greater share of their total sales are found to be more likely to continue to export than enterprises that export less intensively. However, when the export intensity of an enterprise is greater than approximately 45 per cent, the influence of exporting experience on the probability of exporting in the current period begins to decline.[60] As the authors note, "*increasing the amount of experience a firm has in export markets matters more when the share of exports to total sales is low than when it is high*" (Girma *et al*, 2002, p.11).[61]

Thus previous empirical research has established that there are substantial sunk costs involved when manufacturing industries based in Colombia, Morocco, the US, Germany, and the UK enter the export market. Moreover, the physical and intellectual capital required to enter export markets does not appear to depreciate completely after one period (year); enterprises that are absent from the export market for one or two periods have an enhanced probability of exporting in the current period relative to previous non-exporters.

Although the search for the influence of sunk costs on the probability of exporting has been the focus of the empirical studies described above, enterprise heterogeneity is also an important determinant of the export decision. As expected, the probability of exporting

[60] However, only 25 per cent of observations from exporting UK firms have export intensity above 45 per cent, with the median export intensity being 15.7 per cent.

[61] Additionally, Girma *et al* (2002) examine whether more experienced exporters are less likely to *exit* the export market and find that if UK enterprises are more experienced in export markets the probability of

increases in the size and productivity of the enterprise. Whether the size of the enterprise is proxied by the number of employees (Bernard and Wagner, 1998; Bernard and Jensen, 2001; Girma *et al*, 2002) or its capital stock (Roberts and Tybout, 1997), larger enterprises are more likely to export. Similarly, more productive enterprises, measured by either total factor productivity or labour productivity, are more likely to export. Girma *et al* (2002) find the probability of UK manufacturers exporting increases by nine per cent for each one per cent increase in total factor productivity.

Other enterprise variables found to be significant determinants of exporting are labour skill for US and German manufacturers, and average wages for US manufacturers. Roberts and Tybout (1997) find that the age of the enterprise influences the probability of Colombian manufacturers exporting and suggest that the age coefficient may highlight cost differences between producers. If inefficient producers are forced out of production, then older enterprises may be those that are more competitive in world markets. Because of the importance of enterprise heterogeneity, only certain enterprises may have the characteristics needed to take advantage of favourable shocks and enter the export market (Bernard and Jensen, 2001).

One little-explored aspect of the sunk cost hypothesis pertinent to Irish manufacturing is the issue of 'export targeting'. Feinberg (1992) explores a more direct implication of the role of hysteresis by focusing on the effects of exchange rate movements on export targeting. That is, differences in the export response to overall exchange rate movements

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exiting is lower. For every 10 per cent increase in the share of exports to total sales the probability of the enterprise leaving the export market declines by approximately 54 per cent.

may be the result of sunk costs being different between various geographic export destinations. Using data for 359 4-digit US manufacturing industries and the distribution of US exports by country of destination from 1978 to 1987, Feinberg relates overall exchange rate movements to the extent of entering and exiting export markets in particular locations and changes in the distribution of US exports across countries.[62] The empirical results are generally consistent with the hysteresis approach. Although a US-dollar depreciation leads to firms exporting to more destinations, in periods of US-dollar appreciation a similar pattern of exporting emerges, suggesting there may be explanations other than hysteresis for the export destination pattern. This initial work on the nature of sunk costs across various export destinations by Feinberg (1992) has not been directly explored in subsequent empirical research.

Given the evidence in chapter 3 suggesting that Irish exporters to the UK exhibit different enterprise characteristics compared to Non-UK exporters, we extend the concept of export destination patterns to our search for evidence of sunk costs faced by IOEs. If Non-UK exporters exhibit superior performance characteristics relative to UK-exporters, better performance and productivity characteristics may enhance their ability to meet the costs associated with entering the export market. If export entry costs are higher for Non-UK compared to UK destinations, then only IOEs that are relatively more productive and hence able to profit from exporting are likely to enter export markets with relatively higher sunk costs. We thus extend our basic model of sunk costs and other export determinants of IOEs by incorporating the possibility that sunk costs between UK and

[62] Where country of destination is taken as a proxy for the number of export markets served.

Non-UK export destinations are different.

4.3 Theoretical Model

We follow Roberts and Tybout (1997), Bernard and Wagner (1998), and Bernard and Jensen (2001) in modelling the decision to export by the rational, profit-maximising firm as analogous to the decision to market a new product.[63] In addition, we incorporate the geographical destination of Irish exports to the basic model of entry and exit with sunk costs in recognition of our hypothesis that entry costs may differ between export markets.

We begin by outlining the Bernard and Jensen (2001) model of the decision by an enterprise to export or not in the single period (t) case. The enterprise (i) is assumed to always produce at the profit-maximising level of exports (q_{it}^{*}) if it enters the export market. Assuming there are no entry costs in the current period then the enterprise earns profits (π_{it}) of

$$\pi_{it}(X_t, Z_{it}) = p_t.q_{it}^{*} - c_{it}(X_t, Z_{it}|q_{it}^{*}) \qquad (4.1)$$

where p_t is the price of exports and $c_{it}(\cdot)$ is the variable cost of producing the profit-maximising level of exports. The vector X_t contains market variables such as the exchange rate and EU trade regulations relevant to Ireland that the enterprise takes as exogenous.[64] The vector Z_{it} contains enterprise variables that are specific to the enterprise, such as the number of employees, average wages, and predominant export

[63] We follow the model and notation of Bernard and Jensen (2001).

destination.[65] Assuming expected profits from exporting are greater than zero, the enterprise will export. If Y_{it} is the export status of enterprise (i) in period (t), the export status of the enterprise is given by

$$Y_{it} = 1 \quad \text{if} \quad \pi_{it} \geq 0 \qquad (4.2)$$

$$Y_{it} = 0 \quad \text{if} \quad \pi_{it} < 0$$

Expected profits of the enterprise in the multiple-period case are a simple extension of the single-period case given in (4.1). The expected profits of the enterprise become

$$\prod_{it}(X_t, Z_{it}) = E_t\left(\sum_{s=t}^{\infty} \delta^{s-t}\left[p_s q_{is}^* - c_{is}\left(X_s, Z_{is} \middle| q_{is}^*\right)\right]\right) \qquad (4.3)$$

Assuming that the cost function is not dependent upon the output level of the enterprise in a previous period this multi-period model can be solved in the same way as the single-period model.

The multi-period model can be extended to include sunk costs faced by the enterprise when it enters the export market. It is assumed that these entry costs recur in full if the enterprise exits the export market and chooses to re-enter in another time period.[66] In the single period maximisation problem with entry costs, profits for the enterprise are given by

$$\tilde{\pi}_{it}\left(X_t, Z_{it}, q_{i,t-1}^*\right) = p_t q_{it}^* - c_{it}\left(X_t, Z_{it}, q_{it-1}^* \middle| q_{it}^*\right) - N\left(1 - Y_{it-1}\right) \qquad (4.4)$$

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[64] Shocks such as microeconomic reform and tariff reductions cannot be described as hysteric in the strict sense of the word as they are not expected to be reversed. Such shocks are represented by a shift in the supply curve of the enterprise.

[65] See Section 4.5 for a discussion of the specific variables included in the empirical model.

[66] In our empirical analysis of Section 4.5 we test whether there is a higher probability of exporting from having exported in the previous year, or whether entry costs recur for enterprises wishing to re-enter the export market following their exit two years previously.

where N represents the entry cost paid by the enterprise to begin exporting. The enterprise does not pay the entry cost if it exported in the previous period ($Y_{it-1} = 1$). Thus an enterprise will export in the current period if expected profits, net of entry costs, are positive; that is, $Y_{it} = 1$ if $\tilde{\pi}_{it} > 0$.

Entry costs can be incorporated into our dynamic framework, thus allowing the export decision of the enterprise in the current period to influence future decisions to export or not. The presumption of entry costs as sunk costs creates a 'band of inaction' where the enterprise may simply make no decision to enter the export market. The enterprise will choose a sequence of output levels $\left(q_{is}^{*}\right)_{s=t}^{\infty}$ that maximize both current and discounted future profits, given by

$$\prod_{it} = E_t\left(\sum_{s=t}^{\infty} \delta^{s-t}\left[\tilde{\pi}_{is} \cdot Y_{is}\right]\right) \qquad (4.5)$$

Year by year profits are given by equation 4.4 and are constrained to be non-negative because the enterprise can always choose not to export. As Bernard and Jensen (2001) note, this formation is equivalent to the enterprise choosing to export or not in each period because the enterprise always chooses to produce the profit-maximising quantity within each period. The value function $V_{it}(.)$, representing the maximised expected value of payoffs, now incorporates possible entry costs in the within-period profits.

$$V_{it}(\cdot) = \max_{(q_{it}^{*})}\left(\tilde{\pi}_{it}\left[q_{it}^{*} > 0\right] + \delta E_t\left[V_{it+1}(\cdot)\middle| q_{it}^{*}\right]\right) \qquad (4.6)$$

Thus an enterprise will choose to export in the current period $\left(q_{it}^{*} > 0\right)$ if

$$p_t q_{it}^* + \delta\left(E_t\left[V_{it+1}(\cdot)\middle|q_{it}^* > 0\right] - E_t\left[V_{it+1}(\cdot)\middle|q_{it}^* = 0\right]\right) > c_{it} + N_{it}\left(1 - Y_{it-1}\right) \qquad (4.7)$$

The inter-temporal link between exporting today and exporting tomorrow in the multi-period model is incorporated in the cost of entry measure.

In addition to modelling sunk costs in an inter-temporal framework, as outlined by Bernard and Jensen (2001) above, we wish to incorporate the hypothesis that sunk costs may differ between the geographic destinations of exports. That is, the entry cost to the export market may be dependent upon the location of the export market chosen by the enterprise. The entry cost for the firm thus becomes N_{itd} where d is the destination of exports, and the enterprise will choose to export in the current period if

$$p_t q_{it}^* + \delta\left(E_t\left[V_{it+1}(\cdot)\middle|q_{it}^* > 0\right] - E_t\left[V_{it+1}(\cdot)\middle|q_{it}^* = 0\right]\right) > c_{it} + N_{itd}\left(1 - Y_{itd-1}\right) \qquad (4.8)$$

Equation 4.8 is the participation equation that is estimated for Irish manufacturing data in Section 4.5.

4.4 Export Market Entry and Exit

The empirical analysis in this chapter is based on *Census of Industrial Enterprises* data for the period 1991 to 1998. In keeping with previous empirical studies for the UK and Colombia we use a sample of continuously operating Irish-owned enterprises, omitting any enterprise that started or stopped operating during the time period considered. Non-continuous operating enterprises are omitted as including such enterprises would necessitate modelling the probability of enterprise death. The omission of an enterprise in the *Census* data in the year (t + 1) is taken to be the 'death' of the enterprise as the

Census by definition includes all manufacturing enterprises in the period considered. This sample of enterprises does not represent the population of Irish manufacturers over the period but, as Roberts and Tybout (1997) note, such a sample is sufficient for examining the effects of sunk costs on established enterprises without the complication of having to model the simultaneous decisions to enter or exit production and to enter or exit the export market.[67] Table 4.3 details the characteristics of the 1,000 IOEs operating continuously between 1991 and 1998. Relative to the full data set of all IOEs (Table 3.2), continuously operating IOEs, on average, employ more people, produce more turnover, and produce more turnover and gross value added per employee. Moreover, continuously operating and exporting IOEs exhibit superior performance characteristics relative to continuously operating non-exporters.

The combination of sunk costs and uncertainty associated with exporting may induce persistence in the exporting status of IOEs, with enterprises that have already incurred sunk costs in the previous period more likely to export in the current period. If sunk costs of entry are large and important, changes in the concentration of exporting may be slow because the exit decision depends on discounted operating profits turning negative. Thus we expect 'switching rates' by enterprises into and out of export destinations with high sunk costs to be relatively low. Conversely, switching rates for low cost destinations are expected to be high.

[67] It may be argued that continuously operating exporters are more likely to be consistent exporters. In our sample of continuously operating enterprises 12 per cent of total observations in the sample exported 100 per cent of their turnover between 1991and 1998. In contrast, approximately 3 per cent of IOE observations in the *Census* exported 100 per cent of their turnover in the same time period.

Preliminary evidence of the sunk cost hypothesis in Irish exporting is provided by examining transition rates of IOEs into and out of the export marketplace between 1991 and 1998, as summarized in Table 4.4. In our sample of continuously operating IOEs, enterprises that exported continuously over the period are dominant (45 per cent). For IOEs that did not export in 1991, almost 21 per cent continued to be non-exporters in all years to 1998. Of greater interest are those IOEs that *switch* export status between any given years. That is, exporters in year (t) may not export in year ($t+1$), or non-exporters in year (t) may begin exporting in year ($t+1$). The combination of enterprises entering or leaving the export market in the current year, relative to the previous year, is defined as the *switching rate*. In the case of Ireland, less than eight per cent of manufacturers switch export status between any two years, on average, in the period considered. Export switching rates for Irish manufacturing are lower than those found for the US between 1978 and 1992 (Bernard and Jensen, 2001), and higher than those of the UK over the period 1988 to 1999 (Girma *et al*, 2002).[68]

The costs faced by Irish exporters attempting to enter export markets in various geographic locations may be different; Irish enterprises possibly do not face the same sunk costs when exporting to the UK as they do when exporting to Non-UK destinations

[68] For a sample of 650 Colombian manufacturing plants between 1992 and 1989, Roberts and Tybout (1997) report average entry and exit rates of 2.7% and 11.0% per year respectively. Although 86% of plants in their sample never change export status, only 36% remained exporters for the whole sample period. Aitken *et al* (1997) report that between 1981 and 1991, the average annual entry and exit rates for Colombian plants into export markets were 2.7% and 1.7% respectively; for Morocco between 1984 and 1991, 4.9% and 3.7% respectively; and for Mexico between 1986 and 1990, 4.8% and 1.5% respectively. Bernard and Jensen (2001) report large year-to-year transition rates between 1984 and 1992 for US manufacturers. On average over the period, 13.9% of non-exporters start exporting in any given year, whilst 12.6% of exporters stop. Although US plants show greater transition into and out of the export markets than previous studies, there are still a large proportion of continuing exporters (78.6%) and non-exporters (70.4%) over the period. For the UK, Girma *et al* (2002) find relatively low rates of entry (6%) and exit (4%) and corresponding high rates of continuing exporters (96%) and non-exporters (94%).

because of different economic, legal, and institutional structures that must be overcome in order to enter these marketplaces. Thus we expect switching rates into and out of the UK export market to be relatively higher because of assumed relatively low sunk costs; exporters are able to switch between exporting or not to the UK because sunk costs are not a large determinant of operating profits. In contrast, if sunk costs are significant, we expect switching rates to Non-UK destinations to be relatively low because of the effect of relatively high sunk costs on operating profits. Thus we expect UK exporters to have more symmetric entry and exit patterns relative to Non-UK exporting IOEs.

The switching rates for UK and Non-UK exporters are presented in Table 4.4.[69] The data show a significant difference between the switching rates of both types of exporters: Non-UK exporters exhibit greater stability in their exporting patterns with the proportion of switching for Non-UK exporters averaging four per cent in the 1991 to 1998 period, compared to a switching rate of more than ten per cent for UK exporters. Moreover, Non-UK exporters rarely cease exporting whilst UK-exporters are more than twice as likely, on average, to commence exporting compared to Non-UK exporters.

IOEs thus exhibit evidence of switching between exporting and not, although the switching rate is relatively low. A low rate of switching into and out of export markets can possibly be interpreted as "*...prime facie evidence of sunk costs*" (Girma *et al*, 2002, p.7). Moreover, patterns of switching by IOEs differ between export destinations, with Non-UK exporters exhibiting lower and more asymmetric switching rates than UK

[69] UK exporters are IOEs that ship more than 50 per cent of their total exports to the UK. Non-UK exporters are IOEs that ship more than 50 per cent of their total exports to Non-UK destinations.

exporters, suggesting sunk costs are greater for Non-UK exporters relative to UK-exporters. In Section 4.6 we empirically examine whether or not these patterns of export persistence and switching reflect different characteristics of IOEs themselves, the sunk costs associated with entering the export market, or a combination of both factors.[70]

4.5 Empirical Methodology

Persistence in export status may be caused by sunk costs, or may be the result of enterprise heterogeneity. That is, sunk costs may explain the lack of movement of enterprises in and out of export markets. Alternatively, persistent differences in enterprise characteristics may explain differences in gross profits from exporting and thus the entry or exit decision of the enterprise (Bernard and Jensen, 2001). In this section we develop an econometric model that will allow us to distinguish between these explanations of export participation by Irish manufacturers.

The multi-period model of export participation with entry costs in Section 4.3 (equation 4.8) provides the theoretical basis for our empirical study. An enterprise will choose to export if its current and expected revenues are greater than its costs.[71]

$$Y_{it} = \begin{cases} 1 & if \quad \hat{\pi}_{it} > c_{it} + N(1 - Y_{it-1}) \\ 0 & otherwise \end{cases} \qquad (4.9)$$

[70] In practice, export entry or exit to foreign markets may be less well-defined than the strict entry and exit figures given. Export entry and exit rates may be related to export intensity. For example, a decline in the value or volume of exports to a particular country from one period to the next may be defined as 'exit' from that market. For German manufacturers, Bernard and Wagner (1997) find that in years of substantial entry by new exporters, existing exporters also increase the fraction of their shipments going abroad.

[71] We follow the model formation and notation of Bernard and Jensen (2001).

where Y_{it} is the export status of the enterprise and

$$\hat{\pi}_{it} = p_t q_{it}^* + \delta\left(E_t\left[V_{it+1}(\cdot)\middle| q_{it}^* > 0\right] - E_t\left[V_{it+1}(\cdot)\middle| q_{it}^* = 0\right]\right) \qquad (4.10)$$

Export market participation is then given by the dynamic binary-choice equation

$$Y_{it} = \begin{cases} 1 & if \quad \beta X_t + \gamma Z_{it} - N(1 - Y_{it-1}) + \varepsilon_{it} > 0 \\ 0 & otherwise \end{cases} \qquad (4.11)$$

where lagged export status is our proxy for sunk costs (Y_{it-1}). Assuming potential IOE exporters face entry or sunk cost, the past export experience of the enterprise should be a predictor of its current export status. Additionally, we include a similar dummy variable to reflect the influence of sunk costs to the enterprise if it has been absent from the export market for one year (Y_{it-2}) in order to capture the depreciating nature of sunk costs evident in previous empirical studies.

X_t represents temporal variations in export profitability and start-up costs that are common to all enterprises, such as exchange rates and trade-policy conditions, and Z_{it} is a vector of enterprise-specific determinants of current operating profits and start-up costs. More specifically, the vector of observable enterprise characteristics (Z_{it}) includes a size variable ($Size_{it}$) to reflect the results from chapter 3 that show exporting IOEs to be relatively larger than non-exporters. As Bernard and Jensen (2001) note, the inclusion of employment as a proxy for enterprise size may be capturing several characteristics of the enterprise; by definition, larger enterprises have been successful exporters in the past, but

size may also be associated with lower costs (average or marginal), thus providing a separate mechanism for size to increase the likelihood of exporting.

We include both average wages ($Wage_{it}$) and a labour skill variable ($Skill_{it}$) in order to account for the labour quality of the enterprise. Whether both characteristics will have a positive impact on the decision of the enterprise to export is uncertain. The results of chapter 3 suggest that there is little difference in average wages between exporting and non-exporting IOEs. The results in chapter 3 also indicate that exporting IOEs tend to use a higher proportion of less-skilled labour relative to non-exporters, so that low-skilled and lower average wages may be associated with exporting. Labour productivity, measured by turnover per employee ($Turnover_{it}$), is included as a further measure of enterprise quality, with higher labour productivity expected to have a positive association with the propensity to export.

Following Girma *et al* (2002) we examine whether or not the proportion of turnover exported is associated with the probability of exporting. Bernard and Wagner (1997) find that in years where the number of new exporters is high, the proportion of shipments exported by existing exporters also increases. Thus we include the export share of turnover ($Share_{it}$) in the expectation that enterprises that export more intensively are more experienced exporters and thus more likely to continue to export. We also include the squared export share of turnover ($Share_{it}^2$) in order to capture the possible decreasing importance of the proportion of exported turnover.

A set of time dummies ($Year_t$) are included to account for macroeconomic changes and 4-digit NACE Rev.1 industry dummies ($Nace_{it}$) are included to control for industry specific effects.[72]

Despite the observable independent variables (Z_{it}) accounting for many enterprise characteristics there are likely to be unobserved enterprise characteristics such as managerial ability and product quality that may influence the export decisions of IOEs. The presence of unobserved characteristics is likely to induce serial correlation in the error term ε_{it} (Roberts and Tybout, 1997). Using an estimator that ignores the likelihood of this serial correlation will result in overestimation of the entry costs associated with exporting, attributing the induced persistence in exporting to sunk costs.[73] Thus our dynamic binary choice model must incorporate this unobserved heterogeneity.

