LEABHARLANN CHOLÁISTE NA TRÍONÓIDE, BAILE ÁTHA CLIATH | TRINITY COLLEGE LIBRARY DUBLIN
Ollscoil Átha Cliath | The University of Dublin

Terms and Conditions of Use of Digitised Theses from Trinity College Library Dublin

Copyright statement

All material supplied by Trinity College Library is protected by copyright (under the Copyright and Related Rights Act, 2000 as amended) and other relevant Intellectual Property Rights. By accessing and using a Digitised Thesis from Trinity College Library you acknowledge that all Intellectual Property Rights in any Works supplied are the sole and exclusive property of the copyright and/or other IPR holder. Specific copyright holders may not be explicitly identified. Use of materials from other sources within a thesis should not be construed as a claim over them.

A non-exclusive, non-transferable licence is hereby granted to those using or reproducing, in whole or in part, the material for valid purposes, providing the copyright owners are acknowledged using the normal conventions. Where specific permission to use material is required, this is identified and such permission must be sought from the copyright holder or agency cited.

Liability statement

By using a Digitised Thesis, I accept that Trinity College Dublin bears no legal responsibility for the accuracy, legality or comprehensiveness of materials contained within the thesis, and that Trinity College Dublin accepts no liability for indirect, consequential, or incidental, damages or losses arising from use of the thesis for whatever reason. Information located in a thesis may be subject to specific use constraints, details of which may not be explicitly described. It is the responsibility of potential and actual users to be aware of such constraints and to abide by them. By making use of material from a digitised thesis, you accept these copyright and disclaimer provisions. Where it is brought to the attention of Trinity College Library that there may be a breach of copyright or other restraint, it is the policy to withdraw or take down access to a thesis while the issue is being resolved.

Access Agreement

By using a Digitised Thesis from Trinity College Library you are bound by the following Terms & Conditions. Please read them carefully.

I have read and I understand the following statement: All material supplied via a Digitised Thesis from Trinity College Library is protected by copyright and other intellectual property rights, and duplication or sale of all or part of any of a thesis is not permitted, except that material may be duplicated by you for your research use or for educational purposes in electronic or print form providing the copyright owners are acknowledged using the normal conventions. You must obtain permission for any other use. Electronic or print copies may not be offered, whether for sale or otherwise to anyone. This copy has been supplied on the understanding that it is copyright material and that no quotation from the thesis may be published without proper acknowledgement.

Foreign Direct Investment:

Issues in Measurement and Analysis

Clare O'Mahony

School of Business, Trinity College, Dublin

Supervisor: Professor Frank Barry

2015

Submitted for the Degree of PhD

DEAN OF GRADUATE STUDIES
20 JAN 2016
TRINITY COLLEGE, DUBLIN

Ph.D.
School of Business

TRINITY LIBRARY
27 JUL 2016
DUBLIN

Thesis 11062

Declaration

I hereby certify that this thesis has not been submitted as an exercise for a degree at this or any other University. It is entirely my own work and has not been taken from the work of others save to the extent that such work has been cited and acknowledged within the text of my work. To the extent that Chapter Four includes material from a jointly published journal article, the work of others is acknowledged and the published paper is included as an Appendix. I agree that the library may lend or copy the thesis upon request.

Signed:

ID No.

Date:

Summary

This thesis consists of three empirical studies exploring issues in the measurement and analysis of Foreign Direct Investment (FDI). The 'classical form' of FDI is of greenfield, direct one-to-one investment from multinational parent to affiliate in manufacturing industry. The first study highlights the growing significance of financial services FDI, Special Purpose Entities (SPEs), and pass-through investment, and that the nature of FDI has evolved from its classical form to encompass other types of foreign investment. The other two studies explore two forms of FDI at two points along this evolutionary path. The second study focuses on classical FDI in Ireland prior to EU entry while the third study explores venture capital (VC) in Ireland, which is heavily internationalised and, as such, constitutes a 'newer' form of FDI. Ireland is centrally located in many of the changes that have taken place globally in the FDI landscape and, as a late industrialiser and a major recipient of FDI, its experience is of widespread interest to scholars and policymakers.

The thesis makes a number of key empirical contributions. First, it quantifies the extent of the incompatibilities in the balance-of-payments FDI data, finding that they can be very substantial. These data are used in the empirical literature on international capital flows and MNC activity, and also in measures of globalisation. Second, it provides a unique database for the pre-EU entry new grant-aided plants in Ireland. Third, it explores the characteristics and survival outcomes of these early new grant-aided establishments. Fourth, it documents the evolution of the VC environment in Ireland, in comparative perspective, by drawing together a comprehensive set of data. Lastly, it demonstrates the substantial internationalisation of VC in Ireland.

The first study (*Chapter Two: Pitfalls in the Use of FDI Statistics*) explores the balance-of-payments measurement of FDI, demonstrating and quantifying the incompatibilities in the data. Data and metadata are compiled for a group of six EU15 members which are relatively homogenous with long-established collection and reporting systems in place. The results show that countries use different interpretations of the international standards and changed their measurement of FDI over time, thus affecting international and intertemporal comparability. Disaggregated data are found to be less accurate than aggregate data, a result that is particularly relevant for the use of gravity models. Discrepancies are also demonstrated between the various series produced by different agencies. IMF and OECD data, and more recent Eurostat data, are found to be more accurate than UNCTAD data. Differential treatment of SPEs, and the differences in the relative importance of these for particular countries, is also shown to affect the comparability of the data. As the countries chosen in this study are a relatively

homogenous group, these pitfalls are compounded when pooling countries in different regions and with different economic and social structures, stages of development, and statistical systems.

The second study (*Chapter Three: 'New Grant-Aided Industry in Ireland prior to EU Entry: An Establishment-Level Analysis')* compiles a unique database of new grant-aided plants that established in Ireland over the period 1955-1972, before EU entry. It then explores the characteristics of these plants and analyses their survival outcomes. These plants are found to be mostly foreign-owned, larger, and more heavily concentrated in high-tech sectors when compared to the general population of plants at this time. The foreign-owned new grant-aided establishments mark the beginning of export-oriented FDI in Ireland, representing a classical form of FDI. Indigenous new grant-aided plants were predominantly in the food-processing and textiles sectors while foreign-owned new grant-aided plants were larger and were located in a more diverse range of sectors. The survival analysis uses a log-normal regression model, having found violations of the proportional hazards assumption that preclude the use of the popular Cox model, and the overall hazard function has an inverse-U shape. The results show relatively long survival times. Plants in the food, drink and tobacco, and high-tech sectors display better survival prospects. US-ownership is also associated with improved survival probability whereas rest-of-world and UK-owned establishments consistently show poorer outcomes. However, in common with other studies, size is the over-riding statistically significant explanatory variable in the survival analysis.

The final study (*Chapter Four: 'Exploring Financial Foreign Direct Investment: Growth and Internationalisation of Venture Capital in Ireland')* is of a 'newer' form of FDI, given the high degree of internationalisation of VC found in the Irish context. The study compiles a large amount of data to document the development of VC in Ireland from a comparative perspective and also examines the role of government policy. Ireland is found to stand out in two important respects: VC in Ireland constitutes a very large share of private equity over the period studied in this chapter, and is highly internationalised. The role of VC in the economy is an area relatively neglected by economists but of major policy concern as it is associated with the development of innovative start-ups. In Ireland VC is linked to the development of self-sustaining export-oriented indigenous industry. The involvement of government agencies in VC is aimed at the development of indigenous High Potential Start-Ups (HPSUs) but the study finds very substantial foreign involvement in VC-supported industry and that divestment is predominantly through trade sales. These results suggest that foreign ownership stakes are important for many of these firms and that the objective of building a self-sustaining export-oriented indigenous industrial sector is difficult to achieve.

Dedication

To the memory of my parents:

My father, who I lost during these studies taking the floor from under me for quite a while.

My mother, long departed, who returned to me from time to time during the final write-up. She would have written this far more elegantly.

Acknowledgements

Thank you to the large number of people who have supported me in all sorts of ways throughout this journey.

Firstly, I want to thank my supervisor Professor Frank Barry for his guidance, advice, encouragement, and support throughout. His calm in the final stages is also greatly appreciated.