It is possible to model the unobserved heterogeneity as a *fixed effects* or a *random effects* specification. The random effects model requires the enterprise effects to be uncorrelated with the regressors. This required assumption is likely to be violated as enterprise characteristics such as size and labour quality are probably correlated with the unobserved enterprise characteristics such as managerial ability. If the heterogeneity of the unobserved enterprise effects is large, a random effects probit estimate of the lagged dependent variable may be biased upwards (Heckman, 1981a, b, c).

[72] The year dummies are assumed to control for general movements in relative prices and general business cycle effects. Thus we do not explicitly include a price ratio variable in our model.

Alternatively, a fixed effects approach avoids the problem of correlated enterprise effects and regressors: if the time period of the data set is large, the bias induced by the fixed effects estimator will be small. However, determining the appropriate sample length is arbitrary.[74] Fixed effects models will produce biased and inconsistent parameter estimates, especially for the coefficient on the lagged dependent variable.[75]

Various estimation procedures for a dynamic binary choice model with unobserved heterogeneity have been used in previous studies of the determinants of exporting, including *probit* and *linear probability models* (LPM). The linear probability specification and associated estimation methods have several potential problems; for example, the predicted probabilities may lie outside the 0-1 range and R^2 values are generally lower (Gujarati, 2003). Thus a linear probability specification is not a usual choice for a dynamic binary model. A more common estimation strategy is a probit model, with or without random effects, where the coefficient on the lagged dependent variable provides an estimate of sunk costs associated with exporting. When estimating a probit model the issue of enterprise heterogeneity must again be dealt with.

We are thus left with a choice of empirical models that possibly capture the influence of sunk costs on the export decision of the enterprise in a biased manner. Rather than select

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[73] Heckman (1981a,b) discusses the theoretical issues of this problem of 'spurious-state dependence'. Roberts and Tybout (1997) discuss the issue in the context of exporting.

[74] Bernard and Jensen (2001) report the coefficient on the lagged sunk cost variable for a fixed effects estimator for a series of time periods ranging from 2 to 7 years. As the sample lengthens, the coefficient rises rapidly, so that for the 7-year sample length the fixed effects estimator is close to their instrumental variables differences specification. Although still biased, the authors state that the fixed effects estimator in levels performs well.

[75] See Heckman (1981a, b) for a discussion of the issue of state-dependence and enterprise effects in a binary choice model.

one specific approach, we model the various specifications outlined by both Roberts and Tybout (1997) and Bernard and Jensen (2001) for our Irish manufacturing data, and obtain a range of estimates of the influence of sunk costs on the export decision of IOEs that can be compared with previous results for Germany, the US, and Colombia.

Following Roberts and Tybout (1997) we model the impact of sunk costs as a random effects *probit* specification of the form

$$Y_{idt} = \begin{cases} 1 & if \quad \beta X_t + \gamma Z_{it} - N(1 - Y_{it-1}) + \kappa_i + \eta_{it} > 0 \\ 0 & otherwise \end{cases} \qquad (4.12)$$

The error (ε_{it}) is comprised of two components, a permanent enterprise-specific effect and a purely transitory effect ($\varepsilon_{it} = \kappa_i + \eta_{it}$). The permanent component of the error term (κ_i) is assumed to be uncorrelated across enterprises ($\text{cov}(\kappa_i, \kappa_j) = 0$), and the transitory component (η_{it}) is assumed to be uncorrelated across time ($\text{cov}(\eta_{it}, \eta_{it-s}) = 0$). This error term composition, combined with the assumption that the errors are normally distributed, allow Roberts and Tybout (1997) to estimate the model as a dynamic random effects probit. We follow this procedure. [76]

[76] An additional problem arises with the dynamic random effects probit specification. If there are permanent enterprise-specific components in the error term (κ_i), the export status of the enterprise in the initial period (Y_{i0}) is not exogenous. This 'initial conditions' problem should be dealt with by using instruments for these initial values of the export status of the enterprise, allowing the errors to be correlated with the permanent enterprise-specific error. Roberts and Tybout (1997) use a Heckman approach (1981c) to account for the initial conditions problem in their Colombian data. However, given the lack of appropriate instruments, Bernard and Wagner (1998) and Bernard and Jensen (2001) estimate their probit models assuming the initial conditions are exogenous. Given our panel-data set of continuously operating enterprises between 1991 and 1998, we estimate our model of one- and two-year dependent variable lags

We also follow Bernard and Jensen (2001) in estimating three separate models based on a *linear probability* framework that models the unobserved enterprise effects as fixed. The authors argue that the linear probability framework is better able to distinguish the sunk cost influence on the export decision from the unobserved enterprise heterogeneity than the random effects probit model specification modelled by Roberts and Tybout (1997).[77]

The first linear probability specification, equation 4.13, is modelled in levels. This specification undoubtedly overestimates the significance of sunk costs in the export decision of the enterprise, but it effectively gives an upper bound on the importance of sunk costs for IOEs (the lagged endogenous variable). The equation estimated is

$$Y_{it} = \beta Z_{it-1} + \vartheta Y_{it-1} + \varepsilon_{it} \qquad (4.13)$$

Secondly, we consider the role of permanent enterprise effects by modelling equation 4.14 as a levels specification with fixed effects. Although the resulting fixed effects estimates are likely to be biased downwards and inconsistent, they effectively give a lower bound for the importance of sunk costs. The equation estimated is

$$Y_{it} = \beta Z_{it-1} + \vartheta Y_{it-1} + \kappa_i + \eta_{it} \qquad (4.14)$$

where the error term is composed of a permanent enterprise-specific component (κ_i) and a purely transitory component (η_{it}), which captures other endogenous shocks.

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by dropping the 1991 and 1992 observations. Thus the first and second year lags of our 'initial period' of year 1993 are known.

[77] As Bernard and Jensen (2001) note, this specification in levels also allows the effects of any time-invariant enterprise characteristics on the probability of exporting to be observed. Variables that do not change over time will be perfectly correlated with the fixed effect.

Thirdly, we estimate a first differences specification by using an instrumental variables approach; we use two lags on the levels of the independent variables as instruments.[78] Bernard and Jensen (2001) argue that the instrumental variables specification of equation 4.15 avoids the problem of inconsistent estimates found in the fixed effects levels specification.[79]

$$\Delta Y_{it} = \beta \Delta Z_{it-1} + \vartheta \Delta Y_{it-1} + \Delta \eta_{it} \qquad (4.15)$$

In addition to the search for sunk costs across all export destinations we estimate a model incorporating the hypothesis that sunk costs for IOE exporters differ between UK and Non-UK destinations. The dynamic binary-choice equation is reformulated to reflect enterprises that export to the UK only, with all other observations defined as non-exporters in order to isolate the sunk costs associated with exporting to the UK. We expect UK-only exporters to face lower sunk costs relative to enterprises that export to other destinations. The export market participation equation (equation 4.11) is redefined to be

$$Y_{idt} = \begin{cases} 1 & if \quad \beta X_{dt} + \gamma Z_{idt} - N(1 - Y_{idt-1}) + \varepsilon_{idt} > 0 \\ 0 & otherwise \end{cases} \qquad (4.16)$$

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[78] That is $Z_{it-2}, Z_{it-3}, Y_{it-2}, Y_{it-3}$ are used as instruments.

[79] The structure of the error term is crucial in the interpretation of the results of equation 4.4. If shocks affecting export conditions are expected to be transitory, so $\text{cov}(\eta_{it}, \eta_{it-1})=0$, then large costs will maintain the exporting status quo of the enterprise. That is, exporters will continue to export and non-exporters will remain non-exporters. Conversely, perceived persistent shocks to exporting conditions will alter the value of entry to the export market, whereby enterprises will begin exporting if the positive shock enhances the value of entry. Such persistent shocks, if not modelled in the error structure, would be captured by the lagged endogenous variable (the sunk cost proxy) and therefore interpreted incorrectly as high entry costs. Bernard and Jensen (2001) argue that the first differences specification should overcome this problem. (Although as the authors admit, there will be a loss of efficiency in the model if the shocks are purely transitory.)

where lagged export status (Y_{idt-1}) is a proxy for sunk costs for those enterprises that export to the UK, and (d) defines IOEs that export to the UK only. We estimate equation 4.16 using the various estimation procedures outlined above.[80]

In order to avoid possible simultaneity problems in our empirical models all enterprise characteristics and exogenous variables are lagged one year.

4.6 Econometric Results

We estimate all specifications detailed in Section 4.5 on a balanced panel comprising 1,000 continuously operating IOEs between 1991 and 1998. Table 4.5 details the results for each of the model specifications outlined.

Column 1 of Table 4.5 presents the results of the linear probability model (equation 4.13). The estimates of sunk costs in the model do not control for unobserved heterogeneity. That is, if there are significant unobserved enterprise effects, the levels specification will result in inconsistent estimates, and the coefficient on the lagged endogenous variable (the sunk cost variable) will be biased upward. The estimate of sunk costs in this specification is large; enterprises that exported in the previous year ($t-1$) are 67 per cent more likely to export in the current year (t) compared to non-exporters in the previous year. The coefficient on the measure of export status two years previous is also positive and significant, although lower than the first year sunk cost estimate. Being out

[80] Due to the relatively small number of Non-UK only exporters (388) it is not possible to estimate equation 4.16 on a set of Non-UK only exporters. However, by separating UK-only exporters from the remainder of

of the export market for at least one year reduces the entry benefits of once having exported. These results suggest that there are substantial entry costs to exporting, and that they depreciate significantly in one year, but they do not depreciate completely. Because these estimates incorporate any persistent unobserved heterogeneity they are considered the upper limit of the importance of sunk costs for IOEs.

The linear probability model in levels with enterprise fixed effects (equation 4.14) reported in column 2 of Table 4.5 most likely over-controls for unobserved enterprise heterogeneity and yields estimates of sunk costs that are biased downwards. Because of the biased estimates of the fixed effects model in our relatively short panel, the coefficient on the sunk cost proxy (lagged export status) is reduced to approximately 17 per cent. The depreciating effect of sunk costs is not significant in this fixed effects model. Despite this, the positive coefficients on the sunk cost variable in both equations 4.13 and 4.14 suggest that sunk costs are significant, and that IOEs are more likely to export in the current year if they exported in the previous year relative to non-exporters in the previous year.

In column 3 of Table 4.5 we control for unobserved enterprise heterogeneity with a first-differenced instrumental variables specification (equation 4.15). The coefficient on the lagged export status variable is positive and significant, with a value approximately midway between the over- and underestimates of the estimate of sunk costs obtained in equations 4.13 and 4.14 respectively. Having exported in the previous year enhances the

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the data set we can infer the differences in sunk costs between UK and Non-UK exporters.

probability of exporting in the current period, but the positive impact of sunk costs on exporting in the current period depreciates significantly if the enterprise has been out of the export market for one year.

Our final specification of the sunk cost model is a random effects probit (column 4, Table 4.5). Once again, past exporting experience has a positive and significant association with exporting in the current period. Although the random effects probit specification is likely to lead to overestimates of the sunk cost coefficients (Bernard and Jensen, 1997b) the estimate of sunk costs is within the upper and lower boundaries established by equations 4.13 and 4.14.

In addition to the significance of the sunk cost variable, a number of enterprise characteristics are associated with the probability of exporting. In all model specifications estimated we find that enterprises that export more intensively are more likely to export relative to enterprises that ship a lower proportion of their turnover to export markets. But as in the Girma *et al* (2002) study for the UK, we find that the effect of export intensity on export participation decreases as the share of exports in turnover increases, as reflected by the negative and significant squared export share ($Share_{it}^2$) coefficient. This result suggests that export intensity has a positive influence on the export decision of IOEs, but only up to a point; beyond a certain proportion of exports IOEs are no more likely to export than less intensive exporters. This result can be explained in the context of sunk costs; IOEs that are less intensive exporters, but not profitable exporters, may be able to remain in the export market if they are able to effectively 'subsidize' their

exporting activities with profits made through domestic sales. However, enterprises that ship most of their output to export destinations may not have the ability to sustain losses from exporting through 'cross-subsidisation' with domestic sales. Thus if intensive exporters are sustaining losses they may be under greater pressure to withdraw from the export market.

Even after controlling for fixed enterprise effects, we find that enterprise size is still associated with a higher probability of exporting in all model specifications. The significance of enterprise size for exporting is consistent with the existence of start up costs in exporting, as well as the possibility that large enterprises are low marginal cost producers and face a higher return to exporting that other smaller enterprises (Aitken *et al*, 1997). Labour skill intensity is positively associated with exporting in all model specifications except the IV-FD equation, so that enterprises with more highly skilled labour are more likely to export. We recognise that the insignificance of all enterprise characteristics except size in the IV-FD specification is likely to be an indication of the poor nature of the instruments used. [81]

The above results have shown that IOEs, on average, face significant sunk costs when entering all export markets. However, it is possible that IOE exporters face lower sunk costs when exporting to the UK because of similar economic, financial, and legal structures between Ireland and the UK. In order to isolate the sunk costs that UK exporters face we redefine 'exporters' to be those IOEs that export to the UK only. Table

4.6 summarises the characteristics of UK-only exporters. Relative to our full sample of all continuously operating IOEs, UK-only exporters are, on average, smaller in terms of employment and turnover, and less productive, as reflected by lower turnover per employee.

Table 4.7 presents the results for the four model specifications (equations 4.12 to 4.15) where an exporter is defined as an IOE enterprise that exports to the UK only. In each specification, the sunk cost premium for UK exporters is positive and significant, so that exporting in the previous year is associated with IOEs having a higher probability of exporting in the current year, relative to non-exporters in the previous year. However, the sunk cost premium for UK-only exporters is significantly lower than the sunk cost premium obtained when the full sample of IOE exporters was examined, giving support to our hypothesis that sunk costs are lower for UK exporters relative to the sunk costs faced by IOEs exporting to other destinations.

In both the linear probability levels specification (equation 4.13) and the probit specification (equation 4.12), IOEs that exported two years previously are more likely to export in the current year, relative to previous non-exports. However, the fixed effects linear probability specification (equation 4.14) and the IV-FD specification (equation 4.15) indicate that exporting two years previously may actually have a negative influence association with the probability of IOEs entering the export market in the current year. This result possibly reflects the relatively high number of IOEs that switch into and out of

[81] Roberts and Tybouts (1997) suggest that the insignificance of the wage variable may be due to the way it is defined, being the total cost of labour for the enterprise divided by the number of employees, so that

the UK export market noted in Table 4.4, and is a further indication that sunk costs are lower for UK only exporters relative to IOEs that export to other destinations.

In summary, our results indicate that IOE exporters face significantly higher entry costs when attempting to export to the EU, USA, and ELS, relative to exporting to the UK. This result may help to explain the stability in export propensity patterns to the EU and Elsewhere during the 1990s.[82] Moreover, the lack of 'switching' by IOEs into and out of exporting to Non-UK destinations is explained by the relatively higher sunk costs associated with exporting to these destinations, making IOEs reluctant to enter these export markets unless they are sure of the profitability of doing so. Moreover, IOEs appear to be reluctant to exit these Non-UK export markets, possibly because of the sunk costs incurred in entry.

4.7 Summary and Conclusion

Chapter 4 is the first enterprise-level study of sunk costs that IOEs incur when attempting to enter export markets. In the context of identifying the enterprise-level determinants of exporters in Irish manufacturing, we develop and estimate a dynamic discrete-choice model that examines whether or not the current export status of an IOE is a function of its previous exporting status. Additionally, we examine the individual enterprise characteristics that determine the export supply response of IOEs.

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variation between enterprises in unit labour costs may be reflecting differences in labour quality

Using the *Census of Industrial Enterprises* data for IOEs between 1991 and 1998, we analyse entry and exit patterns of IOEs to export markets and find that IOEs switch export status less frequently relative to manufacturers in the US (Bernard and Jensen, 2001). However, the movement of IOEs into and out of export markets is dependent upon the destination of exports; UK-exporters are more than twice as likely to switch export status compared to Non-UK exporters. The frequent movement of IOEs into and out of the UK export market provides initial evidence that sunk costs associated with exporting to the UK are lower than the sunk costs IOEs encounter when exporting to Non-UK destinations.

In order to measure the significance of sunk costs for the export decision of Irish manufacturers we follow the methodology of Roberts and Tybout (1997b) and Bernard and Jensen (2001), and model four empirical specifications that attempt to account for unobserved heterogeneity of enterprises. Regardless of the specification used, our empirical results show that IOEs face significant sunk costs; IOEs that export in the previous year have a higher probability of exporting in the current year, relative to non-exporters in the previous year. Moreover, IOEs that last exported two years previously are also more likely to be exporters in the current period relative to non-exporters, although the benefits of having once been an exporter on the probability of exporting in the current period decline significantly. Thus our various model specifications lead to a range of estimates that strongly indicate that sunk costs are an important determinant in the decision by IOEs export or not, and that costs incurred when entering the export

[82] As noted in chapter 2, the volume and value of IOE exports to all destinations increased between 1991 and 1998. The proportion of total IOE exports to the EU and Elsewhere remained relatively constant.

market do not fully depreciate when enterprises exit the export market. Past exporting experience is a strong enterprise-level indicator of future exporting.

Our analysis of the determinants of Irish exporters extends the work of previous empirical studies by attempting to isolate the impact of sunk costs based on the destination of Irish exports. Because of historical trade links between Ireland and the UK, we test empirically the hypothesis that Irish exporters to the UK face lower sunk costs than IOEs exporting to other destinations. The results indicate that IOE exporters face significantly lower sunk costs when exporting to the UK, relative to the sunk costs associated with exporting to Non-UK destinations. This result may help to explain the relatively high rate of switching by IOEs into and out of the UK export market between 1991 and 1998.

Certain enterprise characteristics are also strong determinants of the export status of IOEs. We find that larger enterprises are more likely to be exporters, a result consistent with the evidence concerning enterprise size and exporting found in chapter 3. Moreover, intensive exporters are more likely to remain exporters, but only up to a point; the effect of export intensity on export participation is decreasing as the share of exports in turnover increases. This result may also be an indictor of sunk costs in that intensive exporters remain in the export market because of the sunk cost investments already made. However, if those enterprises that export the majority of their output are not able to sustain their exporting, then domestic sales cannot cover the losses incurred on export sales, forcing the IOE to withdraw from the export market altogether.

The results of chapter 4 indicate that exporting involves fixed costs when developing new marketplaces. In order to cover these fixed costs, the productivity of intended exporters needs to be higher than continuing non-exporters before actually entering the export market, a requirement also highlighted by chapter 3. Policy initiatives intended to improve the export propensity of IOEs should thus be designed to enhance the productivity of enterprises long before they become exporters. Moreover, IOEs that seek to export beyond the UK face even higher sunk cost requirements than UK exporters, and consequently must improve their productivity levels beyond those of UK exporters. Policies designed to enhance enterprise productivity and export propensity should thus distinguish between future exporters based upon targeted export markets.

Table 4.1 Export Features and Export Destination Patterns of IOEs

IOEs	1991	1998
No. of Enterprises	1,620	1,945
Proportion of exporters (%)	61.2	60.1
Export Intensity (%)	35.0	35.7
Export Destination [a]		
UK	*43.1*	*42.2*
Non-UK	*56.9*	*57.8*
EU	33.5	32.4
USA	6.9	12.1
ELS	16.5	13.2

Source: Own estimates derived from the *Census of Industrial Enterprises*.
[a] Proportion of total IOE exports to each destination.

Table 4.2 Evidence of Sunk Costs and Enterprise Heterogeneity for Exporting: Previous Empirical Studies

Author	Data and Methodology	Evidence of Sunk Costs	Evidence of Enterprise Variables
Feinberg (1992)	USA: 1978-1987; time series data; 359 4-digit SIC industries	Yes	- Export targeting
Menzies and Heenan (1993)	Australia: 1974-1992; sample observations	Yes	..
Roberts and Tybout (1997)	Columbia: plant level panel data; dynamic random effects probit	Yes	- Size - Age
Bernard and Wagner (1998)	Germany (Lower Saxony): 1978-1992; unbalanced panel; linear probability specifications and random effects probit	Yes	- Size - Productivity - Labour skill
Bernard and Jensen (2001)	USA: 1983-1992; unbalanced panel; linear probability specifications and random effects probit	Yes	- Size - Productivity - Average wages - Labour skill - New products
Girma, Greenaway, Kneller (2002)	UK: 1988-1999; dynamic probit model	Yes	- Size - Productivity - Export intensity

Table 4.3 Descriptive Statistics of Continuously Operating IOEs

1991-1998 Average	Mean	Standard Deviation
1. All Enterprises		
8,000 Observations		
Employment	71	137
Skill intensity share	24.02%	15.73%
Average wages	£10,510	£4,624
Turnover	£6,421,584	£19,500,000
Turnover per employee	£71,714	£93,875
GVA per employee	£19,821	£20,371
Capital intensity proxy	£1,441	£2,644
2. Exporters		
5,054 observations		
Employment	85	164
Skill intensity share	24.25%	16.09%
Average wages	£10,699	£4,556
Turnover	£7,832,513	£23,300,000
Turnover per employee	£73,146	£88,526
GVA per employee	£19,851	£20,756
Capital intensity proxy	£1,447	£2,863
3. Non-exporters		
2,946 observations		
Employment	46	62
Skill intensity share	23.61%	15.09%
Average wages	£10,184	£4,721
Turnover	£4,001,069	£9,627,603
Turnover per employee	£69,260	£102,372
GVA per employee	£19,768	£19,696
Capital intensity proxy	£1,432	£2,219

Source: Own estimates derived from the *Census of Industrial Enterprises*.
All monetary values in 1985 constant £IR.

Table 4.4 Export Switching Rates of IOEs

Continuously Operating Enterprises	1991-1998 Annual Average
Total Enterprises	
(8,000 observations)	
Continuing non-exporters	20.9
Continuing exporters	45.3
Stop exporting	3.6
Start exporting	4.0
% Switchers	**7.6**
UK Exporters [a]	
(5,618 observations)	
Stop exporting	4.5
Start exporting	4.1
% Switchers	**8.6**
Non-UK Exporters [b]	
(1,382 observations)	
Stop exporting	0.3
Start exporting	3.7
% Switchers	**4.0**
UK-only Exporters [c]	
(2,299 observations)	
Stop exporting	0.9
Start exporting	9.5
% Switchers	**10.4**

Own estimates derived from the *Census of Industrial Enterprises*.
[a] UK exporters are IOEs that ship more than 50 per cent of their total exports to the UK.
[b] Non-UK exporters are IOEs that ship more than 50 per cent of their total exports to Non-UK destinations.
[c] UK-only exporters are IOEs that ship 100 per cent of the exports to the UK.

Table 4.5 Regression Results for Evidence of Sunk Costs, Various Specifications

Variables	(1) LPM Levels[1]	(2) LPM FE	(3) LPM IV	(4) Probit RE	(5) Probit RE[2]
	(Eqn. 4.13)	(Eqn. 4.14)	(Eqn. 4.15)	(Eqn. 4.12)	
Exported last year Y_{it-1}	0.6767***	0.1663***	0.3907***	2.1087***	0.6312
	(0.0153)	(0.0169)	(0.0186)	(0.0673)	
Exported two years ago Y_{it-2}	0.2451***	-0.0055	0.1078***	0.9002***	0.0399
	(0.0318)	(0.0197)	(0.0184)	(0.0935)	
$\ln(Size_{it-1})$	0.0347***	0.0745***	0.0451*	0.1932***	0.0613
	(.0055)	(.0185)	(0.0259)	(0.0388)	
$\ln(Wage_{it-1})$	-0.0307**	0.0030	0.0281	-0.0053	-0.0017
	(0.0154)	(0.0233)	(0.0232)	(0.0870)	
$\ln(Skill_{it-1})$	0.0173**	0.0450***	0.0103	0.0955**	0.0301
	(0.0078)	(0.0136)	(0.0138)	(0.0466)	
$\ln(Turnover_{it-1})$	0.0184**	0.0219	0.0124	-0.0059	-0.0019
	(0.0093)	(0.0191)	(0.0203)	(0.0418)	
$Share_{it-1}$	0.5161***	0.3699***	0.2505***	4.3572***	1.3824
	(0.0589)	(0.0397)	(0.0949)	(0.4529)	
$Share_{it-1}^2$	-0.4043***	-0.3039***	-0.1804**	-3.1398***	-0.9962
	(0.0569)	(0.0963)	(.0972)	(0.5070)	
F (8,4961)		34.85			
R^2	0.6952	0.5405	0.5516		
Log likelihood				-1,541.47	
Wald test $\chi^2(8)$			566.90	2,834.57	
No. of enterprises	1,000	1,000	1,000	1,000	
No. of observations	5,968	5,968	5,968	5,968	

Note: Statistically significant at *** 1 per cent, ** 5 per cent, * 10 per cent.

[1] Robust standard errors in parentheses.

[2] Coefficients represent the change in probability of exporting due to a one standard deviation increase in the independent variable valued at the means of the other variables (or a change from 0 to 1 in the case of a dummy variable).

Table 4. 6 Descriptive Statistics of Continuously Operating IOEs Exporting to the UK Only

1991-1998 Average	Mean	Standard Deviation
1. All Enterprises (1,000)		
8,000 observations		
Employment	71	137
Skill intensity share	24.02%	15.73%
Average wages	£10,510	£4,624
Turnover	£6,421,584	£19,500,000
Turnover per employee	£71,714	£93,875
GVA per employee	£19,821	£20,371
Capital intensity proxy	£1,441	£2,644
2. UK-only Exporters		
2,299 observations		
Employment	57	71
Skill intensity share	24.14%	15.60%
Average wages	£10,345	£4,585
Turnover	£4,370,232	£10,600,000
Turnover per employee	£66,889	£94,136
GVA per employee	£20,579	£22,338
Capital intensity proxy	£1,525	£3,023

Source: Own estimates derived from the *Census of Industrial Enterprises.*
All monetary values in 1985 constant £IR

Table 4.7 Regression Results for Evidence of Sunk Costs: UK-only Exporters

Variables	(1) LPM Levels[1] (Eqn. 4.13)	(2) LPM FE (Eqn. 4.14)	(3) LPM IV (Eqn. 4.15)	(4) Probit RE (Eqn. 4.12)	(5) Probit RE[2]
Exported last year Y_{it-1}	0.4970*** (.0596)	0.4293*** (0.0498)	0.1913*** (0.0775)	2.0876*** (.1627)	0.6716
Exported two years ago Y_{it-2}	0.0699*** (0.0279)	-0.2196*** (0.0272)	-0.1579*** (0.0350)	0.3075*** (0.1054)	0.1302
$\ln(Size_{it-1})$	0.0033 (.0188)	0.0083 (.0603)	0.0460 (0.0616)	-0.0257 (.0637)	-0.0098
$\ln(Wage_{it-1})$	-0.0018 (0.0445)	-0.0415 (0.0755)	0.0565 (0.0629)	0.0837 (.1559)	0.0285
$\ln(Skill_{it-1})$	-0.0065 (0.0225)	0.1118** (0.0426)	0.0332 (0.0341)	-0.0853 (.0819)	-0.0318
$\ln(Turnover_{it-1})$	0.0393 (0.0269)	-0.0404 (0.0567)	-0.0056 (0.0449)	0.1403* (.0758)	0.0419
$Share_{it-1}$	0.5733*** (0.1344)	0.6853*** (0.2044)	0.4743*** (0.2429)	2.8665*** (0.5744)	0.7984
$Share_{it-1}^2$	-0.6844*** (0.1513)	-0.7456*** (0.2213)	-0.4423*** (0.2504)	-3.0207*** (0.6588)	-0.8423
F (8,4961)		17.15			
R^2	0.3736	0.0859	0.3986		
Log likelihood				-743.98	
Wald test χ^2 (8)			29.79	308.35	
No. of enterprises	1,000	1,000	1,000	1,000	
No. of observations	5,968	5,968	5,968	5,968	

Note: Statistically significant at *** 1 per cent, ** 5 per cent, * 10 per cent.
[1] Robust standard errors in parentheses.
[2] Coefficients represent the change in probability of exporting due to a one standard deviation increase in the independent variable valued at the means of the other variables (or a change from 0 to 1 in the case of a dummy variable).

CHAPTER 5

FOREIGN DIRECT INVESTMENT AND EXPORT SPILLOVERS

5.1 Introduction [83]

5.1.1 Export Spillovers and Irish Manufacturing

The increased presence of FOEs in Irish manufacturing during the 1990s resulted from policy initiatives begun in the 1950s that actively encouraged and facilitated foreign direct investment, via government policies such as fiscal and financial incentives, as a means of promoting general economic development in Ireland (Ruane and Görg, 1999). The concerted effort by the Irish government to attract FDI over a forty-year period is evidence of the perception that hosting FOEs can provide substantial direct and indirect benefits to the host country.

FOEs are assumed to be endowed with enterprise-specific assets and advantages that compensate them for the higher costs incurred when locating in another country, allowing them to overcome any negative consequences of investing in a host country rather than pursuing internationalisation through methods such as exporting or joint venture arrangements.[84] FDI is thought to contribute to the development of the local economy through positive externalities usually in the form of backward linkages, technology transfer, and human capital development (de Arcos *et al,* 1997, p.1).[85] Moreover, inward

[83] Part of this chapter reflects joint work with Frances Ruane.

[84] The FDI literature contains theoretical explanations of the factors that attract FDI. For example, see Dunning's (1977) classic OLI model which focuses on three explanatory factors; ownership, location, and internationalisation. For a survey see Buckley (1995), Markusen (1995), and Caves (1996).

[85] Early empirical studies of the sectoral impact of FOEs can be traced to Caves (1974), who found that the disparity between foreign and domestic value-added per worker in Australian manufacturing disappears as the foreign share of sectoral labour rises.

investment to a host economy is believed to enhance productivity and growth rates of host-country indigenous enterprises, usually through productivity spillovers.[86]

The presence of FOEs is also thought to be a major contributor to the *export performance* of host-countries. The importance of the export-enhancing role of FDI in host countries has been recognized in a number of country-based studies; for example, the United Kingdom (Blake and Pain, 1994), Portugal (Cabral, 1995), and Ireland (Barry and Bradley, 1997). However, such studies generally focus on the export behaviour of FOEs themselves, ignoring any possible influence FOEs may have on the export behaviour of host-country indigenous enterprises.

The influence of FOEs on the export performance of indigenous enterprises is little understood and generally described in non-specific terms. It is possible that indigenous enterprises become more export orientated, by entering the export market and increasing their volume of exports in response to productivity and structural changes in industry that result from the presence of FDI.[87] Similarly, FOEs by definition have a presence in many marketplaces, making them a source of information about foreign markets, consumers, and technology that in turn may create channels through which indigenous enterprises can distribute their goods. If FOEs fail to fully internalise their export-related assets then externalities may 'spill over' to indigenous enterprises, enhancing the ability of indigenous enterprises to both enter the export market and increase their export intensity.

[86] An extensive literature focuses on the productivity enhancement spillover effects generated by FOEs. For surveys of the evidence on productivity spillovers see Blomström, Kokko, and Zejan (2000), Görg and Strobl (2001) and Görg and Greenaway (2002). Ruane and Uğur (2002) investigate FDI and productivity spillovers in Irish manufacturing industry using local unit data.

The activities of FOEs in the host country can thus enhance the export performance of local enterprises directly or indirectly.

The historical lack of enterprise-level data needed to test for the existence of export spillovers from FOEs to indigenous enterprises has restricted extensive empirical analysis. However, recent enterprise-level studies for Uruguay (Kokko *et al*, 2001) and the UK (Greenaway *et al*, 2002) indicate that such *export spillovers* may be positive and significant. The increasingly strong presence of FOEs in Irish manufacturing during the 1990s provides an excellent case study of the influence of FOEs on the export performance of indigenous enterprises. It is possible that export-orientated FOEs in Irish manufacturing have transferred their knowledge about export markets, international technology and marketing, and efficient production methodologies to IOEs, and these *spillovers* may have assisted IOEs to establish or improve their own export performance.[88]

If there are export spillovers associated with the activities of FOEs, previous empirical studies suggest that IOEs will be more likely to export if there is a strong presence of export-orientated FOEs in the same sector. Aggregate data for Irish manufacturing in Table 5.1 show that FOE employment increased by approximately 30 per cent between 1991 and 1998. The export intensity of FOEs also grew over the period so that by 1998 more than 90 per cent of FOE turnover was exported. Despite the increased presence of highly export-orientated FOEs in Irish manufacturing in the 1990s, the export intensity of

[87] The literature on economic geography and trade suggests that the activities of neighbouring enterprises may reduce entry costs to export markets. See Krugman (1992).

IOEs remained constant at approximately 36 per cent and the proportion of exporting IOEs fell marginally over the same period. These aggregate data trends of FDI and trade in Irish manufacturing thus create doubt about the hypothesis that FOEs, through export spillovers, have enhanced the export characteristics of IOEs during the 1990s. However, it is possible that such aggregate data mask spillovers that occur at the level of sectoral aggregation. Alternatively, FOEs located in Irish manufacturing may be so highly export orientated that the linkages between foreign and indigenous owned enterprises needed for export spillovers to occur are effectively inhibited. In this chapter we use our enterprise-level data set of Irish manufacturers for the period 1991 to 1998 to investigate whether or not FOEs have generated export spillovers to IOEs at the Nace Rev. 1 two-digit sectoral level.[89]

We develop the standard analysis of previous empirical studies and focus on the channels through which export spillovers from FOEs to local Irish enterprises may occur at the sectoral level.[90] We investigate empirically two specific propositions. Firstly, do FOEs have any impact on the *export decision* of IOEs. In other words, are IOEs in sectors with a high FOE presence more likely to export? Secondly, given that IOEs in a particular sector export, are there spillover effects from FOEs which will affect the *export intensity*

[88] In keeping with previous empirical case studies of export spillovers, FOE externalities are taken as static.
[89] Lower levels of sectoral aggregation effectively restrict the range over which export spillovers may occur. Ruane and Uğur (2002) search for productivity spillovers in Irish manufacturing between 1991 and 1998 at 2-, 3-, and 4-digit Nace Rev. 1 aggregation and find evidence of spillovers is strongest at the 2-digit level of sectoral aggregation.
[90] The focus of our empirical study is on the possibility of intra-sectoral export spillovers from FOEs to IOEs in Irish manufacturing. We recognise the possibility of intra-sectoral FOE to FOE, IOE to IOE, and IOE to FOE spillovers, as well as inter-sectoral spillovers of each of these. Moreover, it is possible that Irish manufacturing receives spillovers from other sectors of the economy.

of these IOEs? Thus we estimate a two-stage empirical model of the *export intensity* of IOEs, given their *export decision.*

We extend the basic model of export spillovers by searching for evidence that differences in FOE *ownership* may influence the nature of export spillovers. As noted in chapter 1, FOE growth in Irish manufacturing during the 1990s was characterized by the large increase in greenfield investment by US-owned FOEs. Table 5.1 shows that FOE employment growth in Irish manufacturing between 1991 and 1998 was due mainly to employment growth in US-owned enterprises (68 per cent) as Non-US FOE employment growth in the period was static. The distinction between US and Non-US owned FOEs is further exemplified by differences in their export patterns; US-owned FOEs export almost all of the output they produce in Ireland, whilst Non-US FOEs serve the domestic Irish marketplace as well as the export market.[91] This suggests that the potential benefits from FDI, via export spillovers, are more likely to be generated by the highly export-orientated US-owned FOEs.

Furthermore, the sectoral pattern of FDI investment in Ireland is different from that of IOEs; FOEs tend to be concentrated in the high-tech *Chemicals* and *Electronics* sectors.[92] Theories and past empirical evidence of export spillovers generated by FOEs suggest that spillovers are expected to be greater in sectors where there are a relatively higher

[91] Although a number of FOEs from countries such as Italy, Luxembourg, and The Netherlands experienced similar or greater employment growth rates as US-FOEs, they did so from a relatively small base. Similarly, most FOEs located in Ireland are exporting enterprises, but with few exceptions, their export intensity is lower than that of US-FOEs. Data confidentiality prevents the disaggregation of Non-US FOEs.

proportion of export-orientated FOEs. However, this may not be the case in Irish manufacturing. The overwhelming dominance of export-orientated FOEs in the Chemicals and Electronics sectors may actually prevent the development of linkages between FOEs and IOEs that are needed to generate export spillovers. Thus our search for export spillovers in Irish manufacturing also distinguishes between sectors that are overwhelmingly dominated by FOEs relative to the rest of manufacturing in order to determine if there are differences in the nature of FOE spillovers generated in each sector type.

Our search for evidence of export spillovers in Irish manufacturing during the 1990s is motivated by implications for both FDI policy and the exporting nature of IOEs. The existence of export spillovers from FOEs to IOEs, being benefits for which the IOE does not pay the full price, can provide a further rationale for Irish government incentives to attract FDI.[93] If export spillovers are generated by FOEs to IOEs in Irish manufacturing then government intervention to attract FDI is justified on the basis that the social rate of return to an investment will exceed the private rate of return, and IOEs are encouraged to export at minimal expense to policy makers (Girma and Wakelin, 2000).

5.1.2 Chapter Outline

The remainder of this chapter is structured as follows. Section 5.2.1 identifies the nature of export spillovers. Section 5.2.2 reviews previous empirical studies and the theoretical

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[92] *Chemicals* includes *Pharmaceuticals*. *Electronics* includes *Office Machinery and Computers*, *Electrical Machinery*, *Radio, Television and Communication Equipment*, and *Medical, Precision, and Optical Instruments*.

model that provides the basis of our empirical study is outlined in Section 5.2.3. Section 5.3.1 reviews the ownership pattern of enterprises in Irish manufacturing, Section 5.3.2 highlights the need to search for spillovers based on the ownership patterns of FOEs, and Section 5.3.3 provides evidence to suggest that the sectoral pattern of FOEs may influence the nature of export spillovers in Irish manufacturing. The general empirical model analysed is outlined in Section 5.4.1 and model variations based on FOE ownership and sectoral patterns are described in Section 5.4.2. Section 5.5 presents the empirical results and Section 5.6 concludes the chapter.

5.2 Foreign-owned Enterprises and Export Spillovers

5.2.1 Identifying Export Spillovers

FOEs are characterized by enterprise-specific advantages that enhance their ability to locate in foreign markets, overcoming any location-specific advantages held by indigenous enterprises in the host country, making the FOE decision to invest directly in the host country feasible.[94] These enterprise-specific advantages can be summarized as knowledge-based assets that include information relating to product and process technology, managerial ability, and marketing and promotional ability. The intangible nature of knowledge-based assets is most efficiently exploited by FOEs in both international and domestic markets by maintaining activities within the enterprise. However, such assets may have public-good characteristics, making it difficult for the

[93] Historically, the primary objectives of efforts by the Irish government to attract FDI have been employment generation and the development of production linkages between FOEs and IOEs. The possible enhancement of the export performance of IOEs has not featured as a policy focus.

[94] See Caves, 1971; Hymer, 1976; Dunning, 1977; and Helpman, 1984. Rugman (1986) provides a survey.

FOE to fully protect the assets from exploitation by indigenous enterprises in the host country.

FOEs can thus act as a channel for the introduction of new technology and the diffusion of information, as well as acting as a stimulus to domestic competition (Blomström and Kokko, 1998). The resulting changes in economies of scale and increased international specialization help to promote efficiency in indigenous enterprises.[95] Thus productivity spillovers from FOEs to indigenous enterprises may result from the presence of FOEs, in turn providing a stimulus to long-run economic growth in the host country (Edwards, 1993; Balasubramanyam *et al*, 1996; and Borensztein *et al*, 1998).[96] The relationship between productivity and exporting at the enterprise-level has been examined in empirical work initiated by Bernard and Wagner (1997). Studies on Germany, the US, and the UK have found that indigenous exporting enterprises are more productive than non-exporters and eventual exporters are more productive before they enter the export market.[97] Our own study of Irish manufacturers in Chapter 3 has shown that exporting IOEs are, on average, more productive than non-exporters.

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[95] Although we concentrate on the positive spillovers from FDI, spillovers may also be negative. See, for example, Aitken and Harrison (1999), who found that increased FDI lowered the productivity of indigenous enterprises in Venezuela, presumably as a result of increased competition.

[96] The enhanced efficiency of indigenous enterprises and economic growth may assist in reducing potential instability of an over-reliance on FDI that is argued to result from FOE responses to external conditions. See Ruane and Görg, (1997).

[97] Görg and Greenaway (2002) conclude there is little positive evidence of the existence of productivity spillovers from over 30 empirical studies, arguing that the industry-based and cross-section data used in many studies may bias the positive results of these studies. Barry *et al* (2001) find strong negative spillovers from FDI on IOE productivity in Irish manufacturing, which they attribute to competition between IOEs and FOEs for skilled labour in the Irish labour market.

The productivity premium of potential exporters is partly explained by the existence of substantial fixed or sunk costs that must be paid in order to enter the export market. Productivity levels of potential exporters must be relatively higher than those of continuing non-exporters in order for such enterprises to afford the additional costs of entering the export market. Such a scenario explains the self-selection of more productive enterprises into the export marketplace. Thus if more productive indigenous enterprises become exporters, and the productivity of indigenous enterprises is enhanced by the presence of FOEs, then the presence of FOEs indirectly enhances the export propensity of indigenous enterprises. Despite little empirical evidence, this indirect link between FOEs and indigenous exporters seems to be motivating the trade policy reform of many countries, with extensive investment made to attract FOEs in the hope of improving the export competitiveness of indigenous enterprises.[98]

Our approach to the search for export spillovers begins with the assumption that the presence of FOEs can indirectly enhance the export competitiveness of indigenous enterprises by lowering sunk costs associated with entering the export market and/or improving the productivity of indigenous enterprises.[99] FOEs, through their presumed better knowledge of global markets, may dissipate that knowledge to domestic enterprises and hence enable them to become more successful exporters. Similarly, FOEs that penetrate foreign markets reduce entry costs for potential indigenous exporters through learning effects or established commercial networks. Greenaway *et al* (2000) have summarized three channels through which the activity of FOEs can possibly influence the

[98] See UNCTAD (2002). *World Investment Report: Transnational Corporations and Export Competitiveness* for an extensive review of FDI investment and indigenous export competitiveness.

export performance of indigenous enterprises, and the expected impact of each spillover measure.