Thank you also to the very large number of my colleagues and friends for all their help, advice, and morale-boosting. I greatly appreciate that they are so numerous it is not practical to mention them all individually although I wish to single out two for particular mention: Dr. Nicola Timoney for her encouragement and reassurance throughout; and Dr. Deirdre McFeely whose support and kindness have been singular - she told me in the early days that part-time doctoral students usually drop-out and continued to spur me on with similar shoves and reality checks!

I want to acknowledge the assistance that DIT has given me to complete these studies and also thank my students for their patience. I hope both will benefit from the fruits of my labour. The support of Professor Joseph Coughlan, especially in the final year, is gratefully acknowledged. Thanks are also due to the staff and fellow students in the School of Business, TCD.

Without the love, support, and endurance of my family, not to mention their culinary and cleaning skills, this thesis could never have been completed. This has been a long and difficult journey for us all, so a very special thanks to Harry, Fiona, Eva, Niall, Leo, and most especially Dave.

Table of Contents

Summary i
Acknowledgements v
Table of Contents vii
List of Tables xi
List of Figures xiii
List of Abbreviations xv

Chapter One: Introduction

1.1 INTRODUCTION 1

1.2 THEORETICAL PERSPECTIVES 4

1.3 FOREIGN DIRECT INVESTMENT AND THE IRISH ECONOMY 6

1.4 MOTIVATIONS FOR THE THREE STUDIES 8
1.4.1 Chapter Two: Pitfalls in the Use of Foreign Direct Investment Statistics 9
1.4.2 Chapter Three: New Grant-Aided Industry in Ireland Prior to EU Entry: An Establishment-Level Analysis 10
1.4.3 Chapter Four: Exploring Financial Foreign Direct Investment: Growth and Internationalisation of Venture Capital in Ireland 12

1.5 RESEARCH APPROACH 13

1.6 ROAD MAP 14

REFERENCES 15

Chapter Two: Pitfalls in the Use of Foreign Direct Investment Statistics

2.1 CONTEXT 19

2.2 LITERATURE REVIEW 20
2.2.1 Extant Pitfalls Literature 21
2.2.2 Empirical Literature using FDI Data 22
2.2.3 Summary and Discussion 25

2.3 DATA AND METHODOLOGY 26
2.3.1 Methodology 26
2.3.2 Data Sources 27

2.4 ANALYSIS AND RESULTS 31
2.4.1 Issues Treated Differently by Reporting Countries 31
2.4.1.1 Differences in Data Collection Methods 32
2.4.1.2 Differences in Ownership Criteria 33
2.4.1.3 Measurement and Treatment of the Three Components of Direct Investment 34
2.4.1.4 Measurement and Treatment of Indirect and Reverse Investments 37

2.4.1.5 Treatment of the Transactions of Special Purpose Entities 39
2.4.1.6 Differences in Geographical Allocations 42
2.4.1.7 Differences in Valuation of Stock Data 42
2.4.2 Discrepancies in the 'Mirror Data' 44
2.4.3 Discrepancies in the Country-Specific FDI Data Reported by Different International Organisations 53
2.4.3.1 Germany 53
2.4.3.2 France 59
2.4.3.3 United Kingdom 62
2.4.3.4 Netherlands 65
2.4.3.5 Belgium and Luxembourg 68
2.4.4 A Note on the Effects of Revision 71

2.5 CONCLUSIONS 73

REFERENCES 76

Chapter Three: New Grant-Aided Industry in Ireland Prior to EU Entry: An Establishment-Level Analysis

3.1 CONTEXT 83

3.2 LITERATURE REVIEW 87
3.2.1 New Grant-Aided Industry in Ireland before EU Entry 87
3.2.2 Factors Affecting Business Survival 93
3.2.3 Summary and Discussion 100

3.3 DATA AND METHODOLOGY 103
3.3.1 Data Sources 103
3.3.1.1 The 1955-1972 New Grant-Aided Plant Database 103
3.3.1.2 The Forfás Employment Survey 104
3.3.2 Methodology 105
3.3.2.1 Univariate Analysis 105
3.3.2.2 Multivariate Analysis 107

3.4 ANALYSIS AND RESULTS 110
3.4.1 Descriptive Statistics 110
3.4.2 Univariate Analysis 119
3.4.3 Multivariate Analysis 121

3.5 CONCLUSIONS 132

REFERENCES 137

Chapter Four: Exploring Financial Foreign Direct Investment: Growth and Internationalisation of Venture Capital in Ireland

4.1 CONTEXT 141
4.1.1 Definitions of Venture Capital and Private Equity 142
4.1.2 The Development of Venture Capital in the US 144

4.1.3 The Development of European Venture Capital 145
4.1.4 Research Questions 147

4.2 LITERATURE REVIEW 148
4.2.1 Aspects of Venture Capital Financing 148
4.2.2 Government Policy and Venture Capital 151
4.2.3 Internationalisation of Venture Capital 159
4.2.4 Summary and Discussion 162

4.3 DATA AND METHODOLOGY 163

4.4 ANALYSIS AND RESULTS 165
4.4.1 Comparison of Venture Capital Markets 166
4.4.2 Government Policy and Venture Capital in Ireland 180
4.4.3 Internationalisation of Venture Capital 187

4.5 CONCLUSIONS 193

REFERENCES 198

Chapter Five: Conclusions

5.1 CONCLUDING REMARKS 203

5.2 FUTURE RESEARCH DIRECTIONS 204

5.3 KEY CONTRIBUTIONS 206

REFERENCES 206

Appendix 2.1 A Note on the International Standards 209

Appendix 2.2 A Note on Special Purpose Entities and Pass-Through Investment 213

Appendix 2.3 Pitfalls in the Use of FDI Data to Proxy for MNC Activity Data 217

Appendix 3.1 New Grant-Aided Plants: Additional Graphs 221

Appendix 3.2 New Grant-Aided Manufacturing Establishments Database 229

Appendix 4 Reproduction of Publication 237

List of Tables

Chapter Two:

Table 2.1	SPE Transactions as percentage of FDI inflows into Luxembourg	41
Table 2.2	Correlation Matrix for Flows, 1985-2012	50
Table 2.3	Correlation Matrix for Stocks, 1989-2011	52
Table 2.4	Correlation Matrix for Stocks, 1989-1997	52
Table 2.5	Correlation Matrix for Stocks, 1998-2012	53
Table 2.6	Germany: Average Annual Inward Flows	57
Table 2.7	France: Average Annual Inward Flows	60
Table 2.8	Netherlands: Average Annual Inward Flows	67
Table 2.9	Correlation between Partner Country Inward Flows and Netherlands Outward Flows	67
Table 2.10	Correlation between Partner Country Outward Flows and Netherlands Inward Flows	68
Table 2.11	Effect of Revisions Example: UK Inward Flows	71
Table 2.12	Inward Stocks to the UK: Various World Investment Reports	72
Table 2.13	Largest Asymmetries in Mirror Flows, 1985-2012	74
Table 2.14	UK Discrepancies in Selected Series, 1986	75

Chapter Three:

Table 3.1	Comparison of Nationality of Ownership of Plants	111
Table 3.2	Sectoral Distribution of Grant-Aided Plants by Main Home Region	111
Table 3.3	Ranks of Three Most Populated Sectors by Main Home Region	112
Table 3.4	Detailed Breakdown by Home Region and Sector: New Grant-aided Plants	113
Table 3.5	Percentage of Plants by Broad Sector in 1972	113
Table 3.6	Size of Plants in 1972	113
Table 3.7	Size of New Grant-Aided Plants in 1972 by Nationality	114
Table 3.8	Grant Type as Percentage of Main Home Region	114
Table 3.9	Distribution of Grants by Ownership and Sector (1972)	114
Table 3.10	Grant-Type as Percentage of Ownership and Sector	115
Table 3.11	SFADCo Grant-aided Plants in 1972 by Nationality and Sector	115
Table 3.12	Plant Size as Percentage of Grant-type	116
Table 3.13	Broad Sector by Grant-Type	116
Table 3.14	Snap-shots of Characteristics of New Grant-Aided Plants	117
Table 3.15	Survival Rates of New Grant-Aided Plants	118
Table 3.16	Comparison of Survival Rates by Grant-Type	118
Table 3.17	Summary of Prob-Values for Main Explanatory Variables	121
Table 3.18	Model One for 415 New Grant-Aided Plants	122
Table 3.19	Model Two for 415 New Grant-Aided Plants	123
Table 3.20	Model Three for 331 New Grant-Aided Plants	124
Table 3.21	Results for Akaike Information Criterion (AIC)	125
Table 3.22	Model Four Log-Normal Regression for 331 New Grant-Aided Plants	126
Table 3.23	Model Five Log-Normal Regression for 331 New Grant-Aided Plants	127
Table 3.24	Investigating Sample Selection Bias Model One (Log-Normal)	127
Table 3.25	Model Six Log-Normal Regression for 331 New Grant-Aided Plants	129
Table 3.26	Model Seven Log-Normal Regression for 331 New Grant-Aided Plants	130
Table 3.27	Partial Correlations	130
Table 3.28	Model Eight Log-Normal Regression for 331 New Grant-Aided Plants	131
Table 3.29	Comparison of Models	132

Chapter Four:

Table 4.1	The US Venture Capital Market	166
Table 4.2	Venture Capital Funds Invested	167
Table 4.3	Private Equity Funds Raised and Invested	167
Table 4.4	Venture Capital Funds Raised and Invested	168
Table 4.5	Mode of Exit for Private Equity	172
Table 4.6	Mode of Exit for Venture Capital in Portfolio Firms	173
Table 4.7	Sources of PE New Funds Sources of VC New Funds	173
Table 4.8	Sectoral Distribution of PE Investments by Irish PE Houses	174
Table 4.9	Sectoral Distribution of VC Investments into Irish Industry	174
Table 4.10	VC Shares of PE Investment into Irish Industry	175
Table 4.11	Sectoral Distribution of PE Investments by European PE Houses	177
Table 4.12	Sectoral Distribution of VC Investments into European Industry	177
Table 4.13	Sectoral Distribution of VC Investments in the US	178
Table 4.14	Government as Source of PE New Funds: Europe and Ireland	180
Table 4.15	Sources of PE New Funds for European Economies	181
Table 4.16	Enterprise Ireland Investments: Direct versus Seed and Venture Capital	183
Table 4.17	Gross Domestic Expenditure on R&D in Ireland	184
Table 4.18	Percentage of Gross Domestic Expenditure on R&D Financed by Government	185
Table 4.19	Net PE Flows Raised and Invested	191

List of Figures

Chapter One:

Figure 1.1	FDI Flows, Global and by Group of Economies, 1980-2010	2

Chapter Two:

Figure 2.1	German Inward Flows: Effects of Adding Short-Term Loans and Trade Credits	36
Figure 2.2	France: Real Estate and Total Inward Flows, 1994-2012	37
Figure 2.3	Netherlands: Effects of SPEs on FDI Inward Flows, 1999-2012	42
Figure 2.4	France: Flows from the UK, 1985-2012	44
Figure 2.5	France: Flows from the UK, 1985-2011	45
Figure 2.6	UK: Flows from Germany, 1985-2012	46
Figure 2.7	UK: Flows from Germany, 1985-1997 and 1998-2012	46
Figure 2.8	UK: Average Annual Flows from Germany	47
Figure 2.9	Germany: Flows from the Netherlands, 1985-1997 and 1998-2012	48
Figure 2.10	Germany: Average Annual Flows from the Netherlands	48
Figure 2.11	Netherlands: Flows from Germany, 1985-2012	49
Figure 2.12	Netherlands: Flows from the UK, 1985-2012	49
Figure 2.13	Netherlands: Flows from France, 1985-2012	50
Figure 2.14	Netherlands: Stocks from the UK, 1985-2012	51
Figure 2.15	Luxembourg: Stocks from France, 1995-2011	52
Figure 2.16	Germany Inward Flows, 1985-2010	54
Figure 2.17	Germany Inward Flows, 1985-1997	54
Figure 2.18	Germany Inward Flows, 1998-2010	55
Figure 2.19	Germany Inward Flows: Comparison of IMF and Eurostat Data, 1985-1999	55
Figure 2.20	Germany Inward Flows 1985-2010: Comparison of IMF and Eurostat Data and Reinvested Earnings	56
Figure 2.21	Germany Inward Flows1985-1997, Comparison of OECD Series	57
Figure 2.22	Germany Inward Flows: Reinvested Earnings, 1981-2010	58
Figure 2.23	Germany Inward Flows: Reinvested Earnings, 1981-1999	58
Figure 2.24	Germany Inward Stocks, 1994-2010	59
Figure 2.25	France Inward Flows, 1985-2010	59
Figure 2.26	France Inward Flows, 1990-1994	60
Figure 2.27	France Inward Flows, 1995-2010	61
Figure 2.28	France Inward Stocks, 1994-2010	62
Figure 2.29	UK Inward Flows, 1983-2010	62
Figure 2.30	UK Inward Flows, 1983-1997	63
Figure 2.31	UK Inward Flows, 1998-2010	64
Figure 2.32	UK Inward Flows: 1993-2010: Comparison of the Difference between IMF and OECD Series and Real Estate	64
Figure 2.33	UK Average Annual Inward Flows, 1985-2010	65
Figure 2.34	Netherlands Inward Flows, 1985-2010	66
Figure 2.35	Netherlands Inward Flows: Impact of SPE Transactions	67
Figure 2.36	Belgium and Luxembourg Inward Flows, 1985-2001	68
Figure 2.37	Belgium and Luxembourg Inward Flows 1985-2001: Comparison of IMF and UNCTAD Series	69
Figure 2.38	Belgium Inward Flows, 2003-2010	70
Figure 2.39	Luxembourg Inward Flows, 2002-2012	71

Chapter Three:

Figure 3.1	Kaplan-Meier Survival Function for 415 New Grant-Aided Plants	119
Figure 3.2	Kaplan-Meier Survival Function for Ownership	119
Figure 3.3	Kaplan-Meier Survival Function for UK and US Ownership	120
Figure 3.4	Kaplan-Meier Survival Function for Broad Sectors	120
Figure 3.5	Estimated Hazard Function for the New Grant-Aided Plants	125

Chapter Four

Figure 4.1	Internationalisation of European Private Equity	147
Figure 4.2	Venture Capital Investments as a Share of all Private Equity Investments	169
Figure 4.3	Venture Capital Investments as a Share of all Private Equity Transactions by Irish PE Houses	169
Figure 4.4	Venture Capital and Buy-out Investments by Irish and European PE houses	170
Figure 4.5	Venture Capital Investments as Share of National Income	171
Figure 4.6	Early Stage (Seed and Start Up) Investments as Share of Total VC Investments	172
Figure 4.7	Comparison of Investment by Domestic PE houses and into Irish Industry	176
Figure 4.8	PE Investments in High-Tech Projects in Ireland	178
Figure 4.9	VC Investments in High-Tech Projects in Ireland and Europe	179
Figure 4.10	Early-Stage and High-Tech Private Equity Investments	179
Figure 4.11	Early-Stage and High-Tech VC Investments	180
Figure 4.12	Geographical Sources of Funds Raised by the European PE Industry	187
Figure 4.13	Geographical Sources of Funds Raised by the Irish PE Industry	188
Figure 4.14	Geographical Destination of Funds Invested by the European PE Industry	188
Figure 4.15	Geographical Destination of Funds Invested by the Irish PE Industry	189
Figure 4.16	Private Equity: Country of Management, Country of Origin and Country of Destination Comparison	190
Figure 4.17	Flows in PE Funds Raised and Invested in Ireland and Other European Countries	191
Figure 4.18	Net Inflow of PE as Share of Total PE Investment in Portfolio Firms, Ireland and Other European Countries	192
Figure 4.19	Share of Non-European VC Investments in VC Received by Portfolio Firms, Ireland and Other European Countries	193

Appendix 2.1

Figure A.2.1	France Inward flows 1999-2010: Comparison of BPM5 and BPM6 Presentations	210