1. ***FOE concentration***. The presence of FOEs in the host market may initially lead to increased competition, especially if FOEs invest in sectors with high barriers to entry and oligopolistic market structures. The presence of FOEs can reinforce imitation effects as indigenous enterprises engage in more efficient production techniques which may in turn facilitate their entry into foreign markets. Such consequences can be especially important in developed economies where indigenous enterprises have accumulated sufficient know-how to survive the increased competition and are more able to adapt their production methods and absorb new technology (Cantwell, 1989, and Kokko, 1996). The presence of potential FOE *competition spillovers* within a sector is usually proxied by the sectoral share of total employment or production (turnover, net output, etc.) accounted for by FOEs in the host country.

2. ***FOE exports***. Indigenous enterprises may learn from the export activity of FOEs through information externalities relating to export distribution networks, regulations, market intelligence etc. when such knowledge about export destination markets spills over from the FOE to the indigenous enterprise (Aitken *et al*, 1997). The measure of potential FOE export *information spillovers* in a

[99] We focus on static externalities only.

sector is usually proxied by the average export intensity of FOEs in the sector in the host country.

3. ***FOE technology***. The competitive nature of FOEs is reflected in areas such as technological leadership, efficient management methods, and marketing ability. Such skills, although not directly related to exporting, may be passed on to indigenous enterprises through demonstration and imitation, enhancing their ability to compete in export markets through improved productivity. The measure of potential FOE *demonstration spillovers* in a sector is usually proxied by the ratio of R&D expenditure to total sales or turnover of FOEs in that sector in the host country.[100]

Previous empirical studies have incorporated at least one of these measures into their search for FOE spillovers. The relevant channel focussed on has depended on both the nature of the domestic economy being examined and the type and extent of the presence of FOEs in the host country. In addition to the proxy measures of FOE spillover channels, previous empirical studies have incorporated individual enterprise characteristics that could be expected to influence the exporting decisions of indigenous enterprises.

5.2.2 Literature Review

Empirical evidence of the nature of export spillovers at the enterprise-level is limited to a number of country studies. Such studies have included measures of spillovers from both

FOEs and other indigenous enterprises, at the sectoral level, on the export performance of indigenous enterprises. A small number of studies also measure the impact of spillovers from both FOEs and indigenous enterprises on the export performance of FOEs in the host country. In the following review we focus on empirical evidence of FOE spillovers on the export performance of indigenous enterprises only. Table 5.2 summarizes these empirical studies.

Aitken, Hanson and Harrison (1997), using sample data on Mexican manufacturing enterprises between 1986 and 1990, analyse the influence of FOE spillovers on the decision of indigenous enterprises to service the domestic market or to export.[101] The initial model estimated incorporates a measure of FOE export activity that is calculated as the share of state-industry FOE exports in national industry exports, relative to the state share of national manufacturing exports for three-digit ISIC industries (Aitken *et al*, 1997).[102] Enterprise-level characteristics such as size and average wages are included in the model, as well as dummy variables for industry, region, and year. Results of a probit specification using the full sample of indigenous enterprises support the hypothesis that spillovers from FOE export activity are positively associated with the decision by Mexican enterprises to enter the export market.[103]

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[100]Another strand of literature highlights the role of technological innovation (R&D) and technology transfer in promoting the export performance of firms. Empirical evidence supports this view, particularly for the case of developed economies. See, for example, Hirsch and Bijaoui (1985) and Wakelin (1998).

[101] Due to constraints resulting from combining the *Secofi* data set and the Mexican *Industrial Census*, the empirical analysis is restricted to two years, being 1986 and 1989.

[102] FOE export activity = [(State-industry FOE exports/National industry exports) / (State share of national manufacturing exports)]

[103] The enterprise characteristics of size, average wages, and royalty payments are also found to be positively correlated with the probability of exporting.

In order to determine if the export decision of indigenous enterprises is positively correlated to the scale of FOE activity in Mexican manufacturing, regardless of whether FOEs export or serve the local Mexican market, the measure of FOE export activity is replaced by a measure of FOE domestic production, being "the share of state-industry FOE domestic shipments in national industry domestic shipments, relative to the state share of national domestic manufacturing shipments".[104] The export decision of Mexican enterprises is found to be positively correlated with this measure of FOE activity. Such an outcome suggests that the local concentration of FOE activity in Mexican manufacturing, and not necessarily the export activity of FOEs, is the source of FOE spillovers.

Aitken *et al* (1997) test the robustness of their econometric results by excluding industries that are natural resource intensive (food products, petroleum refining, and tequila), on the basis that such industries have site-specific characteristics that are likely to be relatively important in the export decision of indigenous enterprises. Industries with high transport costs (cement, bread, and tortillas) are also excluded because such industries are likely to produce for the local market rather than export. The likelihood of exporting continues to be positively correlated with the local concentration of FOEs, so that evidence for spillovers from FOEs is robust to the exclusion of these two industry types. The authors argue that FOEs are an excellent source of information about foreign markets because of their relationship with foreign parent enterprises, and that FOEs may

[104] FOE domestic activity = [(State-industry FOE domestic shipments/National industry domestic shipments) / (State share of national domestic manufacturing shipments)]

also attract input suppliers in the Mexican market who may in turn attract domestic producers that wish to export.[105]

Kokko, Zejan, and Tansini (2001) investigate the effect of FOE export spillovers on the export decision of indigenous enterprises using cross-sectional enterprise-level data for Uruguay in 1998. The author's proxy the presence of FOEs by the share of FOE output in the total output of each sector, and not the export activity of FOEs.[106] Thus it is unclear through which channel, FOE competition or information spillovers, the presence of FOEs is supposed to lead to spillovers to Uruguayan enterprises. The results for Uruguay suggest that the likelihood of indigenous enterprises exporting increases if the enterprise operates in a sector where the presence of foreign enterprises is relatively high.[107]

Kokko *et al* (2001) also search for spillovers generated by FOEs on the basis of FOE ownership type, distinguished by the time period in which the FOE established in Uruguay. The variable for foreign presence, again measured by the proportion of FOE output relative to total output in the sector, is initially redefined to include only those FOEs established in Uruguay prior to January 1973, a period characterised by traditional import substitution policies in Uruguay. No evidence of any export spillovers from these older FOEs to indigenous enterprises is found. Next, foreign presence is redefined to

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[105] Head and Ries (1994) find that foreign enterprises located in China are attracted to cities with relatively large concentrations of input suppliers.

[106] FOE presence = (FOE output / Total sector output) at the 4-digit sector level.

[107] Measures of inputs at the enterprise level are included in the model estimated, including capital intensity, average wages, technology intensity, age, and the size of the indigenous enterprise relative to others in its 4-digit sector. Relative enterprise size, capital intensity, and technology intensity of indigenous enterprises all appear to have a positive impact on their decision to export when all Uruguayan enterprises are examined. Neither average wages nor enterprise age is found to have a significant impact on the export decision.

include only FOEs established after January 1973, a period of increasingly outward-orientated trade policies in Uruguay, and measured as the proportion of FOE output in the sector as before. The estimated coefficient for foreign presence becomes positive and highly significant for this period, indicating that there are spillovers from outwardly orientated FOEs to indigenous enterprises that affect indigenous exports. These results indicate that the type of trade regime within which FOEs operate may determine their potential to generate positive export spillovers (Görg and Greenaway, 2001).[108]

Barrios, Görg, and Strobl (2001) explain the export behaviour of Spanish manufacturing enterprises between 1990 and 1998 by focusing on both the initial decision to enter the export market or not and the export intensity of enterprises once in the export market. In addition to measuring the importance of enterprise characteristics, the authors focus on the role of FOE export information spillovers (proxied by the average export to sales ratios of FOEs in the relevant sector) and demonstration spillovers (proxied by the average ratio of R&D spend to sales of FOEs in the relevant sector) on the export behaviour of indigenous enterprises.[109] Using a probit model to estimate the export

[108] Kokko *et al* (2001) also attempt to distinguish spillover effects on Uruguayan exports on the basis of FOE *export destination* using two alternative dependent variables to distinguish between FOEs exporting regionally (to neighbouring countries, being Argentina and Brazil) and FOEs exporting to the rest of the world. The authors give two reasons for this approach. First, bilateral trade agreements have given Uruguayan enterprises preferential access to the Argentinean and Brazilian markets since the 1970s. Second, the various transaction costs related to trading with neighbouring countries are significantly lower than the costs connected with exports to distant markets. Both these observations suggest that the potential benefits from FDI may be more important for exports to the rest of the world than for exports to regional markets. The authors find stronger evidence of export spillovers when FOEs export outside of regional markets (Brazil and Argentina).

[109] Information spillovers = [(FOE sectoral exports / Total sectoral exports) / (Total FOE exports / Total exports)]. Demonstration spillovers = (FOE sectoral R&D expenditure / Total sectoral FOE sales). Enterprise-level determinants included in the model are age, size, productivity, average wage per head, R&D intensity, and a dummy variable equal to one if the enterprise is a multi-plant enterprise. Indigenous enterprises are found to be more likely to export if they are older, larger, pay higher average wages, and are more R&D intensive.

decision of indigenous enterprises and a tobit model to estimate the determinants of indigenous export intensity, the authors find no evidence that either the patterns of R&D/sales or exports/sales ratios of FOEs affect the export decision of Spanish enterprises.[110] The tobit estimations indicate that the patterns of R&D spend to sales of FOEs do influence the export intensity of domestic enterprises, but fail to detect any impact of export/sales ratio of FOEs on the export intensity of domestic enterprises.[111]

Greenaway, Sousa, and Wakelin (2002) search for evidence of export spillovers on UK manufacturing enterprises for the period 1992 to 1996. The authors proxy three spillover channels from FOEs to indigenous enterprises, namely competition, information, and demonstration spillovers, and measure their influence on the export decision and export intensity of indigenous enterprises. Competition spillovers are measured as simply the employment share of FOEs in each sector using data at the 5-digit (SIC) level. Information spillovers are computed in a manner similar to that of Aitken *et al* (1997), as the ratio of FOE exports to total exports in each sector, relative to the ratio of FOE exports to total exports for the year at the 5-digit (SIC) level. Thus FOE export activities in each sector are scaled by the relative importance of FOE exports to total exports. Demonstration spillovers are measured as expenditure on R&D performed in the UK by

[110] Barrio *et al* (2001) do find evidence of spillovers from both types of FOE activity on the export decision of other FOEs.

[111] Barrios *et al* (2001) also incorporate the export destination idea into their analysis of Spanish manufacturers. They test for the influence of R&D spillovers on the export/sales ratio of Spanish enterprises by considering two destinations, OECD countries, which are assumed to be technologically intensive, and the rest of the world. The effect of R&D spillovers is expected to be greater for exports to technologically advanced countries because Spanish exporters have to improve their own technology in order to compete successfully in high-tech markets, whilst lower levels of technological sophistication may be sufficient for exporting to less technologically advanced countries or supplying the domestic marketplace. R&D spillovers are shown to have a positive effect on the export ratio of Spanish enterprises when exports are shipped to the EU and OECD, markets with a superior technological capability, but there is no significant relationship for exports destined to the rest of the world.

foreign businesses at the 2-digit (SIC) level.[112] Two hypotheses are examined in the study using a two-step Heckman selection model. Firstly, do FOE spillovers affect the *export decision* of indigenous enterprises? Secondly, given the indigenous enterprises export, do FOE spillovers affect the *export intensity* of indigenous enterprises?[113]

Results for the UK show that the relative importance of FOE exports (information spillovers), R&D expenditure by FOEs (demonstration spillovers), and the relative importance of FOEs by sector (competition spillovers) have a positive association with the probability of a local enterprise being an exporter, with competition spillovers having the most significant influence on the export decision of indigenous enterprises. Both competition and demonstration spillovers have a positive association with the export intensity of indigenous UK enterprises. There is no evidence of association between FOE export information spillovers and the export intensity of indigenous exporters, so that export information spillovers seem to influence only the decision of whether to export or not. The authors argue that export information spillovers assist local enterprises to overcome sunk costs associated with exporting and thus affect their probability of entering the export market, but not necessarily the extent to which an enterprise exports.[114]

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[112] Competition effects = (FOE employment/Total employment) at the 5-digit (SIC) level. Imitation effects = [(FOE sector exports/Total sector exports) / (Total FOE exports/Total exports)]. Demonstration effects = (FOE R&D expenditure) at the 2-digit (SIC) level. Thus the three FOE spillover variables specified by Greenaway *et al* (2002) are a mixture of actual expenditure, relative sectoral importance, and the sectoral importance of FOEs relative to total FOE presence.

[113] Because of the strong correlation between the FOE export activity variable and the FOE employment variable, each is included in turn in both the export decision and the export intensity equations by Greenaway *et al* (2002).

[114] The Greenaway *et al* (2002) study also controls for spillover effects at the sectoral and enterprise level. Spillovers from 'general' export activity are measured as the relative importance of each sector in total domestic exports which, the authors argue, captures the export structure of the host country and controls for factors that affect the overall export profile of the sector. (Sectoral exports = total domestic exports in

The UK study by Greenaway *et al* (2002) provides the basis for our empirical model of FOE spillovers to indigenous enterprises in Irish manufacturing between 1991 and 1998. We follow Kokko *et al* (2001) by incorporating the hypothesis that the nature of spillovers generated may differ depending on FOE ownership; in the case of Irish manufacturing, US-owned FOEs may generate different spillovers relative to Non-US FOEs. Moreover, we search for differences in FOE spillovers based on a sectoral division that groups more recently established, high-tech, FOE-intensive sectors (*Chemicals* and *Electronics*) relative to older, low-tech, IOE-intensive sectors.

5.2.3 Theoretical Model

The model of export spillovers detailed below follows that of Aitken *et al* (1997) and Greenaway *et al* (2002).

An indigenous enterprise is assumed to choose between serving the domestic market (d), the foreign market (f), or both, in order to maximise profits.[115] Enterprise costs are divided into production $h(\cdot)$ and distribution $m(\cdot)$ costs.[116] The purpose of separating production and distribution is to make certain costs market-specific. Market-specific

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sector i / total domestic exports in manufacturing) at the 5-digit level.) A variable measuring industry size in terms of total employment is included to capture possible general spillovers not directly associated with export activity. (Sector size = (Sector i employment / total manufacturing employment) at the 5-digit SIC level.) A sectoral measure of the relative importance of R&D by indigenous enterprises is also included to capture the domestic contribution of total innovation activities carried out in the UK. (Sector R&D = (R&D expenditure by domestic businesses / Total R&D expenditure) at the 2-digit SIC level.) Domestic producer price indices, average production costs, average wages, fixed assets per employee, turnover, and shareholder funds per unit of output are also included in the model. Average wages and fixed assets per employee are found to have a significant positive and negative relationship respectively with the probability of an indigenous UK enterprise being an exporter. Enterprise size, average production costs, and average wages all positively and significantly influence indigenous export propensity.

[115] Although there may be multiple foreign markets we initially assume a single foreign market for simplicity.

costs associated with exporting (for example, advertising and transportation) are assumed to be a decreasing function of the local concentration of export activity. That is, exporters benefit from being near other exporters. Thus total costs for an enterprise are given by:

$$h(q_d + q_f) + m_d(q_d) + m_f(q_f) \qquad (5.1)$$

where q represents the quantity of output sold in each market. We assume the following functional forms for the production and distribution cost functions:[117]

$$h(q_d + q_f) = \frac{a}{2}(q_d + q_f)^2 + g(q_d + q_f) \quad \text{and} \quad m_i(q_i) = \frac{b_i}{2}q_i^2 + c_i q_i$$

where a, g, b and c_i $(i = d, f)$ are scalar parameters. It is assumed that g and c_i are functions of cost variables that the enterprise takes as given when making its output decision:

$$g = g(X, \Omega, \Psi),\ c_d = c_d(X, Z_d),\ c_f = c_f(X, Z_f, \Gamma_{EX}, \Gamma_{FOE})$$

where X represents the production costs that are common to both markets and Z are market-specific production costs. Γ_{EX} is total export activity and Γ_{FOE} is the export activity of FOEs. The relative importance of FOEs in the domestic market is given by Ω, and Ψ represents total innovation activities undertaken by FOEs. This specification implies that costs associated with serving the domestic market are not affected by export spillovers. Moreover, productions costs $h(\cdot)$ are invariant to the destination of output, whilst distribution costs $m(\cdot)$ may vary by destination. This captures the idea that

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[116] Following Aitken *et al* (1997), $h(\cdot)$ and $m(\cdot)$ are increasing and convex in their arguments.

[117] We use a standard functional form of both the production and distribution costs functions and assume the output decision of the enterprise is constant, despite showing in chapter 4 that Irish enterprises appear to face fixed costs when exporting.

distribution costs associated with exporting (Z_f) exceed the costs of distribution in the domestic market.

Information spillovers from exporting FOEs and exports in general are given by equations (5.2) and (5.3). The higher is the concentration of FOE exporting and export activity generally, the greater the benefit of information spillovers to indigenous enterprises, reducing the distribution costs of exporting for indigenous enterprises.

$$\frac{\partial m_f(q_f)}{\partial \Gamma_{EX}} \leq 0 \qquad (5.2)$$

$$\frac{\partial m_f(q_f)}{\partial \Gamma_{FOE}} \leq 0 \qquad (5.3)$$

Competition spillovers that result from the presence of FOEs is captured by the Ω variable. The greater the importance of FOEs in the domestic market, proxied by employment or production shares, the stronger will be the competitive pressure for indigenous enterprises to reduce production costs.

$$\frac{\partial g(q_f + q_d)}{\partial \Omega} \leq 0 \qquad (5.4)$$

Finally, *demonstration* spillovers are captured by Ψ. The higher is the R&D intensity of FOEs in the host country, the greater the potential for indigenous enterprises to imitate this technology and increase their own productive efficiency.

$$\frac{\partial g(q_f + q_d)}{\partial \Psi} \leq 0 \qquad (5.5)$$

The production decision (profit function) for the enterprise is given by the solution to equation (5.6).

$$\max_{q_d, q_f} P_d q_d + P_f q_f - h(q_d + q_f) - m_d(q_d) - m_f(q_f) \qquad (5.6)$$

$$\text{s.t.} \quad q_d > 0, \quad q_f \geq 0$$

The model assumes that all enterprises produce a positive amount for the domestic market. However, enterprises may choose to export or not. A latent variable q_f^* is defined so that $q_f^* = q_f$ if $q_{fj} > 0$, and $q_f^* = 0$ otherwise (where j is the index for the enterprise). Using this, the first order conditions for profit maximisation for a representative enterprise are as follows.

$$q_d = \frac{1}{a + b_d}\left(P_d - a q_f^* - g(X) - c_d(X, Z_d)\right) \qquad (5.7)$$

$$q_f^* = \frac{1}{a + b_f}\left(P_f - a q_d - g(X) - c_f(X, Z_f, \Gamma_{EX}, \Gamma_{FOE})\right) \qquad (5.8)$$

We rewrite equations (5.7) and (5.8) as

$$q_{dj} = \alpha_1 P_d + \alpha_2 q_{fj}^* + \alpha_3' Z_{dj} + \alpha_4' X_j + \mu_{dj} \qquad (5.9)$$

$$q_{fj}^* = \beta_1 P_f + \beta_2 q_{dj} + \beta_3' Z_{fj} + \beta_4' X_j + \beta_5 \Gamma_{EXj} + \beta_6 \Gamma_{FOEj} + \mu_{fj} \qquad (5.10)$$

where Z_{ij} is a $(1 \times K)$ vector of cost variables specific to market i (where $i = d, f$), X_j is a $(1 \times J)$ vector of cost variables common to both markets, α_3 and β_3 are $(1 \times K)$ vectors of coefficients, α_4 and β_4 are $(1 \times J)$ vectors of coefficients, and μ_{ij} is a normally distributed error term for market i and enterprise j, which has zero mean and variance σ_μ^2.

Equations (5.9) and (5.10) can be transformed to reveal the determinants of the optimal quantity to be sold to the foreign market.

$$q_{fj}^{*} = \beta_1 P_f + \beta_2(\alpha_1 P_d + \alpha_3' Z_{dj}) + \beta_3' Z_{fj} + (\beta_2 \alpha_4' + \beta_4')X_j + (\beta_5 + \beta_2\alpha_5)\Omega + (\beta_6 + \beta_2\alpha_6)\Psi + \beta_7 \Gamma_{EXj} + \beta_8 \Gamma_{FOEj} + \nu_j \quad (5.11)$$

where $\nu_j = \beta_2 \mu_{dj} + \mu_{fj}$.

The optimal amount exported by the enterprise thus depends on the price of the goods, enterprise-specific production costs, distribution costs in the foreign and domestic markets, export activity in the country, and three measures FOE influence, defined as information, competition, and demonstration spillovers.