List of Abbreviations

AFT	Accelerated Failure Time
AIC	Akaike Information Criterion
ARD	American Research and Development
BcL	Banque Centrale du Luxembourg
BEA	Bureau of Economic Analysis (United States)
BLEU	Belgo-Luxembourg Economic Union
BPM	Balance of Payments Manual (of the IMF)
BvD	Bureau van Dijk
CEECs	Central and Eastern European Countries
CFR	Constant Failure Rate
CIO	The Committee on Industrial Organisation
CRO	Company Registrations Office (Ireland)
CSO	Central Statistics Office (Ireland)
DFR	Decreasing Failure Rate
DI	Direct Investment
DIE	Direct Investment Enterprise
DNB	De Nederlandsche Bank (Dutch central bank)
ECB	European Central Bank
EFPI	Equity Foreign Portfolio Investment
EI	Enterprise Ireland
EU	European Union
EMU	European Monetary Union
ERISA	Employment Retirement Income Stabilisation Act (United States)
Eurostat	European Statistical Agency
EVCA	European Private Equity and Venture Capital Association
FCS	Fully Consolidated System (of Accounting)
FDI	Foreign Direct Investment
FES	Forfás Employment Survey
FFDI	Financial Foreign Direct Investment
FPI	Foreign Portfolio Investment
GDP	Gross Domestic Product
GNP	Gross National Product
HPSU	High-Potential Start-Up
IB	International Business
ICT	Information and Communications Technology
IDA	Industrial Development Authority
IFR	Increasing Failure Rate
IFSC	International Financial Services Centre
IIP	International Investment Position
IMF	International Monetary Fund
IO	Industrial Organisation
IPA	Industrial Promotion Agency
IPO	Initial Public Offering
ITRS	International Transaction Reporting System
IVCA	Irish Venture Capital Association
LBO	Leverage Buy-Out

M&A	Mergers and Acquisitions
MBI	Management Buy-In
MBO	Management Buy-Out
MES	Minimum Efficient Scale
MFI	Monetary and Financial Institution
MNC	Multinational Corporation
MNE	Multinational Enterprise
NACE	Nomenclature Générale des Activités Economiques dans les Communautés Européennes (Industrial Classification of Economic Activities in the European Communities)
NASDAQ	National Association of Securities Dealers Automated Quotations
NBB	National Bank of Belgium
NTBF	New Technology Based Firms
NVCA	National Venture Capital Association
OECD	Organisation for Economic Co-operation and Development
OFC	Off-shore Financial Centre
OLI	Ownership, Location, Internalisation
OLS	Ordinary Least Squares
ONS	Office of National Statistics (United Kingdom)
PE	Private Equity
PPE	Property, Plant and Equipment
R&D	Research and Development
RIE	Reinvested Earnings
SBIC	Small Business Investment Companies Program (United States)
SDR	Special Drawing Right (IMF)
SFADCo	Shannon Free Airport Development Company
SFI	Special Financial Institution (Netherlands)
SME	Small and Medium-Sized Enterprise
SPE	Special Purpose Entity
SPV	Special Purpose Vehicle
UN	United Nations
UNCTAD	United Nations Conference for Trade and Development
UNECE	United Nations Economic Commission for Europe
VC	Venture Capital
WFG	Deutsche Gesellschaft für Wagniskapital (Germany)

Chapter One

Introduction

"..evidence supports the idea that FDI flows among developed countries have evolved in a way that does not fully reflect activities in the real economy"[1]

UNCTAD (2013:71) *World Investment Report 2013*

1.1 INTRODUCTION

This thesis has a three-paper format consisting of three empirical studies that explore issues in the measurement and analysis of Foreign Direct Investment (FDI). The first study (*Chapter Two: Pitfalls in the Use of FDI Statistics*) explores the balance-of-payments measurement of FDI, demonstrating and quantifying the incompatibilities in the data. The results from this study highlight the growing significance of financial services FDI, Special Purpose Entities (SPEs), and pass-through investment.[2] It is evident that the nature of FDI has evolved from its classical form of greenfield, direct one-to-one investment from multinational parent to affiliate, in manufacturing, to encompass other types of foreign investment. The other two studies explore two forms of FDI at two points along this evolutionary path. Literature reviews are contained within the empirical chapters.

FDI is defined as a long-term investment involving a management interest in an enterprise located abroad.[3] The commonly held view of FDI is of foreign investment by large Multinational Corporations (MNCs) in subsidiaries located abroad, leading to an increase in productive activity in the host economy. However, these are two different, albeit overlapping, concepts. The international standards essentially define FDI as any investment where there is a 10 per cent ownership stake together with a management interest and this opens up the door for FDI to be far wider than the common perception. For example, FDI incorporates investment through SPEs which may have little or no relationship to productive economic activity. On the other hand, not all MNC investment in productive activity abroad is measured by FDI because finance is often raised locally. Furthermore, not all FDI is

[1] UNCTAD (2013) does not define the 'real economy' but the term is widely used to refer to 'real' economic variables directly related to productive activity (see also DNB, 2003; ECB, 2007; Popov and Roosenboom, 2009; Claessens et al, 2012; Lawless et al, 2012; Buch et al, 2014). DNB (2003:7) suggests that transactions related to the real economy include "goods imports and exports, international trade in services and cross-border generated income". More generally, the term 'real economy' is used to refer to employment, output of goods and services, sales, exports, and productivity. Due to its widespread use the term 'real' is used in this context elsewhere in this thesis.

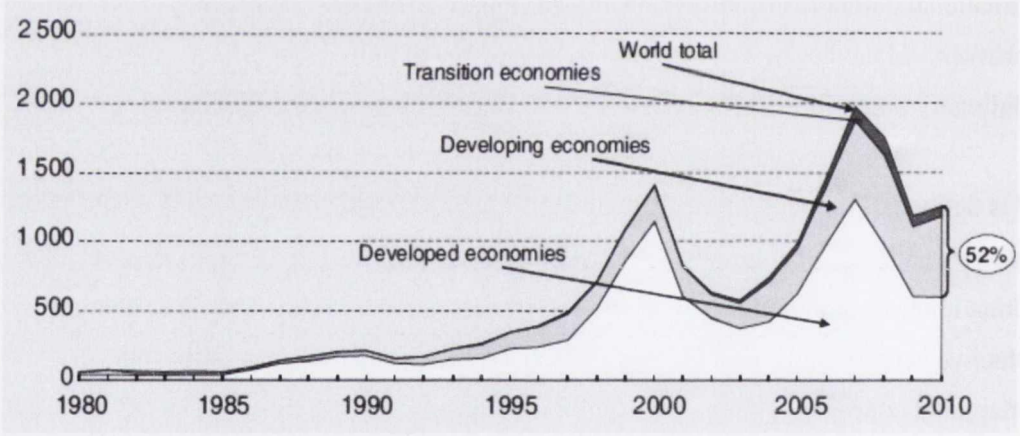
[2] There is no one unique commonly accepted definition of Special Purpose Entities but they have been defined as majority foreign-owned entities, organised or established in economies abroad, which are engaged primarily in international transactions with little or no contribution to employment or production in the host economy (DNB, 2008; Eurostat, 2009; OECD, 2012).

[3] Formerly, control was a requirement to qualify as FDI.

undertaken by MNCs. Many real estate investments, often made by wealthy individuals, and many international venture capital (VC) investments also qualify as FDI.

There has been a large increase in both FDI and MNC activity over recent decades.[4] The global FDI stock grew by some 200 per cent between 1987 and 1997, and further increased by more than 300 per cent over the following decade. Between 1990 and 2005 the number of MNCs across the globe doubled to 70,000, the number of MNC affiliates grew more than fourfold, and the number of countries in which the average MNC operated increased from four to ten (UNCTAD, 2006). From a peak in 2007, FDI fell as a result of the financial crisis but global FDI inward stocks in 2012 were still more than ten times higher than in 1990.[5] Figure 1.1 shows the growth in FDI experienced by developed, transition, and developing economies over 1980-2010 and the sharp surge that occurred in the late-1990s. Although dips occurred after 2000 (due to the collapse of the dot-com bubble) and after 2007 (due to the global financial crisis), the level of FDI remained much higher than in the 1980s and early 1990s.

Figure 1.1
FDI Flows, Global and by Group of Economies 1980-2010



Source: World Investment Report 2011, UNCTAD
Note: Vertical axis is in US $ billion

These dramatic increases have been attributed to a number of factors including increased international integration, market liberalisation, taxation changes, increased mergers and acquisitions (M&A) activity, developments in information and communications technology (ICT), and the growing importance of R&D-intensive and advertising-intensive sectors. Partially as a consequence, the structure of MNCs has changed with hierarchical structures being replaced by global networks and chains of ownership involving the use of holding

[4] MNC activity covers employment, sales, value-added, or property, plant and equipment (PPE) of MNCs in overseas operations.
[5] Author's own calculations based on data from UNCTAD (2013) *World Investment Report: Global Value Chains: Investment and Trade for Development* New York; Geneva

companies and Special Purpose Entities (SPEs) often as conduit entities for pass-through investment.[6] Originally, critical and higher-order activities were centralised in the company's headquarters which remained located in the home country. Offshoring in the 1990s led to headquarters often being located abroad and the development of global chains of ownership and fragmentation of economic activity in line with comparative advantages (Desai, 2009). This fragmentation developed further with the increased use of outsourcing of activity to firms outside the corporate chain, retaining only the most critical activities within the firm itself, and with the establishment of regional headquarters (Desai, 2009). Corporate headquarters also have become increasingly international mobile, often driven by tax considerations, leading to 'corporate inversion'.[7] These changes have impacted the relationship between FDI and the level of MNC activity causing increased decoupling between the two, as referenced in the opening quote from the 2013 *World Investment Report*. It also affects the measurement of FDI itself and its geographical and sectoral locations, as discussed in the first paper in Chapter Two. Related developments are the internationalisation of VC, which has been referred to as a new form of 'financial FDI' (FFDI) as these investments bear many similarities to the classical form of FDI, and the increase in services sector FDI (Agmon, 2006; Agmon and Messica, 2009). Although the classical form of FDI, common in the theoretical literature, still exists, the nature of Foreign Direct Investment (FDI) has therefore evolved over time.

Furthermore, flows of FDI have become more complex in recent decades. Capital flows not just from parent to affiliate, as is the commonly held view, but back from the affiliate to the parent (reverse investment) and also between fellow affiliates (indirect investment). Some of these capital flows are for corporate convenience or tax planning purposes which are not directly related to real economic activity such as employment and output. For example, how these variables are affected by capital movements related to M&A activity is uncertain. Sometimes an acquisition leads to a fall, rather than a rise, in employment and output when operations are closed-down or otherwise downsized. Although M&A activity often appears in the balance-of-payments, it can involve corporate restructuring rather than additional investment (Graham and Krugman, 1993).

The next section contains an outline of the theoretical perspectives on FDI while Section 1.3 looks at FDI in the Irish economy. A detailed discussion of the motivations and connections

[6] A conduit entity is defined as "an enterprise that obtains or borrows funds, often from unaffiliated enterprises, and remits those funds to its direct investor or another affiliated enterprise" (OECD, 2008:101).
[7] Corporate inversion refers to the relocation of corporate headquarters abroad, usually in a low tax location, with the original parent becoming a legal subsidiary. A US MNC, for example, may have its corporate headquarters in Bermuda or Ireland (for further discussion see Desai, 2009). Corporate inversion is largely a tax avoidance phenomenon.

between the three empirical chapters then follows. Section 1.4 briefly discusses the research approach underpinning the thesis, and this is followed by a road map to the thesis.

1.2 THEORETICAL PERSPECTIVES

There is no one theoretical perspective on FDI and MNC activity. The international business (IB) approach focuses on the role of the MNC and its motivations for choosing FDI (as opposed to exporting its goods and services or engaging in licensing and franchising arrangements) rather than on FDI capital movements.[8] Economists have emphasised capital flows to a greater extent. Two economic approaches can be distinguished: A microeconomic trade theory approach and a macroeconomic approach. Markusen (2008) traces a split between these approaches in the 1980s when the microeconomic approach began to distinguish between direct and portfolio investment, and give a more central role to the firm itself, viewing FDI as not about capital flows *per se* but about the role of MNC investment in the real economy and its impact on output, employment, and exports. This approach has therefore moved closer to the IB approach. Macroeconomists, on the other hand, continue to focus on capital flows. Markusen (2008) notes that despite the increased recognition of the need to look at the firm-level, one problem that remains is the widespread use of the FDI data to proxy for MNC investment as the FDI data are measuring capital flows rather than MNC investments *per se*. As expounded by Graham and Krugman in 1993:

> 'Ideally.... the analyst should measure the growth of multinational enterprise by looking directly at the share of each economy controlled by foreign firms rather than by looking at capital movements' Graham and Krugman (1993:15)

The microeconomic approach therefore brings the firm centre stage and suggests that the first theory that should be looked at when studying FDI is the theory of the firm. Such theory has its roots in the work of Coase (1937) on the nature of the firm, and of Williamson (1985) on transaction costs.

It is therefore possible to distinguish two broad strands in the theory of FDI and MNC activity in the economy, arising from the IB and microeconomic perspectives: The 'Ownership, Location, Internalisation' (OLI), or eclectic, paradigm largely attributed to John Dunning, and the 'Knowledge Capital Model' mostly associated with Markusen (1995, 1998).

---

[8]See Wilkins (1999) for some discussion of the evolution of this, and the perception of financial versus 'real' investment. The term 'real investment' is defined by Stephan and Pfaffmann (2001:195) as "any increase of the asset base of the affiliate ... because it increases the value of assets engaged in international production." It is used here to refer to investment that impacts 'real' economic variables as defined earlier.

The OLI paradigm is the dominant theoretical framework found in the IB literature. It has its antecedents in a number of disciplines including neoclassical international trade theory, location theory, and industrial organisation (IO) theory. The theory suggests that firms engage in FDI as opposed to the alternative strategies of exporting or licensing if they have (i) market power due to the ownership of products or production processes (O) i.e. ownership-specific advantages; (ii) an advantage in locating their plant in a foreign country rather than at home (L); and (iii) an advantage from internalising their foreign activities within the boundaries of the firm (I).

Taking the microeconomic perspective, Markusen (1995, 1998) developed a 'Knowledge Capital Model' of the MNC. Such knowledge capital is more important for MNCs than for other firms, and its existence helps explain why most FDI occurs between high-income, developed economies. This model emphasises economies of scale at the firm level and the role of intangible assets leading firms to engage in FDI rather than licensing. According to Markusen (1995) an MNC will engage in FDI if at least one of the following conditions holds: firm-specific activities or intangible assets are important; plant-level economies of scale are not important; there are barriers to trade through tariffs or other trade costs but low barriers to FDI.

More recent literature has focused on the development of networks and chains of ownership. Restructuring has involved greater managerial independence of affiliates and a change in the role of headquarters (Nachum, 2000). Greater local autonomy increases local linkages and technology transfer (Nachum, 2000) but the use of holding companies and other SPEs has increased pass-through, or 'transit', investment and the 'round-tripping' of investment. In their study on German FDI, Mintz and Weichenreider (2010) argue that the parallel increase in inward and outward FDI for some small host countries can be attributed to the increased use of conduit entities. Their use will overstate the amount of 'real' investment in economies and distort the geographical and sectoral sources and destinations of FDI. 'Immediate' sources and destinations of investments, rather than the 'ultimate' sources and destinations, are generally recorded in the FDI statistics. Funds may come from a number of countries and companies into an SPE and out again. As UNECE (2011:45) point out: "an MNE may create many SPEs in different countries and channel funds through a succession of them to a non-SPE counterpart". The use of intangible assets enables firms shift the 'nominal location' or reported location of production without moving real inputs such as labour (Lipsey, 2010). Furthermore, the more extensive use of intangible assets in the services sector, compared to in manufacturing, makes it more difficult to define or observe

the location of services production. The reported location of profits, sales, and financial and intangible assets can be shifted by intra-firm paper transactions to reduce tax liability.

A distinction is often made between 'horizontal' and 'vertical' FDI. Horizontal FDI occurs where similar activities take place in different locations and relies on the availability of a large market that is difficult to service by other modes such as exporting or licensing. The existence of tariffs and/or high transport costs makes exporting expensive while firms with proprietary technology may be unwilling to licence local producers. Vertical FDI involves the establishment of a stage of production abroad. It is 'resource-seeking', the motivation often being the control of some crucial input, lower production costs, or other location-specific advantages. Vertical FDI involves substantial intra-firm trade. Desai (2009) traces the evolution of MNC engagement in FDI from the horizontal FDI of the 1950s and 1960s, to the increase in vertical FDI, through to the rise in the use of offshoring in the 1990s, and of outsourcing in the 2000s.