Given our interest is the export decision of the enterprise, we focus on the probability that an enterprise exports by estimating the dummy variable y_j, where

$$\begin{cases} y_j = 1, & if \quad q_{fj} > 0 \\ y_j = 0, & otherwise \end{cases}$$

Thus the model of the probability that an enterprise exports is given by

$$\Pr(y_j = 1) = \Pr[\beta_1 P_f + \beta_2(\alpha_1 P_d + \alpha_3' Z_{dj}) + \beta_3' Z_{fj} + (\beta_2 \alpha_4' + \beta_4')X_j + (\beta_5 + \beta_2\alpha_5)\Omega + (\beta_6 + \beta_2\alpha_6)\Psi + \beta_7 \Gamma_{EXj} + \beta_8 \Gamma_{FOEj} + \nu_j \geq 0] \quad (5.12)$$

where $\nu_j = \beta_2 \mu_{dj} + \mu_{fj}$. The distributional assumptions on μ_{dj} and μ_{fj} imply ν_j is normally distributed.

5.3 FDI and Spillovers in Irish Manufacturing

5.3.1 Irish Model of Export Spillovers

Our model of export spillovers generated by FOEs in Irish manufacturing is based on that developed by Aitken *et al* (1997) and Greenaway *et al* (2002). We concentrate solely on export spillovers generated by FOEs to IOEs and investigate the possibility of spillovers generated via competition and information channels only; we do include demonstration channels in our model because of the imprecise measure of research and development expenditure available to us. The research and development variable of each enterprise (FOEs and IOEs) in the Census of Industrial Enterprises is a measure of the research and development services purchased by the enterprise from others; it excludes the wages and salaries of own-enterprise employees who conduct R&D as well as capitalised R&D of the enterprise. Thus the measure of R&D available to us excludes "in-house" R&D expenditure. Due to the imperfect nature of the R&D expenditure data we concentrate on FOE spillovers derived via employment and export channels and include the measure of R&D spillovers in an extension of the model in Appendix 5.B.

Although we investigate FOE export spillovers generated via competition and information channels, the generic description of the nature and impact of these spillover effects given in Section 5.2.1 does not necessarily apply to the case study of Irish manufacturers between 1991 and 1998. Thus in the following sections we outline the characteristics of FOEs present in Irish manufacturing during the 1990s and suggest reasons why the nature of any FOE export spillovers to IOEs may be unique in the Irish case.

5.3.2 Ownership Patterns of FOEs: US and Non-US

In our model of export spillovers we hypothesise that the effect of FOEs is related to both the intensity of FOEs within the sector, as well as FOE *ownership*. FOEs operating in Irish manufacturing differ in terms of nationality of ownership, enterprise characteristics, and export propensity. Thus *a priori* we do not expect all FOEs to generate the same manner of spillovers to IOEs.[118]

A feature of FDI in Irish manufacturing during the 1990s has been the growth and dominance of US-owned enterprises, particularly in certain sectors. Table 5.1 shows that FOE employment growth was approximately 30 per cent between 1991 and 1998. However, employment growth of US-FOEs accounted for nearly all of this increase as growth in Non-US FOE employment was static over the period. Moreover, US-FOEs produced more than half of total Irish manufacturing output in 1998, and the proportion of total manufacturing output produced by Non-US FOEs fell from approximately one-quarter to less than one-fifth between 1991 and 1998.

Almost all FOEs export some portion of their output, regardless of ownership, so that the proportion of exporting US and Non-US FOEs was between 96 and 98 per cent in the 1990s. However, export characteristic differences between US and Non-US FOEs are also evident: the export intensity of Non-US FOEs remained well below the export intensity of US-FOEs (more than 96 per cent), despite increasing from 63 per cent in 1991 to 72 per cent in 1998.

[118] See chapter 2, Table 2.1 for a review of the characteristics of FOEs present in Irish manufacturing between 1991 and 1998.

The higher employment growth rate and export intensity of US-FOEs during the 1990s suggest that they may be better able to generate export spillovers to IOEs relative to Non-US IOEs. Moreover, such differences between US and Non-US FOEs may influence their respective production, exporting, and technological characteristics. It is possible that US and Non-US owned FOEs pass on their respective unique characteristics via spillovers to IOEs, resulting in differences in the type and volume of FOE export spillovers available to IOEs. Thus just as Kokko *et al* (2001) noted the different spillover effects between FOEs present in Uruguay during periods of inward and outward orientated trade regimes, we extend our basic model of FOE export spillovers to distinguish between US and Non-US FOEs in Irish manufacturing on the basis that each of these FOE types have particular enterprise characteristics and exporting profiles that they pass on to IOEs through spillovers.[119]

5.3.3 Sectoral Patterns of Export Spillovers

The distinction between US and Non-US FOEs in Irish manufacturing is further pronounced when examined at the sectoral level. If we expect FOEs to generate spillovers to IOEs, then the nature of the spillovers generated may depend on the type and extent of FOEs present in the sector. Table 5.1 shows that more than 95 per cent of FOEs located in Irish manufacturing between 1991 and 1998 were exporters, and more than 90 per cent of turnover produced in Ireland by FOEs was exported. However, these aggregate figures mask the sectoral concentration of FOEs in Irish Manufacturing.

[119] Girma and Wakelin (2001), in a study of UK manufacturing, show that the nationality of the FDI may affect whether or not there are productivity spillovers. Their results indicate that spillovers are strongest from Japanese FDI while there do not appear to be any positive effects on domestic productivity from US

The *Chemicals* and *Electronics* sectors of Irish manufacturing were developed during the past few decades through the active encouragement of FDI by the Irish government.[120] The success of such FDI policies is reflected in average FOE employment intensity in Chemicals and Electronics of more than 80 per cent between 1991 and 1998. Moreover, these sectors are characterised as strongly export-orientated, high-tech, and FOE-dominant relative to all other sectors in Irish manufacturing. Chemical and Electronic sectors can thus be described as *New Manufacturing* (*New-Mfg*), and all other sectors in Irish manufacturing as *Old Manufacturing* (*Old-Mfg*).

Table 5.3 shows that FOEs in New-Mfg and Old-Mfg employ approximately the same number of people. However, FOE employment intensity, being FOE employment as a proportion of total employment in Old-Mfg, is about one-third, whereas more than 80 per cent of all employees in New-Mfg are employed by FOEs. The export characteristics of New-Mfg also contrast with those of Old-Mfg. Old-Mfg sectors are comprised of fewer exporting enterprises (51.9 per cent relative to 88.5 per cent in New-Mfg) and the export intensity of FOEs in Old-Mfg (71 per cent) is lower than that for New-Mfg (92 per cent). FOEs are thus less concentrated and relatively less export orientated in Old-Mfg sectors compared to New-Mfg sectors. Such differences have possible consequences for the nature of FOE export spillovers that may be available to IOEs within the respective sectors.

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investment. This is attributed to the latter being of generally older vintage and using older, more established production techniques compared to Japanese enterprises.

[120] The *Chemicals* sector (Nace Rev. 1: 24) includes the FDI-dominant *Pharmaceutical* sub-sectors (Nace Rev.1: 244). The *Electronics* sector is composed of Nace Rev.1 sectors: *Office Machinery and Computers*

Although the high proportion of exporting FOEs in New-Mfg sectors could generate positive spillovers to IOEs, the overwhelming dominance of FOEs in New-Mfg sectors may actually have adverse implications for the nature of FOE export spillovers available to IOEs in these sectors. For example, the FOE concentration spillover channel described in Section 5.2.2 implies that FOEs in the domestic Irish market enhance the efficiency of IOEs by inducing productivity gains in IOEs through increased competition between IOEs and FOEs servicing the domestic Irish marketplace. However, the export-propensity of FOEs in New-Mfg indicates that they locate in Irish manufacturing for the purpose of exporting and do not compete on any significant scale with IOEs in the domestic market. As Barry *et al* (2001) point out, product market competition is unlikely to be an important factor for indigenous enterprises where FOEs are primarily export-orientated and competition with indigenous enterprises is limited or non-existent. There may be little scope for FOEs to enhance the productivity and hence the exporting nature of IOEs if the expected linkages facilitating spillovers between FOEs and IOEs do not develop. The influence of FOE concentration spillovers may thus be sensitive to the proportion of FOEs in the sector.

Similarly, the general description of the FOE export information spillover channel suggests that the extent to which FOE information spillovers are available to IOEs may depend upon whether IOEs operate in a sector with a high proportion of export-orientated FOEs, or whether they are in less export-orientated IOE intensive sectors. IOEs in New-Mfg may be more export orientated as a result of information externalities because FOEs

(30); *Electrical Machinery and Apparatus* (31); *Radio, Television and Communication Equipment* (32); and *Medical, Precision and Optical Instruments* (33).

in these sectors are so highly export orientated that FOE export information externalities are excessive and easily captured by IOEs. Similarly, the availability of information spillovers in Old-Mfg may be less than those available in New-Mfg because of the lower export propensity of FOEs in Old-Mfg sectors. However, if few linkages between FOEs and IOEs develop in the sector as a result of FOEs exporting almost all of their output, there may be little opportunity for export information to spill over.

Given the distinct patterns of FOE ownership and export propensity in the sectors we define as New-Mfg and Old-Mfg, and the consequences of these characteristics for generating FOE export spillovers to IOEs, we incorporate this sectoral division into our empirical analysis of FOE spillovers in Irish manufacturing.

5.4 Empirical Methodology

5.4.1 Empirical Model

Based on the theoretical model outlined in Section 5.2.3 we develop an empirical model to analyse the possible effects of FOEs on the export behaviour of indigenous enterprises in Irish manufacturing. We follow Greenaway *et al* (2002) and consider two aspects of the export behaviour of local enterprises:

1. the influence of FOEs on the *decision* of IOEs to export or not, and
2. given that IOEs export, the influence of FOEs on the *proportion* of exports by IOEs.

This approach results in two empirical models, the first being our *export decision* model

$$Export_{ijt} = \alpha + \beta_1 FOEemplt_{jt} + \beta_2 FOEex_{jt} + \beta_3 Sectemplt_{jt} + \beta_4 Sectex_{jt} + \beta_5 Emplt_{ijt} + \beta_6 Wage_{ijt} + \beta_7 RD_{ijt} + \beta_8 GVA_{ijt} + \beta_9 Year_t' + v_{ijt} \quad (5.13)$$

where $Export_{ijt}$ is a dichotomous variable that takes the value of 1 if the enterprise (i) in sector (j) exports during year (t), 0 otherwise, and $v_{ijt} \sim N(0,1)$. The equation is estimated on the full sample of indigenous enterprises, both exporting and non-exporting, and effectively acts as the sample selection for the second equation estimated.

The second equation estimated captures the influence of FOE export spillovers on the *export intensity* of IOEs

$$Expint_{ijt} = \alpha + \beta_1 FOEemplt_{jt} + \beta_2 FOEex_{jt} + \beta_3 Sectemplt_{jt} + \beta_4 Sectex_{jt} + \beta_5 Emplt_{ijt} + \beta_6 Wage_{ijt} + \beta_7 RD_{ijt} + \beta_8 Year_t' + u_{ijt} \quad (5.14)$$

where $Expint_{ijt}$ is the proportion of turnover exported by enterprise (i) in sector (j) during year (t), and $u_{ijt} \sim N(0,\delta)$.[121]

The approach taken allows us to examine the influence of FOE spillovers on the export behaviour of all IOEs and not just exporting enterprises. Additionally, as Greenaway *et al* (2002) note, such a methodology avoids any selectivity biases that may be associated with focusing solely on the influence of FOEs on the export intensity of IOEs.[122]

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[121] Additionally, $corr(v_{ijt}, u_{ijt}) = \rho$ and $(v_{ijt}, u_{ijt}) \sim$ *bivariate normal* $[0,0,1,\delta,\rho]$.

[122] See Heckman (1979) for a discussion of sample selection bias.

The independent variables included in equations (5.13) and (5.14) can be divided into three broad categories: (1) FOE "spillover" variables, (2) sectoral scale variables, and (3) IOE variables, all of which are defined in Appendix 5.A.

The influence of FOEs on the export decisions of IOEs is captured by spillover variables that reflect the possible transmission mechanisms of FOE presence and exporting information externalities. Both spillover variables are measured at the Nace Rev.1, 2-digit sector level (j) on an annual basis (t).[123] Export spillover proxies are measures of the 2-digit FOE sectoral influence relative to the total influence of FOEs for the year, thus taking into account both the relative importance of FOEs within the sector as well as the importance of the FOE sectoral presence relative to the total presence of FOEs in Irish manufacturing.

$FOEemplt_{jt}$ captures spillovers from FOE concentration by using employment as a proxy for the presence of FOEs.[124] The expected coefficient of $FOEemplt_{jt}$ for both the export decision and export intensity equations is uncertain. As noted in Section 5.3.3, many FOEs in Irish manufacturing produce almost solely for the export market so there may be little scope for FOEs to compete with IOEs and enhance the productivity and hence export propensity of IOEs. The expected influence of competition spillovers may thus be dependent upon the sectoral concentration of FOEs.

[123] Lower levels of sectoral aggregation effectively restrict the range over which export spillovers may occur. Ruane and Ugür (2002) search for productivity spillovers in Irish manufacturing between 1991 and 1998 at 2-, 3-, and 4-digit Nace Rev. 1 aggregation and find that their results are stronger at the 2-digit level of sectoral aggregation.

$FOEex_{jt}$ is included to capture spillovers affecting the export behaviour of IOEs linked with FOE export activities, or export information externalities. It is generally expected that a higher FOE export intensity within a sector will create more export information externalities. Thus it could be expected that export information spillovers will be more extensive in the New-Mfg sectors rather than the IOE intensive sectors, where the export intensity of FOEs is lower. However, the dominance of exporting FOEs in New-Mfg may preclude the development of linkages between IOEs and FOEs necessary for information externalities to spill over. The expected influence of information spillovers in Irish manufacturing is thus uncertain.

In addition to FOE spillover variables we include sectoral variables that control for the employment size and the export propensity of each sector relative to others. $Sectemplt_{jt}$ is defined as employment in the 2-digit sector as a proportion of total manufacturing employment each year, and is included in the model to control for sectoral size. $Sectex_{jt}$ scales the export intensity of each sector and is defined as total exports in the 2-digit sector as a proportion of exports in all Irish manufacturing. Both sectoral variables are measured annually.

Chapters 3 and 4 of the thesis have incorporated various enterprise-level characteristics that are thought to be determinants of the exporting performance of IOEs. In keeping with this methodology we include a number of variables designed to capture the influence of enterprise heterogeneity on the export decision and intensity of IOEs.

[124] Some previous studies use an output measure to capture the influence of FOEs within a sector. However, because of extensive transfer pricing, output or turnover of FOEs in Irish manufacturing are not

Enterprise employment ($Emplt_{ijt}$) is a proxy for the size of the enterprise. It is expected that relatively larger enterprises are more able to overcome any fixed costs associated with entering an export market and to exploit economies of scale in the exporting process.[125]

Average wages ($Wage_{ijt}$) are included to control for labour skills that are thought to be a determinant of exports in a developed country such as Ireland. Given our results in Chapters 3 and 4 where the average wages of each enterprise have a mixed influence on the determinants of exporting, the impact of labour quality on enterprise export decisions is uncertain. On the one hand, skilled labour may be a scarce resource and thus relatively expensive, so that manufacturers may use other more abundant and lower cost resources. Alternatively, higher quality labour, reflected by higher average wages, may enhance the ability of IOEs to export via their contribution to higher value added products.

R&D expenditure per employee (RD_{ijt}) is included to indicate the ability of the local enterprise to capture spillovers.[126] Enterprises that purchase more R&D may be better able to absorb information externalities that may flow from FOEs.[127] Capital stock per employee (Cap_{ijt}) is included to account for the capital sophistication of the enterprise

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such reliable measures.

[125] See for example: Hirsch and Adlar, 1974; Glesjer *et al*, 1980; and Lall and Kumar, 1981.

[126] However, as noted previously, the R&D expenditure variable in the *Census* reflects purchases of R&D by each enterprise outside the enterprise and does not include internal R&D expenditure such as wages and salaries of employees conducting R&D in-house.

[127] Only IOEs that perform a certain amount of in-house R&D may have a sufficient absorptive capacity enabling them to benefit from superior technology introduced by FOEs. If the technological capabilities between FOEs and IOEs are too great, IOEs may not be able to benefit from the introduction of new technology. Alternatively, if the technology gap is too small, FOEs may transmit few benefits to IOEs. See Bleaney and Wakelin (2002).

and is expected to be positively associated with both the decision to export and export propensity.[128] Gross value added in used as a proxy for enterprise profitability (GVA_{ijt}) to reflect the ability of the enterprise to meet the fixed costs of entering the export market. A set of year dummies ($Year_t$) is included in order to capture inter-temporal effects.[129]

5.4.2 Sectoral and FOE Ownership Models

We extend the basic model of FOE spillovers outlined above by hypothesising that the extent and nature of export spillovers generated by FOEs to IOEs may be different across sectors. Specifically, spillovers generated in New-Mfg sectors are expected to be different from spillovers generated by FOEs in Old-Mfg sectors. Thus in addition to estimating the export spillovers model defined by equations 5.13 and 5.14 on our *entire* data set of IOEs for the 1991 to 1998 period, we divide our data set into Old- and New-Mfg sectors, and estimate equations 5.13 and 5.14 on these two sets of data. Table 5.4 reports descriptive statistics of IOEs in Old- and New-Mfg sectors.

We also wish to determine if the extent and nature of export spillovers generated by FOEs are different based on FOE ownership. In order to determine this we redefine our model of export spillovers as outlined in equations 5.15 and 5.16 so that FOE concentration and export information spillovers are measured by US and Non-US FOE ownership. Appendix 5.A (Model 2) details the revised FOE spillover variables. All other

[128] We continue to use "purchases of fuel and power" as a proxy for capital stock.

[129] Following Barrios *et al* (2001) we do not include price indices in our empirical model for several reasons, despite the fact that our theoretical equation in Section 5.2.3 included such. Firstly, it is enterprise-level indices are preferred as sectoral-level price indices may introduce aggregation bias in our estimates. Because our nominal variables were deflated with the sectoral-level indices, the use of price indices as

variable definitions are unchanged. Thus our adjusted model based on FOE ownership consists of equations (5.15) and (5.16).

The export decision equation is now

$$\begin{aligned} Export_{ijt} &= \alpha + \beta_1 USemplt_{jt} + \beta_2 NUSemplt_{jt} + \beta_3 USex_{jt} + \beta_4 NUSex_{jt} \\ &+ \beta_5 Sectemplt_{jt} + \beta_6 Sectex_{jt} + \beta_7 Emplt_{ijt} + \beta_8 Wage_{ijt} + \beta_9 RD_{ijt} \\ &+ \beta_{10} GVA_{ijt} + \beta_{11} Year' + v_{ijt} \end{aligned} \tag{5.15}$$

and the export intensity equation becomes

$$\begin{aligned} Expint_{ijt} &= \alpha + \beta_1 USemplt_{jt} + \beta_2 NUSemplt_{jt} + \beta_3 USex_{jt} + \beta_4 NUSex_{jt} \\ &+ \beta_5 Sectemplt_{jt} + \beta_6 Sectex_{jt} + \beta_7 Emplt_{ijt} + \beta_8 Wage_{ijt} + \beta_9 RD_{ijt} \\ &+ \beta_{10} GVA_{ijt} + \beta_{11} Year_t' + u_{ijt} \end{aligned} \tag{5.16}$$

Equations 5.15 and 5.16 are estimated on the data set of all IOEs in Irish manufacturing.

5.5 Econometric Results

Our equations are estimated on the enterprise-level data set of Irish manufacturers between 1991 and 1998 using an econometric technique based on the two-step Heckman selection model, which estimates the probability of exporting in the first step and estimates the factors that affect the export ratio of the enterprise in the second step (Heckman, 1979). The Heckman model takes into account the truncated nature of the sub sample of exporting enterprises used in the export intensity model, as well as the sample selection mechanism given by the export decision equation.[130]

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additional explanatory variables may introduce collinearity problems. Thirdly, we require export prices in order to consider relative prices but such data are not available to us (Barrios *et al*, 2001).

[130] The Stata7 command for the Heckman two-step consistent estimator specifies that Heckman's (1979) two-step efficient estimates of the parameters and covariance matrix (standard errors) of the model are produced.

The pooled data are clustered by enterprise, which allows the use of robust standard errors and unspecified serial correlation within enterprises, whilst assuming independence between them (that is, the observations are assumed to be independent across, but not necessarily within, enterprises). Maximum likelihood estimates are obtained for all equations. Wald tests are used to test for the overall significance of the models and the reported results indicate that, taken jointly, the coefficients of the regressors are significant. The correlation coefficient between the error terms of the export decision and export intensity equations (rho) is significantly different from zero and likelihood-ratio tests validate the choice of the Heckman selection model for both models estimated.

5.5.1 Evidence for FOE Export Spillovers

Columns (1) and (2) of Table 5.5 report the regression results for equations 5.13 and 5.14 regressed on the data set of all IOEs. The export decision of IOEs is positively and significantly related to the concentration of FOEs ($FOEemplt_{jt}$) implying that IOEs are more likely to enter the export market if they are in a sector with a relatively strong FOE presence. Moreover, once in the export market, IOEs in FOE-dominant sectors are likely to export relatively more than IOEs in sectors where the presence of FOEs is weaker.