Stefan and Pfaffmann (2001) develop a typology of FDI based on the 'mode of entry' (greenfield or acquisition), pointing out that although the theoretical literature has often assumed greenfield entry, empirically the main mode of entry globally is through M&A. The degree of ownership is the other criterion used. Greenfield investments are found to be either 100 per cent owned or joint ventures. Acquisitions are less than wholly owned if the investor buys only a stake in the affiliate or if it engages in a joint venture. MNC activity is not the same as FDI, as Stephan and Pfaffmann (2001:195) succinctly put it: "FDI flows are just one source of funds which finance real investment activities of the affiliate" and "not all FDI flows are used for real investment activities."

1.3 FOREIGN DIRECT INVESTMENT AND THE IRISH ECONOMY

Ireland is centrally situated in the evolving global FDI landscape. The Irish economy is highly FDI-intensive with substantial foreign MNC activity. It has also experienced increases in financial services FDI and in the use of SPEs for conduit investment, as well as growth in cross-border VC. The establishment of regional headquarters resulting from fragmentation and the unbundling of MNC headquarter activity has seen Ireland become the predominant home of many foreign MNC regional headquarters for the Europe, Middle East, and Africa (EMEA) region.[9] Desai (2009:1283) attributes Ireland's success at attracting regional headquarters to its "low tax rates, an accommodating regulatory regime, proximity to major markets, and strong institutions." More recently, Ireland has become the

[9] For further discussion see Desai (2009).

legal home of a number of redomiciled PLCs through corporate inversion.[10] In contrast to many other European countries however, the level of M&A FDI in Ireland is relatively low.

The over-riding concern of Irish industrial policy since Independence has been job creation. At Independence, the Irish economy was underdeveloped and, due to the problems associated with late industrialisation, the market failed to create the requisite number of jobs and emigration was high. Although the import-substitution policy of the 1930s and 1940s resulted in growth in manufacturing employment, large scale emigration continued. Furthermore, the 1950s brought a balance-of-payments crisis, described by O'Malley (1989) as inevitable due to increased import demand (resulting from economic growth) outstripping export demand. The move to outward-looking policies after 1948 was partially informed by the acceptance that protectionism could not provide the required level of growth and employment. State policy supported industry in a number of ways, the most important being the provision of grants and tax concessions. Although these supports were not exclusively available to foreign-owned firms, in practice new grant-aided industry was mostly foreign-owned.[11] Breznitz (2012) argues that foreign-owned MNCs were expected to provide jobs more quickly than was possible through the longer-term development of indigenous industry and these jobs were immediately measureable and achievable. Ultimately more employment, prosperity, and lower levels of emigration resulted.

Although the role of foreign investment in the Irish economy is usually traced back to the 1950s, foreign involvement in Irish industry goes back much further. There was fairly substantial participation in industry by mainly British firms in the protectionist era, for example. Such firms were 'tariff-jumpers' producing output aimed at the local domestic market. Because of restrictions on foreign ownership at the time it is likely that the true levels of participation were higher than revealed. According to Desai (2009) horizontal FDI involves firms engaging in 'self-replication', maintaining critical activities at home, similar to most of the earlier foreign-owned industry in Ireland. O'Malley (1989) sees the foreign tariff-jumpers of the protectionist era as an early example of 'local market-oriented' or horizontal FDI whereas Northcott (1972:187) describes the earlier new grant-aided foreign-owned manufacturing plants in Ireland that established in the period before EU entry, the focus of the second paper in Chapter Three, as offering jobs which lacked the sufficient "range and variety likely to be needed to remove all *desire* for emigration".[12] Later the

[10] Redomiciled PLCs is the technical term given to MNCs that "have relocated their headquarters to Ireland without generating any real activity in the economy in terms of employment or purchases of domestic inputs" (Fitzgerald, 2013:1).
[11] In Chapter Three it is shown that in 1972, 76.7 per cent of the new grant-aided plants that had established in the years 1955-1972 were foreign-owned compared with just 13.2 per cent of all manufacturing industry (of those plants in the Forfás Employment Survey).
[12] Later firms were attracted by access to the UK and Commonwealth markets and, on EU entry, by access to the EU market.

industrial agencies began to target more capital-intensive industries and higher-order functions.

Breznitz (2012:91) argues that "Ireland saw foreign capital as market-enhancing and local capital as an untrustworthy rent-seeking market-distorting force." Whether because of indigenous firms being considered rent-seekers, or a tunnel-vision on the part of state agencies, it has been argued that there has been a neglect of indigenous industry in Ireland leading to a dualistic industrial structure. However, the development of indigenous industry and concern over the degree of foreign ownership has been a consistent theme in Ireland for a number of decades. The growth and development of an indigenous software industry in the 1990s, together with criticism in both the *Telesis Report* of 1981and *Culliton Report* in 1992 highlighting the importance of a strong self-sustaining indigenous industry, spurred an involvement by the state in the VC sector, discussed in the third paper in Chapter Four.[13]

1.4 MOTIVATIONS FOR THE THREE STUDIES

Chapter Two explores the measurement of FDI and the incompatibilities in the data are discussed and quantified. It is evident from this research that FDI has evolved from its classical form of greenfield, manufacturing, direct investment, to encompass other types of foreign investment. The other empirical chapters study two different forms of FDI from two different eras in Ireland. The preeminent role of FDI in the Irish economy, together with Ireland's status as a late industrialiser, and its central position in many of the changes that have occurred globally on the FDI landscape, ensures that the Irish experience with FDI is of wider interest to scholars and policy-makers.[14]

The eras chosen are neither at the beginning nor the end of the story of FDI in an Irish context but are points in time along an evolutionary path in the nature of FDI and in the country's economic development. Although there was earlier foreign ownership of industry, the dominance of FDI in the Irish economy is usually traced back to the tentative beginnings of outward-looking policy in the 1950s. Chapter Three studies the new grant-aided industry that established in Ireland over the years 1955-1972. As this industry was mostly foreign-owned, this is largely a study of a classical form of FDI: Greenfield manufacturing investment directly from parent to subsidiary. Chapter Four documents the development of the VC market in Ireland in comparison with Europe and the US. To the large extent that

[13] The *Telesis Report* was published in summary form by the National Economic and Social Council (NESC) in *A Review of Industrial Policy*. The *Culliton Report* is the popular name given to the Report of the Industrial Policy Review Group (1992) *A Time for Change: Industrial Policy for the 1990s*.

[14] Ireland is not included in Chapter Two because a similar analysis on Ireland already exists in Barry and O'Mahony (2005).

VC is internationalised in the Irish context, chiefly beginning in the 1990s, this is a study of a 'newer' form of FDI. VC is associated with innovative start-ups which are seen as integral to global business networks. The greater decentralisation of MNCs is evident in the results in Chapter Two also where the measurement of FDI is impacted by increases in reverse and indirect investment, and in the use of SPEs. All three studies therefore explore issues of measurement and analysis that arise from the evolving nature of FDI. The motivations for each chapter are discussed in more detail in the following sub-sections.

1.4.1 Chapter Two: Pitfalls in the Use of FDI Statistics

Chapter Two explores the measurement of the balance-of-payments FDI data published by international and national agencies for a group of EU15 countries, examining and quantifying the extent of incompatibilities in the data across time and across countries. These data are widely used in the empirical literature on FDI and MNC activity, as well as in measures of globalisation. Incompatibilities in the data are generated by the use of different methodologies and differing interpretations of the international recommendations.

The genesis of this study is an earlier paper co-authored with Professor Frank Barry on the Irish FDI balance-of-payments data, which was presented to the Statistical and Social Inquiry Society of Ireland on 17th November 2004 and published as: Barry, F and C. O'Mahony (2005) 'Making Sense of the Data on Irish Inward FDI' *Journal of the Statistical and Social Inquiry Society of Ireland* Vol. XXXIV, 28-57. This paper investigated the differences in the national and international FDI balance-of-payments series on Ireland, many of which bore little relationship to each other. This involved an analysis of the items included in, and excluded from, the various databases in a search for any underlying consistency between them. The results found that the various series used different sources and included different components of FDI at different times. Some of these issues were related to the measurement of financial intermediation. For example, financial intermediation flows were excluded from most series until 1998 when the Irish Central Statistics Office (CSO) began to survey them. Eurostat, on the other hand, had used its own independent estimates for these flows and this appeared to explain the much higher FDI flow figures found in the Eurostat series. The overall lack of comparability suggested that *caveat emptor* applied to the use of these series in empirical research. These results led to the question of whether similar issues arise in the FDI data series for other countries. Accordingly, Chapter Two studies the data for six EU15 countries: The UK, France, Germany, Belgium, Luxembourg, and the Netherlands. This is a relatively homogenous group of countries with long-established collection and reporting systems in place which

minimises noise arising from methodological variation. Incompatibilities found between these countries are expected to be magnified in studies where the countries studied are more dissimilar in economic development and structure, as well as in statistical convention.

This chapter examines the FDI balance-of-payments data in detail for the selected countries, and asks:

- What do these data measure?
- How comparable are these data both intertemporally and internationally?

Chapter Two's key contribution to the literature is in quantifying the size of these discrepancies in the data, which can be very substantial.

Furthermore, this research highlights the growing significance of financial services FDI, Special Purpose Entities (SPEs), and pass-through investment. In particular it is demonstrated that the treatment of SPE transactions varies across countries, over time, and by different agencies.[15] SPEs are becoming more numerous in certain countries, and the levels of pass-through investment have been rising. This has a number of implications for the use of the FDI data. First, when the FDI data are used to proxy for MNC activity in the host economy, they now overstate the size of this activity to a greater extent than in the past. Second, as SPEs are more numerous in some countries than in others, the gulf between MNC investment and the FDI data is also wider for some economies than for others. Third, the differential treatment of SPE transactions across countries, as demonstrated in Chapter Two, means that international comparisons do not compare like with like. The changing nature of FDI is therefore evident from the research in Chapter Two.

1.4.2 Chapter Three: New Grant-Aided Industry in Ireland Prior to EU Entry: An Establishment-Level Analysis

Chapter Three focuses on new grant-aided manufacturing plants that established in Ireland during 1955-1972, prior to EU entry.[16] This period marks the beginning of Ireland's experience with outward-looking FDI and the high degree of FDI-intensity which was to continue in subsequent decades and, as such, is a very significant period in the evolution of FDI in an Irish context. This era is largely neglected in the literature, especially when compared with the post-EU entry era. The research for this chapter necessitated the compilation of a specially hand-collected database. This database is detailed in Appendix

[15] Ouddeken (2005) has commented that this form of FDI is now so common that FDI has become 'Foreign Indirect Investment.'

[16] Grants were first introduced in 1952 for industry establishing in areas designated as underdeveloped and were extended country-wide in 1956. Efforts to attract FDI were gradual over this time however. One of the first significant IDA successes was the opening of a factory at Fermoy, County Cork, by German pencil manufacturer Faber-Castell in 1955. 1955 was consequently chosen as the first year of this study. The same year is the starting point for O'Hearn (1987).

3.2. There was a new emphasis in this era on 'export-led growth' and an expectation that new plants would not compete with established industry on the domestic market. Most of these plants were foreign-owned and as such are examples of 'traditional' or 'classical' FDI: Greenfield, direct from parent to subsidiary, occurring in manufacturing industry.[17] The characteristics of these plants are first explored and briefly compared with the general population of plants in 1972 in order to obtain a picture of how they fit in the general industrial landscape at the time.[18] A survival analysis for the new grant-aided industry is then undertaken.

The research questions in this chapter are:

- What are the characteristics of the new grant-aided plants that established in Ireland prior to EU entry?
- What factors affect the survival performance of these new grant-aided plants?

The key contributions of Chapter Three are, firstly, the provision a new database on early new grant-aided industry in Ireland prior to EU entry, facilitating further research on this important but relatively neglected period and, secondly, the examination of the characteristics and survival performance of these plants. In addition there are a number of other novelties which fill other gaps in the literature. One of these is the identification of the role of industrial sector on survival, absent from previous survival studies on Irish plants. Another novelty is the disaggregation of foreign ownership by home region whereas most Irish survival studies lump all foreign-ownership together. The final novelty is the exclusion of incumbents which provides a clearer picture of the characteristics of the new grant-aided industry that established in Ireland at the time. This is in contrast to extant studies that include incumbents and therefore provide a much hazier picture of the survival outcomes of manufacturing plants in Ireland as they include many plants that established during, and before, the protectionist era, which are expected to have poorer outcomes with the advent of trade liberalisation.

[17] This study is limited to manufacturing plants and most grants were only available to manufacturing. SFADCo (Shannon Free Airport Development Company) grants were available to services companies but these were very few and are not included in this study.

[18] This general population of plants are those contained in the *Forfás Employment Survey* and are therefore 'clients' of Forfás rather than the full population of plants as such. Estimates of coverage of the full population of plants in this survey, however, are very high, ranging from 80-99 per cent. Further discussion of this database is contained in Chapter Three.

1.4.3 Chapter Four: Exploring Financial Foreign Direct Investment: Growth and Internationalisation of Venture Capital in Ireland

Chapter Four explores one 'new' form of FDI: The internationalisation of VC, seen by many as 'financial FDI' (FFDI).[19] The term 'financial' here is used to refer to the financial intermediation role of VC funds. There has been an increase in the flow of VC investment from developed countries to small and emerging markets (see for example, Agmon and Messica, 2009) and Ireland, as is shown in Chapter Four, is a substantial net recipient of such investment flows from overseas.

VC in the Irish context has both similarities and contrasts to the classical form of FDI explored in Chapter Three. Both forms of investment receive public sector assistance to support mainly export-oriented industry. However, the support for VC, despite the degree of foreign involvement, is viewed as support for indigenous industry. Also, there are obvious sectoral differences with the grant-aided industry in Chapter Three concentrated in certain manufacturing sectors and VC in Ireland heavily concentrated in software. The employment created also differs, with higher skill levels amongst employees in VC-supported firms, for whom human capital is an important asset. VC-backed firms also have more intangible assets as VC is concentrated in innovative high-tech projects. Some of these differences reflect wider changes in industrial structure and technology, and the increased internationalisation of production and investment. The contrast in the two forms of FDI demonstrates not just the evolving nature of FDI itself over time, but also changes in the nature of international business, in comparative advantage, in the emphasis of state industrial policy, and in the extent of Ireland's economic development.

Similarities between the two forms of FDI include the syndication of overseas VC deals which has been likened to MNC parents engaging in joint ventures, and the involvement by venture capitalists in the management of the firm in a similar way to a parent's involvement with a subsidiary. Common drivers include the distance between home and host countries, and language and cultural ties - political and policy stability being particularly important to both forms of FDI. The development of indigenous industry via VC can be considered as both a substitute and a complement to classical FDI. In Ireland the relationship is mostly complementary. As VC involves deal-making and the syndication of funds, networks and cultural ties are very important and classical FDI has had a role in developing these links.

[19] See for example, Baygan and Freudenberg (2000), Agmon (2006), Aizenman and Kendall (2008), and UNCTAD (2012). The latter refers to this investment as 'FDI by private equity firms'. Different motivations, exit strategies and shorter time horizons differentiate it from the 'classical' FDI undertaken by MNCs. However, VC investors are involved in the management of the investee and have longer time horizons than Foreign Portfolio Investment (FPI). The 10 per cent equity participation should also be met to qualify as FDI.

As Lerner (2009) says in the preface to his book, *Boulevard of Broken Dreams*, economists have only recently begun to research this area. Parts of this chapter were published as: Barry, F., C. O'Mahony and B. Sax (2012) 'Venture Capital in Ireland in Comparative Perspective' *Irish Journal of Management, 32* which is reproduced as Appendix 4 to this thesis.[20] The documentation of the development of Irish VC in an international context, together with the extensive data presented both in the published paper and in Chapter Four, contributes to the Irish empirical research in this area.

The research questions in this chapter are:

- How does the development of the VC environment in Ireland compare with the US and elsewhere in Europe?
- What is the nature of state intervention in the Irish VC market?
- What is the degree of internationalisation of VC in Ireland in comparison to other countries?

The key contributions of Chapter Four are in documenting the evolution of the VC environment in Ireland in comparative prospective by drawing together this comprehensive set of data, as well as in pointing to its substantial internationalisation.

1.5 RESEARCH APPROACH

As is common within economic research, the research approach in this thesis can be described as positivist or, more accurately, post-positivist. Positivism is based on the belief that the social world can be studied in the same way as the natural world, and asserts that there is one reality that can be known with certainty. It is assumed that it is possible to observe social life and to establish reliable, valid knowledge about how it functions. Introspective and intuitive knowledge are rejected. It contends that, much as the physical world operates according to gravity and other absolute laws, so too does society. Many methods used in economics, such as the concept of equilibrium, can be traced to the natural sciences. The survival analysis in Chapter Three is a good example also, as it is widely used in the biological and medical sciences.