In contrast, the export intensity of FOEs ($FOEex_{jt}$) has a negative association with both the IOE decision to export and the IOE export intensity once in the export market. Externalities from FOEs regarding information about export markets do not appear to filter through to IOEs, so much so that belonging to a sector where FOEs are strong exporters is associated with IOEs being relatively poor exporters.

Next, we divide our data set of Irish manufacturers into those operating in the Old-Mfg and New-Mfg sectors and observe whether or not the results obtained above hold when we focus on IOE and FOE intensive sectors respectively. Equations 5.13 and 5.14 are estimated for each sectoral data set and the results are presented in Columns (3), (4), (5), and (6) of Table 5.5.

The positive influence of FOE concentration ($FOEemplt_{jt}$) on the IOE decision to export originates in Old-Mfg. Moreover, if IOEs do enter the export market, their export intensity will be relatively higher than if they are located in New-Mfg. The negative association between FOE export intensity and the export decision and intensity of IOEs ($FOEex_{jt}$) occurs predominantly in Old-Mfg sectors, where relatively export-intensive FOEs appear to discourage IOEs from both exporting and exporting more. In contrast, belonging to a FOE export-intensive sector in New-Mfg has no significant association with the export decision or intensity of IOEs.

Besides FOE spillover influences, we include a number of other variables that may determine the exporting profile of IOEs. The employment sectoral scale variable ($SECTemplt_{jt}$) has no significant association with the export decision of IOEs across all IOEs. However, this insignificant aggregate result is a combination of a positive association between relative sector size and the IOE decision to export in Old-Mfg and a negative association in New-Mfg. Thus IOEs in larger New-Mfg sectors tend to concentrate on servicing the domestic marketplace instead of becoming exporters, whilst IOEs in larger Old-Mfg sectors are more likely to enter the export market.

Sectoral scale has a strong positive association with the export intensity of IOEs across all manufacturing, suggesting that IOEs in larger sectors tend to export relatively more. Most of this positive association derives from New-Mfg sectors, so that although IOEs belonging to a relatively large New-Mfg sector tend to service the Irish marketplace, if they do export they do so more intensively in larger sectors.

The export intensity of sectors ($Sectex_{jt}$) across all manufacturing is negatively associated with the IOE decision to export, so that IOEs in less-export intensive sectors will be more likely to enter the export market. This aggregate association is again the combination of diverse sectoral patterns; IOEs in relatively export intensive Old-Mfg sectors are unlikely to enter the export market, whereas IOEs in export intensive New-Mfg are more likely to be exporters. The export intensity of sectors has no significant association with IOE export intensity across all sectors, although IOEs in relatively more export-intensive New-Mfg sectors are likely to export less intensively.

Individual enterprise characteristics prove to be a significant influence on the decision of IOEs to export. Like the results for Colombia (Roberts and Tybout, 1997) and Spain (Barrios *et al*, 2001) we find that large enterprises are more likely to export ($Emplt_{ijt}$). This result is consistent with our own findings in chapters 3 and 4 that indicate a strong correlation between exporting and the size of IOEs. Higher average wages ($Wage_{ijt}$) are associated with a higher probability of exporting, a result consistent with export

production being relatively skill-intensive.[131] However, higher export propensity appears to have no association with higher wages. The R&D intensity of the enterprise (RD_{ijt}) is positively associated with both the decision to become an exporter and the intensity of exporters, a finding consistent with various studies emphasising the role of technology in determining the export status of enterprises (for example, Bleaney and Wakelin, 2002). Finally, our measure of enterprise profitability (GVA_{ijt}) indicates that profitability is not a necessary condition for becoming an exporter, possibly reflecting the sunk costs associated with entering the export market.

5.5.2 Evidence for FOE Ownership Differences

Next, we examine differences in the nature of FOE export spillovers based the FOE ownership divide. Using equations (5.15) and (5.16) that reflect differences in FOE employment and export intensity defined by US and Non-US FOE ownership, we re-estimate the two-step Heckman model. Our model specification essentially divides the spillover impact into that generated by US-FOEs and Non-US FOEs, making it possible to observe whether or not the nature of spillovers generated differ by FOE ownership. Table 5.6 presents the results.

The positive spillover effects on the export decision of IOEs as a result of FOE concentration are generated almost entirely by US-FOEs; Non-US FOEs have a minimal

[131] Aitken *et al* (1997) argue that wages might be interpreted as a measure of the skill intensity of enterprise production. Barrios *et al* (2001) check this assumption by replacing wages per head by more direct measures of skill, using the ratio of non-production to total employees and the percentage of technical employees. They find that only the coefficient of percentage of technical employees is significant. This result is similar to the finding of Bernard and Jensen (2001) that provides only weak evidence for a positive effect of skill on the decision of US firms to export.

association with the increased probability of an IOE becoming an exporter. Moreover, the positive association between FOE concentration and the export intensity of IOEs is generated by US-FOEs alone. Thus the concentration of US-FOEs generates nearly all the positive influence on the export characteristics of IOEs.

The negative association between FOE export intensity and both the export decision and export intensity of IOEs is the result of negative information spillovers from US-FOEs alone. The export intensity of Non-US owned FOEs have no significant impact on the export characteristics of IOEs.

All other results for the sectoral and enterprise variables remain the same as in Model 1.

5.5.3 Interpreting the Results

Our regression results for all models estimated suggest that FOE spillovers to IOEs do exist in Irish manufacturing. Both the *export decision* and *export intensity* of IOEs are positively associated with the concentration of FOEs in Irish manufacturing (proxied by the employment intensity of FOEs) and negatively associated with information spillovers (proxied by the export intensity of FOEs).

The positive association between FOE concentration and the IOE *export decision* is generated in Old-Mfg, whilst the positive association between IOE *export intensity* nd FOE concentration is generated mainly in New-Mfg, although there is a relatively small positive spillover effect originating in Old-Mfg. The negative spillover association

between the export intensity of FOEs and the export characteristics of IOEs is generated almost entirely in Old-Mfg.

Our analysis of spillovers by sectoral group allows greater insight into the nature of spillovers in Irish manufacturing. The dominance of export-orientated FOEs in New-Mfg results in few spillovers of any type that possibly enhance the productivity of IOEs and thus their ability to enter export markets. The overwhelming dominance of FOEs in New-Mfg appears to prevent the creation of linkages between FOEs and IOEs that lead to spillovers that motivate IOEs to enter the export market. However, once in the export market, IOEs located in these FOE-intensive sectors do export relatively more intensively.

Negative spillovers from FOEs concerning knowledge of export markets extend to both the export decision and export intensity of IOEs in Old-Mfg. Such a result may be a reflection of the lower concentration of FOEs and their lower export intensity in Old-Mfg relative to New-Mfg, so that there is simply less information from FOE exporting available to IOEs in Old-Mfg. This interpretation is confirmed by the insignificance of FOE export intensity on IOE export characteristics in New-Mfg.

US-owned FOEs generate nearly all of the spillovers resulting from FOE concentration described above, with Non-US owned FOEs having a small positive competition spillover effect on the IOE decision to export. This result is not surprising given that the growth of US-FOEs averaged more than 14 per cent per annum during the 1991 to 1998

period, whilst the number of Non-US FOEs actually declined. However, US and Non-US FOEs each employed approximately one-quarter of all employees in Irish manufacturing over the period examined, so that export spillovers from the concentration of Non-US FOEs could be expected to be greater than exhibited.

The strong influence of exporting US-FOEs via export information spillovers can be explained by the fact that they consistently exported more than 90 per cent of their turnover in the 1991 to 1998 data period, whereas Non-US FOEs exported less than three-quarters of their output. However, unlike previous empirical studies that find positive spillovers are generated by export-intensive FOEs, FOEs in Irish manufacturing are associated with *negative* information spillovers on both the decision to export and the export intensity of IOEs. Our FOE ownership analysis suggests that these negative spillovers originate in US-FOEs. In both Old-Mfg and New-Mfg this negative association may be a consequence of the failure of highly export-orientated US-FOEs to develop significant export knowledge linkages with IOEs. It may also reflect the fact that US-FOEs tend to concentrate in high-tech, export-orientated areas where any IOEs located in these same sectors simply concentrate on servicing the local market.[132]

[132] Kokko (1994) searches for productivity spillovers, via technology transfers, from FOEs to indigenous enterprises, in Mexican manufacturing. He finds no evidence for spillovers in industries where FOEs use highly complex technologies; industries with large technology gaps and a high proportion of FOEs experience lower productivity spillovers than others. Kokko (1994) argues that these FOE-dominant industries exhibit 'enclave' characteristics, where FOEs have little interaction with indigenous enterprises,

5.6 Summary and Conclusion

Although export-orientated FOEs have invested heavily in Irish manufacturing during the past four decades, there has been little if any empirical work conducted at the enterprise-level attempting to explain the influence FOEs may have on the exporting characteristics of IOEs. Chapter 5 provides an initial examination of this issue.

Our results confirm that the strong presence of FOEs in Irish manufacturing create export spillovers to IOEs. We find that the concentration of US-FOEs generate nearly all of the positive competition spillovers across all sectors of Irish manufacturing, suggesting that the employment growth of US-FOEs during the 1990s has had a positive impact on the competitive nature of IOEs, indirectly improving the export characteristics of IOEs.

In contrast to previous empirical studies, the export intensity of FOEs is found to be negatively associated with the export characteristics of IOEs. Such a result is of particular consequence for policy makers promoting inward FDI as a vehicle to support indigenous exporting and economic development generally. If FOEs are using their Irish manufacturing base almost exclusively as a platform for exporting, linkages between FOEs and IOEs that help to transmit information about export markets may not occur. Our empirical evidence suggests that IOEs need to be located in sectors where FOEs ship a proportion of their output to the domestic Irish market if they are to be associated with improvements in the exporting nature of IOEs.

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and thus there is little if any scope for productivity spillovers. A similar situation is possible in FOE-dominant sectors of Irish manufacturing, preventing export spillovers to IOEs in the same sectors.

Given the contrasting impact of the competitive influence and export intensity of FOEs on the export characteristics of Irish enterprises, further investigation is warranted into the policies that can be implemented in order to maximise the benefit to exporting IOEs of hosting FOEs. Görg and Greenaway (2001) list a number of trade related investment measures (TRIMS) that may be used to specifically encourage export spillovers. Further, given the variation in export spillover effects depending upon the sectoral concentration of FOEs in Irish manufacturing, a focus on the ability of specific sectors to generate export spillovers from FOEs, as well as the ability or absorptive capacity of IOEs to receive export spillovers, seems warranted.[133]

[133] Girma and Wakelin (2000) find that there are regional spillovers from FDI to indigenous enterprises in the UK. However, there is some evidence that spillovers from FOEs are relatively lower in less-developed regions. The authors suggest that his may be due to enterprises in these regions not having the necessary knowledge and skills to benefit from the presence of FOEs. Thus policies designed to attract FOEs to less-developed areas may limit their potential spillover benefits.

Table 5.1 Ownership and Exporting Trends, 1991-1998

Ownership	1991	1998	1991-1998 % change
IOEs			
Enterprises	1,620	1,945	20.1
Employment	95,204	114,865	20.6
Exporting Enterprises	61.2%	60.1%	
Export Intensity [a]	35.0%	35.7%	
Output as % of total mfg output	41.2%	23.1%	
Exports as % of total mfg exports	23.0%	10.6%	
FOEs			
Enterprises	589	581	-1.3
Employment	86,486	112,966	30.6
Exporting Enterprises	95.4%	97.2%	
Export Intensity [a]	82.2%	90.5%	
Output as % of total mfg output	58.8%	76.9%	
Exports as % of total mfg exports	77.0%	89.4%	
US FOEs			
Enterprises	214	250	14.4
Employment	38,612	64,968	68.2
Exporting Enterprises	98.1%	98.4%	
Export Intensity [a]	96.9%	96.4%	
Output as % of total mfg output	33.0%	58.1%	
Exports as % of total mfg exports	51.0%	72.0%	
Non-US FOEs			
Enterprises	375	331	-11.7
Employment	47,874	47,998	0.3
Exporting Enterprises	93.9%	96.4%	
Export Intensity [a]	63.3%	72.2%	
Output as % of total mfg output	25.8%	18.8%	
Exports as % of total mfg exports	26.0%	17.4%	

[a] Export intensity defined as the proportion of turnover exported.
Source: Own estimates derived from the *Census of Industrial Enterprises* (CSO).

Table 5.2 FOEs and Export Spillovers: Previous Empirical Studies

Authors	Data and Methodology	RESULTS[a]	
		Export Decision	Export Propensity
Aitken, Hanson, and Harrison (1997)	Mexico: 1986 and 1989; probit model; plant level data; export activity of FOEs in the industry and region used as a proxy for export information externalities; confusion over whether export activity or mere presence of FOEs influences indigenous export activity.	✓	..
Barrios, Görg, and Strobl (2001)	Spain: 1990 to 1998; firm level panel data; probit model for export decision and tobit model for export ratio. Focus on export and R&D spillovers; measure spillover effects on both FOEs and indigenous enterprises in Spanish manufacturing.	×	×
Kokko, Zejan, and Tansini (2001)	Uruguay: 1988; cross-sectional firm level data; probit model; output share of FOEs in an industry used as a proxy for FOE presence; distinguish between FOE presence in import-substituting and export-orientated industries; most evidence for export spillovers outside neighbouring markets (Brazil and Argentina).	✓[b]	..
Greenaway, Sousa, Wakelin (2002)	UK: 1992-1996; firm-level panel data; two-step Heckman selection model; focus on export, demonstration and competition spillover channels; competition effects found to be most important.	✓	✓

[a] The results presented are for evidence of spillovers from FOEs to indigenous enterprises only.
[b] Evidence for spillovers from FOEs in export-orientated industries and not import-substituting industries.
✓ = positive result; × = negative result; .. = not analysed.

Table 5.3 Sectoral Features of Irish Manufacturing

1991-1998 Average	Employment	Employment FOEs	Export Intensity* Total	Export Intensity* IOEs	Export Intensity* FOEs	FOE Exports as % of Total Exports
		(%)	(%)	(%)	(%)	(%)
New-Mfg [a]	59,967	82.3	88.5	38.0	92.3	96.7
Old-Mfg [b]	141,794	34.4	51.9	34.8	71.0	64.6
Total	201,761	48.6	69.5	35.1	85.0	84.3

Source: Own estimates derived from the *Census of Industrial Enterprises*.
[a] Nace Rev. 1 Sectors (24+30+31+32+33).
[b] Nace Rev. 1 Sectors (15-37) less (a).
* Export intensity is defined as turnover exported as a proportion of total turnover.

Table 5. 4 Descriptive Statistics of IOEs by Sector

1991-1998 Average	Mean	Standard Deviation
1. All IOEs		
(14,065 observations)		
Employment	59	114
Skill	23.9%	16.2%
Average Wages	£10,073	£4,635
Turnover	£5,317,577	£16,400,000
Turnover per employee	£69,719	£97,115
GVA per employee	£19,176	£21.409
Capital intensity	£1,326	£2,343
1. New-Mfg enterprises		
(1,423 observations)		
Employment	60	81
Skill	35.6%	23.0%
Average Wages	£13,878	£7,398
Turnover	£6,209,203	£15,100,000
Turnover per employee	£100,323	£160,659
GVA per employee	£19,821	£20,371
Capital intensity	£1,438	£4,187
2. Old-Mfg enterprises		
(12,642 observations)		
Employment	59	117
Skill	22.5%	14.7%
Average Wages	£9,645	£3,991
Turnover	£5,217,215	£16,600,000
Turnover per employee	£66,274	£86,441
GVA per employee	£18,073	£19,532
Capital intensity	£1,313	£2,033

Source: Own estimates derived from the *Census of Industrial Enterprises.*
All monetary values in 1985 constant £IR.

Table 5.5 Regression Results for IOE Export Decision and Export Intensity

Model 1	All Mfg		Old Mfg Sectors		New Mfg Sectors	
	Export Decision (1)	*Export Intensity (2)*	*Export Decision (3)*	*Export Intensity (4)*	*Export Decision (5)*	*Export Intensity (6)*
$FOEemplt_{jt}$	.7371***	.1487***	.8430***	.0612**	.2038	.5544***
	(.0392)	(.0220)	(.0501)	(.0277)	(.3747)	(.1136)
$FOEex_{jt}$	-.6611***	-.1912***	-.5965***	-.2073***	-.1880	.3075*
	(.0638)	(.0282)	(.0671)	(.0288)	(.6090)	(.1762)
$Sectemplt_{jt}$	-.3966	.8408***	1.6219**	.3269	-2.6428***	3.2980**
	(.3283)	(.1098)	(.6729)	(.2496)	(.5240)	(1.6150)
$Sectex_{jt}$	-.9856***	-.1374	-3.0992***	.3416	2.8670***	-1.0121***
	(.2843)	(.0955)	(.6983)	(.2684)	(.6859)	(.2103)
$Emplt_{ijt}$	.0039***	-.0001**	.0039***	-.0001**	.0045***	-.0001
	(.0002)	(.0000)	(.0002)	(.0000)	(.0009)	(.0000)
$Wage_{ijt}$	.0001**	.0001	.0001***	.0001*	-.0001	.0001
	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)
RD_{ijt}	.0001***	.0001***	.0001***	.0001***	.0001***	.0001
	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)
Cap_{ijt}	.0001**	-.0001***	.0001***	-.0001***	.0001	-.0001
	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)
GVA_{ijt}	-.0001**	..	-.0001	..	-.0001	..
	(.0000)		(.0000)		(.0000)	
Year Dummies	Yes		Yes		Yes	
Observations	14,065		12,642		1,423	
Censored Obs.	5,593		5,195		398	
Uncensored Obs.	8,472		7,447		1,025	
Wald χ^2	1,241.11		1,126.25		198.27	
Rho	-.86136		-.86416		-.85138	

Note: Summary regression results derived from equations 5.1 and 5.2.
Robust standard errors in parentheses.
Statistically significant at *** 1 per cent, ** 5 per cent, * 10 per cent.

Table 5.6 **Regression Results for IOE Export Decision and Export Intensity:**

US- and Non-US Owned FOEs

Model 2	***Export Decision***	***Export Intensity***
	EQUATION 5.3	*EQUATION 5.4*
$USemplt_{jt}$	.3351***	.1218***
	(.0293)	(.0124)
$NUSemplt_{jt}$	.1477***	-.0166
	(.0381)	(.0140)
$USex_{jt}$	-.4516***	-.1696***
	(.0457)	(.0200)
$NUSex_{jt}$	.0156	-.0182
	(.0314)	(.0109)
$SECTemplt_{jt}$	-.4174	1.0355***
	(.3426)	(.1136)
$SECTex_{jt}$	-.4016***	-.1198
	(.2935)	(.0957)
$Emplt_{ijt}$	.0039***	-.0001**
	(.0002)	(.0000)
$Wage_{ijt}$	.0001***	-.0001
	(.0000)	(.0000)
RD_{ijt}	.0001***	.0001***
	(.0000)	(.0000)
Cap_{ijt}	.0001*	-.0001***
	(.0000)	(.0000)
GVA_{ijt}	-.0001**	..
	(.0000)	
Year Dummies	Yes	
Observations	14,065	
Censored Obs.	5,593	
Uncensored Obs.	8,472	
Wald χ^2	1,318.87	
Rho	-.86748	

Note: Summary regression results derived from equations 5.3 and 5.4.
Robust standard errors in parentheses.
Statistically significant at *** 1 per cent, ** 5 per cent, * 10 per cent.

Appendix 5.A

Table 5.A.1 Variable Definitions

All variables are derived from the *Census of Industrial Enterprises*, 1991-1998, where i = enterprise, j = sector, and t = year.

MODEL 1: General Spillover Model	
Dependent Variables	
$Export_{ijt}$	Dichotomous variable taking the value of 1 if the IOE exports, 0 otherwise.
$Exprop_{ijt}$	Proportion of turnover exported (export intensity) by IOE
FOE Spillover Variables	
$FOEemplt_{jt}$	$\frac{\text{(FOE Employment}_{jt})/(\text{Employment}_{jt})}{(\text{FOE Employment}_{t})/(\text{Employment}_{t})}$
$FOEex_{jt}$	$\frac{\text{(FOE Exports}_{jt})/(\text{Exports}_{jt})}{(\text{FOE Exports}_{t})/(\text{Exports}_{t})}$
$FOErd_{jt}$	$\frac{\text{(FOE R\&D Expenditure}_{jt})/\text{R\&D Expenditure}_{jt})}{(\text{FOE R\&D Expenditure}_{t})/(\text{R\&D Expenditure}_{t})}$
Sectoral Scale Variables	
$Sectemplt_{jt}$	Employment_{jt} / Employment_{t}
$Sectex_{jt}$	Exports_{jt} / Exports_{t}
$Sectrd_{jt}$	$\text{R\&D expenditure}_{jt}$ / $\text{R\&D Expenditure}_{t}$
IOE Variables	
$Emplt_{ijt}$	Employment_{ijt}
$Wage_{ijt}$	$\text{Average wage}_{ijt}$
RD_{ijt}	$\text{R\&D expenditure per employee}_{ijt}$
Cap_{ijt}	$\text{Capital intensity per employee}_{ijt}$
GVA_{ijt}	$\text{Gross value added per employee}_{ijt}$
$Year_{t}$	Year dummies, 1991-98

MODEL 2: US and Non-US FOE Ownership	
$USemplt_{jt}$	$\frac{(\text{US Employment}_{jt})}{(\text{Employment}_{jt})}$ / $\frac{(\text{US Employment}_{t})}{(\text{Employment}_{t})}$
$USex_{jt}$	$\frac{(\text{US Exports}_{jt})}{(\text{Exports}_{jt})}$ / $\frac{(\text{US Exports}_{t})}{(\text{Exports}_{t})}$
$USrd_{jt}$	$\frac{(\text{US R\&D Expenditure}_{jt})}{(\text{R\&D Expenditure}_{jt})}$ / $\frac{(\text{US R\&D Expenditure}_{t})}{(\text{R\&D Expenditure}_{t})}$
$NUSemplt_{jt}$	$\frac{(\text{NUS Employment}_{jt})}{(\text{Employment}_{jt})}$ / $\frac{(\text{NUS Employment}_{t})}{(\text{Employment}_{t})}$
$USex_{jt}$	$\frac{(\text{NUS Exports}_{jt})}{(\text{Exports}_{jt})}$ / $\frac{(\text{NUS Exports}_{t})}{(\text{Exports}_{t})}$
$NUSrd_{jt}$	$\frac{(\text{NUS R\&D Expenditure}_{jt})}{(\text{R\&D Expenditure}_{jt})}$ / $\frac{(\text{NUS R\&D Expenditure}_{t})}{(\text{R\&D Expenditure}_{t})}$

APPENDIX 5.B
Extended Model: Regression Results Including R&D Expenditure

The inadequacy of the research and development measure available to us in the *Census of Industrial Enterprises* leads us to omit the influence of FOE R&D spillovers from the model reported in chapter 5.[134] For completeness, we include both a FOE R&D spillover variable and a variable that scales for the R&D purchases of each sector relative to others. $FOErd_{jt}$ is intended to capture demonstration externalities that may spill over from FOEs. It is expected that the more research and development services purchased by FOEs, the greater is the available stock of innovation and technology from which IOEs can draw or imitate. $Sectrd_{jt}$ controls for the R&D intensity of each sector relative to all other manufacturing sectors. Appendix 5.A details the variable definitions. Given the measure of R&D expenditure provided in the Census we do not expect $FOErd_{jt}$ and $Sectrd_{jt}$ to reflect the true influence of R&D expenditure in Irish manufacturing.

The inclusion of the R&D variables in our approach results in two empirical models, the first being our *export decision* model.

$$\begin{aligned} Export_{ijt} &= \alpha + \beta_1 FOEemplt_{jt} + \beta_2 FOEex_{jt} + \beta_3 FOErd_{jt} \\ &+ \beta_4 Sectemplt_{jt} + \beta_5 Sectex_{jt} + \beta_6 Sectrd_{jt} + \beta_7 Emplt_{ijt} \\ &+ \beta_8 Wage_{ijt} + \beta_9 RD_{ijt} + \beta_{10} GVA_{ijt} + \beta_{11} Year_t' + \nu_{ijt} \end{aligned} \qquad (5.A.2)$$

The second equation estimated captures the influence of export spillovers on the *export intensity* of IOEs.

$$\begin{aligned} Expint_{ijt} &= \alpha + \beta_1 FOEemplt_{jt} + \beta_2 FOEex_{jt} + \beta_3 FOErd_{jt} \\ &+ \beta_4 Sectemplt_{jt} + \beta_5 Sectex_{jt} + \beta_6 Sectrd_{jt} + \beta_7 Emplt_{ijt} \\ &+ \beta_8 Wage_{ijt} + \beta_9 RD_{ijt} + \beta_{10} Year_t' + u_{ijt} \end{aligned} \qquad (5.B.2)$$

Similarly, the inclusion of FOE and sectoral R&D measures in the model of FOE ownership results in the following revised equations.

[134] The research and development variable of each enterprise (FOEs and IOEs) in the *Census of Industrial Enterprises* is a measure of the research and development services purchased by the enterprise from others; it excludes the wages and salaries of own enterprise employees who may be conducting R&D as well as capitalised R&D of the enterprise. Thus our measure of R&D excludes "in-house" R&D expenditure.

The *export decision* equation is

$$Export_{ijt} = \alpha + \beta_1 USemplt_{jt} + \beta_2 NUSemplt_{jt} + \beta_3 USex_{jt} + \beta_4 NUSex_{jt} + \beta_5 USrd_{jt} + \beta_6 NUSrd_{jt} + \beta_7 Sectemplt_{jt} + \beta_8 Sectex_{jt} + \beta_9 Sectrd_{jt} + \beta_{10} Emplt_{ijt} + \beta_{11} Wage_{ijt} + \beta_{12} RD_{ijt} + \beta_{13} GVA_{ijt} + \beta_{14} Year_t' + v_i \quad (5.B.3)$$

and the *export intensity* equation becomes

$$Expint_{ijt} = \alpha + \beta_1 USemplt_{jt} + \beta_2 NUSemplt_{jt} + \beta_3 USex_{jt} + \beta_4 NUSex_{jt} + \beta_5 USrd_{jt} + \beta_6 NUSrd_{jt} + \beta_7 Sectemplt_{jt} + \beta_8 Sectex_{jt} + \beta_9 Sectrd_{jt} + \beta_{10} Emplt_{ijt} + \beta_{11} Wage_{ijt} + \beta_{12} RD_{ijt} + \beta_{13} Year_t' + v_i \quad (5.B.4)$$

Results for all equations using the Heckman two-step estimation procedure as outlined in chapter 5 are given in Tables 5.B.1 and 5.B.2. As expected, the R&D measures have no significant association with either the export decision or export intensity of IOEs.

Table 5.B.1 Regression Results for IOE Export Decision and Export Intensity: Extended Model

Model 1	All Mfg		Old Mfg Sectors		New Mfg Sectors	
	Export Decision (1)	*Export Intensity (2)*	*Export Decision (3)*	*Export Intensity (4)*	*Export Decision (5)*	*Export Intensity (6)*
$FOEemplt_{jt}$	.7226***	.1521***	.8324***	.0462	.1880	.5446***
	(.0413)	(.0221)	(.0535)	(.0284)	(.3768)	(.1113)
$FOEex_{jt}$	-.6056***	-.2011***	-.5887***	-.1653***	-.1266	.2559
	(.0768)	(.0308)	(.0844)	(.0341)	(.6091)	(.1728)
$FOErd_{jt}$	-.0349	.0023	.0568	-.0295	1.3326	-1.1252**
	(.0471)	(.0165)	(.0507)	(.0178)	(1.2863)	(.3600)
$Sectemplt_{jt}$	-.6043	.8827***	1.4237*	.0095	-2.5562***	2.3206
	(.3654)	(.1224)	(.8104)	(.2931)	(.4134)	(2.0335)
$Sectex_{jt}$	-.7786***	-.1864	-2.7714***	.6667*	4.1572***	-.9250***
	(.3358)	(.1110)	(.8687)	(.3199)	(1.0092)	(.2889)
$Sectrd_{jt}$	-.1391	.0414	-.2620	-.1250	-.7631**	.1788**
	(.1597)	(.0533)	(.2537)	(.0966)	(.3217)	(.0843)
$Emplt_{ijt}$	.0039***	-.0001**	.0039***	-.0001**	.0045***	-.0001
	(.0002)	(.0000)	(.0002)	(.0000)	(.0002)	(.0000)
$Wage_{ijt}$	.0001**	.0001	.0001***	.0001	-.0001	.0001
	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)
RD_{ijt}	.0001***	.0001***	.0001***	.0001***	.0001***	.0001
	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)
Cap_{ijt}	.0001**	-.0001***	.0001***	-.0001***	.0001	-.0001
	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)
GVA_{ijt}	-.0001**	..	-.0001	..	-.0001	..
	(.0000)		(.0000)		(.0000)	
Year Dummies	Yes		Yes		Yes	
Observations	14,065		12,642		1,423	
Censored Obs.	5,593		5,195		398	
Uncensored Obs.	8,472		7,447		1,025	
Wald χ^2	1,243.99		1,134.73		218.87	
Rho	-.86118		-.86401		-.79773	

Note: Summary regression results derived from equations 5.B.1 and 5.B.2.
Robust standard errors in parentheses.
Statistically significant at *** 1 per cent, ** 5 per cent, * 10 per cent.

Table 5.B.2 Regression Results for IOE Export Decision and Export Intensity (All Mfg): By US- and Non-US Owned FOEs, Extended Model

Model 2	*Export Decision*	*Export Intensity*
	EQUATION 5.B.3	*EQUATION 5.B.4*
$USemplt_{jt}$	.3397***	.1221***
	(.0298)	(.0126)
$NUSemplt_{jt}$	.1482***	-.0163
	(.0382)	(.0141)
$USex_{jt}$	-.4369***	-.1757***
	(.0532)	(.0218)
$NUSex_{jt}$	.0211	-.0003
	(.0322)	(.0112)
$USrd_{jt}$	-.0439	.0118
	(.0363)	(.0129)
$NUSrd_{jt}$	-.0048	-.0003
	(.0038)	(.0013)
$SECTemplt_{jt}$	-.4486	1.0675***
	(.3739)	(.1246)
$SECTex_{jt}$	-.4299***	-.1284
	(.3345)	(.1092)
$SECTrd_{jt}$	.0772	-.0031
	(.1678)	(.0558)
$Emplt_{ijt}$	.0039***	-.0001**
	(.0002)	(.0000)
$Wage_{ijt}$	.0001***	-.0001
	(.0000)	(.0000)
RD_{ijt}	.0001***	.0001***
	(.0000)	(.0000)
Cap_{ijt}	.0001*	-.0001***
	(.0000)	(.0000)
GVA_{ijt}	-.0001**	..
	(.0000)	
Year Dummies	Yes	
Observations	14,065	
Censored Obs.	5,593	
Uncensored Obs.	8,472	
Wald χ^2	1,318.87	
Rho	-.87084	

Note: Summary regression results derived from equations 5.B.3 and 5.B.4.
Robust standard errors in parentheses.
Statistically significant at *** 1 per cent, ** 5 per cent, * 10 per cent.

CHAPTER 6

SUMMARY AND POLICY IMPLICATIONS

6.1 Overview

The growth of merchandise exports from Irish manufacturing was a major contributing factor to Ireland's remarkable economic performance during the 1990s (Gray, 1997; Sachs, 1997). This thesis has analysed various aspects of the exporting characteristics of Irish-owned enterprises during this time period.

Chapter 1 set the framework for our analyses by describing the policy context of Irish export promotion. The growth of manufacturing exports is considered a direct result of an industrial strategy based on large inflows of FDI encouraging FOEs to establish manufacturing plants in Ireland specifically to produce for export markets. As a result, the average export intensity of all manufacturing enterprises in Ireland rose during the 1990s. A feature of FDI in Irish manufacturing has been the dominance of US-owned green-field FOE investment. Chapter 1 described these unique features of Irish manufacturing.

Chapter 2 reflects upon the traditional macroeconomic explanations of Irish export patterns in the 1990s, and notes that changes in export patterns of Irish manufacturers can be better understood by examining the export features of individual enterprises. The thesis is thus comprised of three micro-level empirical studies of the characteristics of Irish manufacturing exporters at the *enterprise* level. The data used throughout the thesis

are from the *Census of Industrial Enterprises* of Irish manufacturing for the years 1991 to 1998 inclusive. Our initial examination of the Census of Industrial Enterprises in chapter 2 highlights the differences in enterprise and export features of foreign and indigenous-owned enterprises. Because foreign-owned enterprises present in Irish manufacturing export more than 90 per cent of their turnover, and exhibit distinctive enterprise characteristics relative to indigenous-owned enterprises, the thesis examines the export characteristics of indigenous or Irish-owned enterprises only.

Despite the growth of total Irish manufactured exports, a feature of export patterns of Irish manufacturers during the 1990s was the relatively stable export intensity of IOEs; between 1991 and 1998 the export propensity of all IOEs remained constant at approximately 36 per cent. This stability in export intensity led Forfás (2000), amongst others, to question the export competitiveness of IOEs. Moreover, despite significant policy emphasis aimed at expanding export shipments beyond the UK, Ireland's traditional trading partner, the proportion of total exports by IOEs to all Non-UK destinations (except the USA) did not increase significantly between 1991 and 1998. The purpose of the three empirical studies in chapters 3, 4, and 5 is to add to our understanding of IOE exporting characteristics in the 1990s in the context of these export features.

Our first empirical study in chapter 3 considers the characteristics of Irish manufacturing exporters relative to non-exporters. Before concentrating on the export characteristics of IOEs only, we confirm our decision in chapter 2 to exclude FOEs from further analysis

by establishing empirically that FOEs, on average, exhibit overwhelmingly superior performance characteristics relative to IOEs. Chapter 3 next focuses on explaining the characteristics of IOEs in terms of exporters and non-exporters. For each of seven enterprise characteristics examined, exporting IOEs are superior to non-exporting IOEs, a result that reflects previous empirical studies of manufacturing sectors in other developed countries such as the USA (Bernard and Jensen, 1999) and the UK (Girma *et al*, 2002). We extend the analysis by examining exporting enterprises only and find that IOEs that export more intensively are, on average, larger in terms of employment and turnover, and pay marginally higher wages than less intensive exporters. However, we also find that more intensive exporters use less skilled labour, suggesting that export intensive IOEs tend to be relatively large enterprises that employ a higher proportion of lower skilled labour.

Chapter 3 introduces the destination pattern of exports into our analyses. We distinguish between IOEs that export predominantly to the UK and those that export predominantly to Non-UK destinations on the basis that the UK can be viewed as a 'regional' market for Irish manufacturers. We find that Non-UK exporters are, on average, larger than UK-exporters in terms of employment and turnover, pay higher wages, and are more productive. This is the first enterprise-level study of Irish manufacturing that attempts to examine the characteristics of IOE exporters in terms of their output shipment patterns.

Chapter 3 also examines the proposition that IOEs self-select to become exporters; more productive and efficient enterprises are expected to be able to sustain any additional

expenses incurred when entering a foreign marketplace. We find that in the years leading up to entering the export market, IOEs are larger and more productive than continuing non-exporters. However, once in the export marketplace, exporters do not become more productive relative to IOEs that sell their output on the domestic Irish market only. These results have important implications for Irish industrial policy; policies designed to increase the number of exporting IOEs should be aimed directly at improving the productivity of IOEs before they become exporters. In addition, export policy initiatives need to take into account the intended export destination of export shipments because IOEs that seek to export beyond the UK must be even more productive than UK exporters.

Although chapter 3 provides insights into the enterprise level characteristics of exporting relative to non-exporting IOEs, it does not address the reasons why IOEs become exporters. Chapter 4 examines this issue by presenting a dynamic model of the determinants of exporting in Irish manufacturing that focuses on the influence of sunk costs required to enter export markets on the decision to export or not. Furthermore, we test for possible differences in sunk costs faced by IOEs exporting to UK and Non-UK destinations.

Hysteresis in trade participation may be an indication of significant sunk costs associated with exporting, so our approach to the search for evidence of sunk costs faced by IOEs begins by examining the movement of IOEs into and out of export markets, that is, the 'switching' rates of IOEs. In a sample of IOEs we find that the annual average proportion

of IOEs that switch between exporting and not exporting between any two given years in the period 1991 to 1998 is approximately 8 per cent, a rate comparable with that for manufacturing enterprises in the US and UK. In keeping with the export destination approach introduced in chapter 3, we examine the switching rates of IOEs exporting to the UK compared to those exporting to Non-UK destinations. Because of the strong historical export links between the UK and Ireland, we expect switching rates into and out of the UK export market to be relatively higher than the switching rates of IOEs into and out of Non-UK markets, where sunk costs are expected to be higher for IOE exporters. The data show that Non-UK exporters exhibit greater stability in their exporting patterns with the proportion of switching for Non-UK exporters averaging four per cent per annum, compared to an annual average switching rate of over ten per cent for UK exporters. We consider this to be preliminary evidence of the existence of lower sunk costs for IOE exporters to the UK relative to Non-UK exporters.

The empirical model of the determinants of exporting in chapter 4 is based on that developed by Roberts and Tybout (1997), and includes both sunk costs and enterprise heterogeneity as explanations of the decision of IOEs to become exporters or not. However, unobserved enterprise heterogeneity involves a number of econometric issues that we address by modelling four different specifications, three models based on a linear probability framework (Bernard and Jensen, 2001), and one consisting of a random effects probit model (Roberts and Tybout, 1997). Each specification estimated shows that IOEs face significant sunk costs when entering the export market. Regardless of the model estimated, exporting in the previous year is associated with a higher probability of

exporting in the current year. Exporting two years previously is also associated with a higher probability of exporting in the current period, albeit a far smaller probability. These results suggest that IOEs face substantial entry costs when entering the export market, and that the benefits of having once been an exporter depreciate significantly after being absent from the export market for one year, but do not depreciate completely. Our results for Irish manufacturing are consistent with those for manufacturing enterprises in Colombia, the US, and the UK. We extend the basic model of export determinants to investigate any differences in sunk costs faced by IOE exporters to UK versus Non-UK destinations. Our results indicate that sunk costs vary with the pattern of export destination; sunk costs faced by Irish exporters to the UK are lower than those faced by exporters to Non-UK destinations. This result explains the higher switching rates of IOEs into and out of UK relative to Non-UK markets.

The results obtained in chapter 4 emphasise the conclusions reached in chapter 3; IOEs that intend to export need to be relatively more productive than continuing non-exporters because of fixed costs associated with entering the export market. Moreover, enterprises that export to Non-UK destinations face higher sunk costs than exporters to the UK, suggesting that Non-UK exporters need to be even more productive than UK-exporters in order to enter these non-traditional export markets. The focus on specific export destinations in our analyses of chapters 3 and 4 has emphasised the need for Irish policymakers to distinguish early the intended export markets of IOEs, and tailor policy measures to enhance the productivity and export characteristics of IOEs to their intended marketplaces, domestic, UK, or Non-UK.

Our final empirical study in chapter 5 focuses on the role of export spillovers from foreign to indigenous enterprises in Irish manufacturing. Since the 1960s Ireland has implemented an industrialisation strategy that has relied on FDI to promote dynamic export products (UNCTAD, 2002). One consequence of this strategy is the possibility that 'export spillovers' from FOEs present in Irish manufacturing encourage indigenous enterprises to become exporters, or to export more intensively. Chapter 5 develops a Heckman specification that attempts to capture the nature of export spillovers from FOEs on both the export decision and export intensity of IOEs. The results indicate that the presence of FOEs in Irish manufacturing is positively associated with the decision by IOEs to begin exporting and the export intensity of exporters. However, the export intensity of FOEs is negatively associated with the export decision and intensity of IOEs. These results can be partly explained by the overwhelming presence of highly export orientated FOEs in certain sectors of Irish manufacturing, such as Chemicals and Electronics. Our results suggest that FOEs located in these sectors are so dominant, both in terms of turnover produced and exports shipped, that few linkages between FOEs and IOEs are developed. Thus the channels that might be expected to transmit export spillovers from FOEs to IOEs are not developed.

A feature of chapter 5 is the introduction of FOE nationality as a consideration in the nature of export spillovers. The growth of export-orientated US-owned FOEs in Irish manufacturing during the 1990s leads us to distinguish between US and Non-US FOEs, and search for export spillovers from each of these FOE types to IOEs. Although employment and turnover by US-FOEs grew significantly between 1991 and 1998, US

and Non-US FOEs employed a similar number of persons over the period, suggesting that the extent of export spillovers generated by US and Non-US FOEs may be similar. However, we find that export spillovers to IOEs are mainly generated by US-FOEs.

With FDI expected to continue to play an important role in the economic development of Ireland (IDA, 2001), the results of chapter 5 suggest that policies designed to maximise the potential for positive export spillovers are needed, both in terms of encouraging FOEs to transfer spillovers and improving the absorptive capacity of indigenous enterprises to capture export spillovers. Furthermore, the importance of the sectoral concentration of FDI for the nature of export spillovers in Irish manufacturing should be examined in light of the lack of positive spillovers to IOEs in sectors where FDI is dominant.

In each of the three empirical studies in this thesis we have included enterprise size as an explanatory variable in the models of exporting behaviour analysed. All of the econometric results obtained show that larger enterprises have a higher probability of exporting. The significance of enterprise size for exporting is consistent with the existence of start up costs in exporting, as well as the possibility that large enterprises are low marginal cost producers and face a higher return to exporting than smaller enterprises (Aitken *et al*, 1997). More generally, exporting appears to be associated with declining per unit foreign distribution costs for larger enterprises, which are able to spread the fixed costs of exporting over higher output levels.

The thesis has contributed to the literature on micro-level evidence of enterprise characteristics and exporting performance by examining Irish manufacturing between

1991 and 1998, a period of significant export growth. The analysis has distinguished between enterprises and their export propensity on the basis of enterprise ownership, a factor not highlighted in previous studies of manufacturing sectors in other developed countries. The thesis has incorporated extensively the influence of the destination of exports on the characteristics of Irish manufacturing enterprises. Our findings suggest that patterns of export destination have a significant association with the enterprise and export characteristics of Irish manufacturers. The thesis has also extended the literature on the role of foreign enterprise export spillovers to indigenous enterprises by noting that export spillovers may vary with the nationality of foreign enterprise ownership, a feature that has not been highlighted in previous empirical studies.

Despite the attributes noted above, we recognise a number of limitations in our analysis and the data used. Although the *Census of Industrial Enterprises* used in the empirical analyses of the thesis is a rich data set that permits rigorous econometric analysis of the issues examined, the data correspond to a relatively short time period (1991 to 1998) and may thus not reveal longer term trends in enterprise exporting. Furthermore, the time period covered was one of exceptional Irish and world economic growth, with corresponding levels of high domestic and world demand, and exceptional FDI investment in Irish manufacturing. By extending the data time period beyond the year 2000, a clearer picture of the longer term ability of IOEs to meet changing economic and export conditions will emerge.

A further data restriction of the *Census* is the definition of labour employed; it was not possible to distinguish between full-time and part-time persons employed. This is of particular consequence because the 1990s was a period of exceptionally strong part-time employment growth overall in the Irish economy.[135] The result is that our measure of average wages is most likely underestimated, and may explain the insignificance of many of the results associated with measuring average wages. Similarly, our measure of skilled labour is most likely imprecise, and may explain the contrasting results obtained; our measure of skilled labour shows that exporting enterprises tend to employ less skilled labour than non-exporters in chapter 3, but is found to be a significant determinant of the IOE decision to become an exporter in chapter 5.

6.2 Concluding Comments

The analyses undertaken and the results obtained in the thesis regarding the relationship between enterprise characteristics and their exporting patterns suggest a number of areas for further research.

Enterprise level characteristics that have a direct effect on the cost competitiveness of IOEs in the export market, such as wages and skill levels, could be further examined in order to determine the measures needed for individual enterprises in Irish manufacturing to remain internationally competitive. The predominance of US-owned FOEs in Irish manufacturing and the increase in IOE exports to the USA during the 1990s suggests an

[135] Between 1991 and 1997, part-time employment in the Irish economy grew by seventy five per cent, while full-time employment grew by less than 15 per cent in the same period. See

extension of the analysis of FOE ownership and export targeting of indigenous enterprises in the context of sunk costs and export spillovers. For example, do US-owned FOEs located in Irish manufacturing lower the sunk costs for IOEs intending to export to the US? Analysis of such issues will extend previous empirical analyses by focusing on the relationship between enterprise characteristics and exporting specifically in the context of Irish manufacturing trends.

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www.eirestat.cso.ie/diska/LFAA.CVS

BIBLIOGRAPHY

Aitken B, G Hanson, and A Harrison (1997). "Spillovers, Foreign Investment and Export Behaviour", *Journal of International Economics*, Vol. 43, pp. 103-132.

Aitken B and A Harrison (1999). "Do Domestic Firms Benefit From Direct Foreign Investment? Evidence from Venezuela", *American Economic Review*, Vol. 89, No. 3, pp. 605-618.

Ahmad J and A Kwan (1991). "Causality Between Exports and Economic Growth", *Economic Letters*, Vol. 37, pp. 243-248.

Anderson J (1979). "A Theoretical Foundation for the Gravity Equation", *American Economic Review*, Vol. 69, No.1 , pp. 106-116.

Aw B and A Hwang (1995). "Productivity and the Export Market: A Firm Level Analysis", *Journal of Development Economics*, Vol. 47, No. 2, pp. 313-332.

Balasubramanyam V, M Salisu, and D Sapsford (1996). "Foreign Direct Investment and Growth in EP and IS Countries", *Economic Journal*, Vol. 106, pp. 92-105.

Baldwin R (1988). "Hysteresis in Import Prices: The Beachhead Effect", *American Economic Review*, September, Vol. 78, No. 4, pp. 773-785.

Baldwin R (1989). *Sunk Cost Hysteresis*, National Bureau of Economic Research, Cambridge MA.

Baltagi B (1995). *Econometric Analysis of Panel Data*, Chichester: John Wiley and Sons.

Barrell R and N Pain (1997). "The Growth of Foreign Direct Investment in Europe", *National Institute Economic Review*, No. 160, pp. 63-75.

Barrios S, H Görg, and E Strobl (2001). "Explaining Firms' Export Behaviour: The Role of R&D and Spillovers", GEP *Research Paper 01/27*, University of Nottingham.

Barry F (1999). *Understanding Ireland's Economic Growth*, London: Palgrave Macmillan.

Barry F and J Bradley (1997). "FDI and Trade: The Irish Host-Country Experience", *Economic Journal*, Vol. 107, pp. 1789-1811.

Barry F, Bradley J, and E O'Malley (1999). "Indigenous and Foreign Industry: Characteristics and Performance", Chapter 3 in Barry (ed.), *Understanding Ireland's Economic Growth*, pp. 45-74.

Barry F, H Görg, and E Strobl (2001). "Foreign Direct Investment and Wages in Domestic Firms: Productivity Spillovers versus Labour-Market Crowding-Out", Mimeo, University College Dublin and University of Nottingham.

Bartelsman E and M Doms (2000). "Understanding Productivity: Lessons from Longitudinal Micro-data Bases", *Journal of Economic Literature*, Vol. 38, No. 3.

Bell J (1997). "The Role of Export Promotion Organisations", B Fynes and S Ennis (eds.), *Competing from the Periphery*, Dublin: Oaktree Press

Bernard A (1995). "Exporters and Trade Liberalisation in Mexico: Production Structure and Performance", MIT, mimeo.

Bernard A and J Jensen (1995). "Exporters, Jobs, and Wages in US Manufacturing, 1976-1987", *Brookings Papers on Economic Activity: Microeconomics*, Washington DC.

Bernard A and J Jensen (1997a). "Exporters, Skill-upgrading, and the Wage Gap", *Journal of International Economics*, Vol. 42, pp. 3-31.

Bernard A and J Jensen (1997b). "Why Some Firms Export: Experience, Entry Costs, Spillovers, and Subsidies", Yale mimeo.

Bernard A and J Jensen (1997c). "Inside the US Export Boom", *National Bureau of Economic Research Working Paper*, No. 6438.

Bernard A and J Jensen (1999). "Exceptional Exporter Performance: Cause, Effect, or Both?", *Journal of International Economics*, Vol. 47, pp. 1-25.

Bernard A and J Jensen (2001). "Why Some Firms Export", *NBER Working Paper No. 8349.*

Bernard A and J Wagner (1997). "Exports and Success in German Manufacturing", *Weltwirtschaftliches Archiv*, Vol. 133, pp. 134-157.

Bernard A and J Wagner (1998). "Export Entry and Exit by German Firms", *NBER Working Paper 6538.*

Blake A and N Pain (1994). "Investigating Structural Change in UK Export Performance: The Role of Innovation and Direct Investment", *NIESR Discussion Paper No. 71.*

Bleaney M and K Wakelin (2002). "Efficiency, Innovation, and Exports", *Oxford Bulletin of Economics and Statistics*, Vol. 64, pp. 3-15.

Blomström M and A Kokko (1998). "Multinational Corporations and Spillovers", *Journal of Economic Surveys*, Vol. 12, pp. 247-277.

Blomström M, A Kokko and M Zejan (2000). *Foreign Direct Investment: Firm and Host Country Strategies*, London: Macmillan.

Borensztein E, J De Gregorio, and J Lee (1998). "How Does Foreign Direct Investment Affect Economic Growth?", *Journal of International Economics*, Vol. 45, June.

Buckley P (1995). *Foreign Direct Investment and Multinational Enterprises*, London: Macmillan.

Cabral S (1995). "Comparative Export Behaviour of Foreign and Domestic Firms in Portugal", *Banco de Portugal Economic Bulletin*, March, pp. 69-78.

Cantwell J (1989). *Technological Innovation and Multinational Corporations*, Oxford: Basil Blackwell.

Castellani D (2001). "Export Behaviour and Productivity Growth: Evidence from Italian Manufacturing Firms", Universita di Urbino, mimeo.

Caves R (1971). "International Corporations: The Industrial Economics of Foreign Investment", *Economica*, February, Vol. 38, No. 149, pp. 1-27.

Caves R (1974). "Mulitnational Firms, Competition, and Productivity in Host-country Markets", *Economica*, May.

Caves R (1996). *Multinational Enterprises and Economics Analysis*, (2nd ed.), Cambridge: Cambridge University Press.

Central Bank of Ireland (2000). *Bulletin*, (Winter, Spring), Dublin: Government Publications.

Central Statistics Office (1991a-1998a). *Census of Industrial Production*, Dublin: Government Publications.

Central Statistics Office (1991b-1998b). *Economic Series*, Dublin: Government Publications.

Central Statistics Office (1991c-1998c). *Statistical Bulletin*, Dublin: Government Publications.

Central Statistics Office (2002). *External Trade*, Dublin: Government Publications.

Clerides S, S Lach, and J Tybout (1998). "Is Learning-By-Exporting Important: Micro-Dynamic Evidence From Colombia, Mexico, and Morocco?", *Quarterly Journal of Economics*, Vol. 113, pp. 903-948.

Culliton (1992). "A Time for Change – Industrial Policy for the 1990s", (The Culliton Report), Dublin: The Stationary Office.

De Arcos L, A Arundel, J Hagedoorn, R Narula, G van de Paal, and E an Sluijs (1997). "Innovative Capacity, Embeddedness, and the Contribution of Foreign Firms to Innovation in their Host Region", *EIMS Project, MERIT No., 93/65*, European Commission.

Deardorff A (1998). "Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?", in J Frankel (ed.), *The Regionalisation of the World Economy*, Chicago: University Press.

Delgado M, J Fariñas, and J Ruano (2002). "Firm Productivity and Export Markets: A Non-Parametric Approach", *Journal of International Economics*, Vol. 57, pp. 397-422.

Dixit A (1989a). "Entry and Exit Decisions under Uncertainty", *Journal of Political Economy*, June, Vol. 97, No. 3, pp. 620-638.

Dixit A (1989b). "Hysteresis, Import Penetration, and Exchange-Rate Pass-Through", *Quarterly Journal of Economics*, May, Vol. 104, No. 2, pp. 205-228.

Dunning J (1977). "Trade Location of Economic Activity and the MNE: A Search for an Eclectic Approach", in B Ohlin, P Hesselborn, and P Wijkman (eds.), *The International Allocation of Economic Activity*, London: Macmillan, pp. 395-418.

Dunning J (1993). *Multinational Enterprises and the Global Economy*, Wokingham: Addison-Wesley.

Edwards S (1993). "Openness, Trade Liberalisation and Growth in Developing Countries", *Journal of Economic Literature*, Vol. 31, pp. 1358-1393.

European Commission (1990). *One Market, One Money*, Brussels.

Feder G (1982). "On Exports and Economic Growth", *Journal of Development Economics*, Vol. 12, pp. 59-73.

Feinberg R (1992). "Hysteresis and Export Targeting", *International Journal of Industrial Organization*, Vol. 10, pp. 679-684.

Forfás (2000). *International Trade and Investment Report 2000*, January, Dublin: Government Publications.

Forfás (2002). *International Trade and Investment Report 2001*, January, Dublin: Government Publications.

Girma S and K Wakelin (2000). "Are There Regional Spillovers From FDI in the UK?", *GEP Research Paper 2000/16*, University of Nottingham.

Girma S and K Wakelin (2001). "Regional Underdevelopment: Is FDI the Solution? A Semiparametric Analysis", *CEPR Discussion Paper DP2995*.

Girma S, D Greenaway, and R Kneller (2002). "Does Exporting Lead To Better Performance? A Microeconomic Analysis of Matched Firms", *Leverhulme Centre Research Paper 2002/09*.

Glejser H, A Jacquemin, and J Petit (1980). "Exports in an Imperfect Competition Framework: An Analysis of 1446 Exporters", *Quarterly Journal of Economics*, Vol. 94, No. 3, pp. 507-524.

Görg H and D Greenaway (2001). "Foreign Direct Investment and Intra-Industry Spillovers", UNECE/*EBRD Expert Meeting on Financing for Development*, Geneva.

Görg H and D Greenaway (2002). "Much Ado About Nothing: Do Domestic Firms Really Benefit From Foreign Direct Investment?", *CEPR Discussion Paper 3485*.

Görg H and E Strobl (2001). "Multinational Companies and Productivity Spillovers: A Meta-analysis", *Economic Journal*, Vol. 111, pp. F723-F739.

Gray A (1997). *International Perspectives on the Irish Economy*, Dublin: Indecon.

Greenaway D and D Sapsford (1994a). "What Does Liberalisation Do For Exports and Growth?' *Weltwirtschaftliches Archiv*, Vol. 130, pp. 152-174.

Greenaway D and D Sapsford (1994b). "Exports, Growth and Liberalisation: An Evaluation", *Journal of Policy Modelling*, Vol. 16, No. 2, pp. 165-186.

Greenaway D, N Sousa, and K Wakelin (2000). "Multinationals and Export Spillovers", *Research Paper 2000/14*, Centre for Research on Globalisation and Labour Markets, University of Nottingham.

Greenaway D, N Sousa, and K Wakelin (2002). "Do Domestic Firms Learn to Export From Multinationals?", *Research Paper*, Centre for Research On Globalisation and Labour Markets, University of Nottingham.

Gujarati D (2003). *Basic Econometrics*, New York: McGraw-Hill Higher Education.

Head K and J Ries (1994). "Inter-city Competition for Foreign Investment: Static and Dynamic Effects of China's Incentive Areas", University of Colombia.

Heckman J (1979). "Sample Selection Bias as a Specification Error", *Econometrica*, Vol. 47, pp. 153-161.

Heckman J (1981a). "Heterogeneity and State Dependence", in S Rosen (ed.), *Studies in Labour Markets*, Chicago: University of Chicago Press.

Heckman J (1981b). "Statistical Models for Discrete Panel Data", in C Manski and D McFadden (eds.), *Structural Analysis of Discrete Data*, Cambridge, MA: MIT Press.

Heckman J (1981c). "The Incidental Parameters Problem and the Problem of Initial Conditions in Estimating a Discrete Time-Discrete Data Stochastic Process" in C Manski and D McFadden (eds.), *Structural Analysis of Discrete Data*, Cambridge, MA: MIT Press.

Helpman E (1984). "A Simple Theory of International Trade with Multinational Corporations", *Journal of Political Economy*, Vol. 92, No. 3, pp. 451-471.

Hirsch S and Z Adar (1974). "Firm Size and Export Performance", *World Development*, Vol. 2, No. 7, pp. 41-46.

Hirsch and Bijaoui (1985). "R&D Intensity and Export Performance: A Micro View", *Weltwirtschaftliches Archiv*, Vol. 121, pp. 138-251.

Hymer S (1976). *The International Operations of National Firms: A Study of Direct Foreign Investment*, Boston: MIT Press.

Irish Development Agency (2001). *Annual Report*, Dublin: Government Publications.

Jenkins R (1990). "Comparing Foreign Subsidiaries and Local Firms in LDCs: Theoretical Issues and Empirical Evidence", *Journal of Development Studies*, Vol. 26, No. 2, pp. 202-228.

Kokko A (1994). "Technology, Market Characteristics, and Spillovers", *Journal of Development Economics*, Vol. 43, pp. 279-293.

Kokko A (1996). "Productivity Spillovers from Competition between Local Firms and Foreign Affiliates", *Journal of International Development*, Vol. 8, No. 4, pp. 517-530.

Kokko A, M Zejan, and R Tansini (2001). "Trade Regimes and Spillover Effects of FDI: Evidence from Uruguay", *Weltwirtschaftliches Archiv*, Vol. 137, pp. 124-149.

Kraay A (1999). "Exports and Economic Performance: Evidence from a Panel of Chinese Enterprises", *World Bank Review of Economic Development*, pp. 183-207.

Krugman P (1989). *Exchange Rate Instability*, Cambridge, MA: MIT Press.

Krugman P (1992). *Geography and Trade*, Cambridge, MA: MIT Press.

Krugman P (1997). "Good News From Ireland: A Geographic Perspective", in A. Gray (ed.), *International Perspectives on the Irish Economy*, Dublin: Indecon.

Lall S and R Kumar (1981). "Firm-level Export Performance in an Inward-looking Economy: The Indian Engineering Industry", *World Development*, May.

Leddin A and B Walsh (1997). "Economic Stablisation, Recovery and Growth Ireland, 1979-1996", *Irish Banking Review*, Summer, pp. 2-18.

Maddala G (ed.) (1993). *The Econometrics of Panel Data*, Volumes I and II, Cheltenham: Edward Elgar.

Markusen J (1995). "The Boundaries of Multinational Enterprises and the Theory of International Trade", *Journal of Economic Perspectives*, Vol. 9, pp. 169-189.

McAleese D (1971). *Effective Tariffs and the Structure of Industrial Production in Ireland*, Dublin: Economic and Social Research Institute.

McAleese D (1998). "Economic Policy and Performance: The Irish Experience", *Journal of the Statistical and Social Inquiry Society of Ireland* 1997/98, Vol. XXVII, Part V, pp 3-18.

McCarthy J (1999). "Foreign Direct Investment: An Overview", *Central Bank of Ireland Bulletin*, Autumn, pp. 55-65.

Menzies G and G Heenan (1993). "Explaining the Recent Performance of Australia's Manufactured Exports", Reserve Bank of Australia, *Research Discussion Paper 9310.*

Murphy A (2000). "The Celtic Tiger – An Analysis of Ireland's Economic Growth Performance", *EUI Working Paper 2000/16*, Robert Schuman Centre for Advanced Studies.

OECD (2002). *Economic Outlook*, various issues, Paris.

O'Malley E (1989). *Industry and Economic Development: The Challenge for the Latecomer*, Dublin: Gill and Macmillan.

Richardson J and K Rindal (1995). "Why Exports Really Matter!", *The Institute for International Economics and the Manufacturing Institute*, Washington DC.

Roberts M and J Tybout (1997). "The Decision to Export in Columbia: An Empirical Model of Entry with Sunk Costs", *American Economic Review*, Vol. 87, No. 4, September.

Roper S and A Frenkel (2000). "Different Paths to Success? The Electronics Industry in Israel and Ireland", *Environment and Planning*, Vol. 18, pp. 651-665.

Roper S and J Love (2001). "The Determinants of Export Performance: Panel Data Evidence for Irish Manufacturing Plants", *Northern Ireland Economic Research Centre, Working Paper Series No. 69.*

Ruane F and H Görg (1996). "Aspects of Foreign Direct Investment in Irish Manufacturing Since 1973: Policy and Performance", *Journal of the Statistical and Social Inquiry Society of Ireland*, Vol. XXVII, Part IV.

Ruane F and H Görg (1997). "The Impact of Foreign Direct Investment on Sectoral Adjustment in the Irish Economy." *National Institute Economic Review*, No. 160, pp. 76-86.

Ruane F and H Görg (1999). "Irish FDI Policy and Investment from the EU", in R Barrell, and N Pain (eds), *Investment, Innovation and the Diffusion of Technology in Europe*, Cambridge; Cambridge University Press, pp 44-64.

Ruane F and J Sutherland (2001). "Globalization, Europeanization and Trade in the 1990s: Export Responses of Foreign and Indigenous Manufacturing Companies", in H Kierzkowski (ed.), *Europe and Globalization*, New York; Palgrave Macmillan.

Ruane F and A Uğur (2002). "Foreign Direct Investment and Productivity Spillovers in The Irish Manufacturing Industry: Evidence from Firm Level Panel Data", *Trinity Economic Papers*, 2002/6.

Rugman A (1986). "New Theories of the Multinational Enterprise: An Assessment of Internationalization Theory", *Bulletin of Economic Research*, Vol. 32, No. 2, pp. 101-118.

Sachs J (1997). "Ireland's Growth Strategy: Lessons for Economic Development", in Gray A (ed.), *International Perspectives on the Irish Economy*. Dublin: Indecon, pp. 54-63.

StataCorp (2001). *Stata Statistical Software: Release 7.0*, College Station: Stata Corp.

Stewart J (1976). "Foreign Direct Investment and the Emergence of a Dual Economy", *Economic and Social Review*, Vol. 7, No. 2, pp. 173-197.

Sweeney P (1998). *The Celtic Tiger – Ireland's Economic Miracle Explained*, Dublin: Oak Tree Press.

United Nations Conference on Trade and Development (2002). *World Investment Report 2002*, Geneva: UNCTAD.

Wakelin K (1998). "Innovation and Export Behaviour at the Firm Level", *Research Policy*, Vol. 26, pp. 829-841.

Wrynn J (1997). "Foreign Direct Investment to a Peripheral Country – The Case of Ireland", B Fynes and S Ennis (eds.), *Competing From the Periphery*, Dublin: Oaktree Press.