The emphasis is on objectivity and rationality. Positivist research methods are quantitative and value-free, seeking causal relationships between variables which are found to be generally applicable 'laws' as in the natural sciences. As Keynes has said, it deals with

[20] This publication was a collaborative process. This author's main contribution was to completely update earlier data through their collection, analysis, and presentation. The final drafting of the paper was undertaken by this author in collaboration with Professor Frank Barry. This author had a further role as corresponding author.

'what is' not 'what ought to be' (as cited by Friedman, 1953). The task of positive economics is according to Friedman (1953:4) "to provide a system of generalizations that can be used to make correct predictions about the consequences of any change in circumstances." However, despite the emphasis on objectivity, in any social science the researcher is more involved than in the physical sciences because s(he) is dealing with human behaviour. 'Post-positivism' accepts that reality can never be known with certainty but strives to know it with a high probability. Post-positivist conclusions are tentative and subject to falsification.

Research conducted using this approach is evaluated using three criteria: Validity, reliability and generalisability. 'Validity' refers to the extent to which an approach or procedure gives the correct answer and 'reliability' to the extent to which it gives the same answer whenever it is carried out. 'Generalisability' refers to the extent to which the findings of a study can be applied outside of the study context.
Boland (2005:3) has criticised the emphasis on methodology "for methodology's sake". He has argued that there is no one universal methodology in economics but instead a series of problem-dependent methodologies each suited to a limited number of questions (Boland, 2003). This thesis is a set of three empirical pieces and the research approach and methods adopted are those that best help to answer the research questions being asked, using the common and most appropriate methods employed in the extant literature to answer similar questions.

Arguing for a greater practice of science in economics, Payson (1996:267) states that there is "a cultural tendency" among economists to accept the classification of economic data as given by the compiler. Economists do not consider this their responsibility, while the compilers may not have considered epistemological issues in the data analysis when deciding on classification which may not then be appropriate for the research purpose. Payson (1996:267) goes on to argue that in biology data are available according to a number of classification systems, pointing out that the idea of having a "conceptual framework" in the compilation of economic data is seen as an option rather than "a scientific imperative." Much of the data used by economists have been collected for other purposes. This is an issue particularly relevant to Chapter Two of this thesis and, to a lesser extent, Chapter Four.

1.6 ROAD MAP

As already discussed, each of the next three chapters is a study exploring issues in the measurement and analysis of FDI. For coherence, the relevant literatures are reviewed

within the empirical chapters. Concluding remarks are made in Chapter Five, together with a brief discussion of suggested future research directions and of the key research contributions made by the thesis.

REFERENCES

Agmon, T. (2006) 'Bringing Financial Economics into International Business Research: Taking Advantage of a Paradigm Change' *Journal of International Business Studies, 37*, 575-577

Aizenman, J. and J. Kendall (2008) 'The Internationalization of Venture Capital and Private Equity '*NBER WP14344*

Barry, F and C. O'Mahony (2005) 'Making Sense of the Data on Irish Inward FDI' *Journal of the Statistical and Social Inquiry Society of Ireland* Vol. XXXIV, 28-57

Baygan, G. and M. Freudenberg (2000) *The Internationalisation of Venture Capital Activity in OECD Countries: Implications for Measurement and Policy.* OECD Science, Technology and Industry Working Papers DSTI/DOC (2000)7, OECD Publishing

Boland, L. (2003) *Foundations of Economic Method: A Popperian Perspective* Routledge, London and New York

Boland, L. (2005) *Critical Economic Methodology: A Personal Odyssey* Routledge, London and New York

Breznitz, D. (2012) 'Ideas, Structure, State Action and Economic Growth: Rethinking the Irish Miracle' *Review of International Political Economy, 19*(1), 87-113

Buch, C., I. Kesternich, A. Lipponer and M. Schnitzer (2014) 'Financial Constraints and the Margins of FDI' *Review of World Economics/Weltwirtschaftliches Archiv, 150*(2), 393-420

Claessens, S., H. Tong and S. Wei (2012) 'From the Financial Crisis to the Real Economy: Using Firm-Level Data to Identify Transmission Channels' *Journal of International Economics*, *88*(2), 375-387

Coase, R. (1937) 'The Nature of the Firm' *Economica, 4*(November), 386-405

De Nederlandsche Bank (DNB) (2003) *Statistical Bulletin* Special Edition 2003

De Nederlandsche Bank (DNB) (2008) *Statistical Bulletin* December 2008

Desai, M. (2009) 'The Decentering of the Global Firm' *World Economy*, *32*(9), 1271-1290

ECB (2007) *European Union Balance of Payments/International Investment Position Statistical Methods,* May

Eurostat (2009) *Task Force on the Recording of Certain Activities of Multinationals in National Accounts: Final Report* Eurostat, July 2009, 17th Meeting of The GNI Committee 7-8 July 2009, Luxembourg) available at (http://www.unece.org/fileadmin/DAM/stats/groups/wggna/Report_TF_recording_activities_multinationals_national_accounts.pdf)

Fitzgerald, J. (2013) 'The Effect of Redomiciled PLCs on Irish Output Measures and the Balance of Payments' *ESRI Quarterly Economic Commentary,* Research Note, Spring

Friedman, M. (1953) 'The Methodology of Positive Economics' in *Essays in Positive Economics*, University of Chicago Press

Graham, E. and P. Krugman (1993) 'The Surge in Foreign Direct Investment in the 1980s' in K. Froot (ed) *Foreign Direct Investment* University of Chicago Press

Industrial Policy Review Group (1992) *A Time for Change: Industrial Policy for the 1990s*, Stationery Office, Dublin. This is widely known as the "Culliton Report"

Lawless, M., F. McCann and T. McIndoe-Calder (2012) 'SMEs in Ireland: Stylised Facts from the Real Economy and Credit Market' *Quarterly Bulletin Papers,* 99-123, Central Bank of Ireland, April

Lerner, J. (2009) *Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital have Failed-and What to Do about it* Princeton University Press

Lipsey, R. (2010) 'Measuring the Location of Production in a World of Intangible Productive Assets, FDI, and Intrafirm Trade' *Review of Income and Wealth*, *56*(Special Issue 1), S99-S110

Markusen, J. (1995) 'The Boundaries of Multinational Enterprises and the Theory of International Trade' *Journal of Economic Perspectives, 9*(2), 169–189

Markusen, J. (1998) 'Multinational Firms, Location and Trade' *World Economy, 21*(6), 733-756

Markusen, J. (2008) 'Foreign Direct Investment (FDI)' in K. Reinert and R. Rajan (eds) *Princeton Encyclopedia of the World Economy,* Princeton University Press

Mintz, J. and A.Weichenrieder (2010) *The Indirect Side of Direct Investment* CESifo Book Series, MIT, Cambridge

Nachum, L. (2000) 'Economic Geography and the Location of TNCs: Financial and Professional Service FDI to the USA' *Journal of International Business Studies*, 31(3), 367-385

OECD (2008) *Benchmark Definition of Foreign Direct Investment* (4th edition)

OECD (2012) 'Holdings, Head Offices and SPEs: Issues and Way Forward' Working Party on International Trade in Goods and Trade in Services Statistics, Note by M.Chavoix-Mannato and S. Hagino. Available at http://search.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=STD/TBS/WPTGS%282012%2919&docLanguage=En

O'Hearn, D. (1987) 'Estimates of New Foreign Manufacturing Employment in Ireland (1956-1972)' *Economic and Social Review, 18*(3), 173-188

Ouddeken, F. (2005) 'SPEs and FDI – Some Further Considerations' *IMF Direct Investment Technical Expert Group (DITEG)* mimeo

O'Malley, E. (1989) *Industry and Economic Development: The Challenge for the Latecomer* Gill and Macmillan, Dublin

Payson, S. (1996) 'Regardless of Philosophy, Economics will not be a Science until it is based on Science' *Journal of Post Keynesian Economics*, *19* (2), 257-274

Popov, A. and P. Roosenboom (2009) *On the Real Effects of Private Equity Investment: Evidence from New Business Creation* Working Paper No. 1078, European Central Bank.

Stephan, M. and E. Pfaffmann (2001) 'Detecting the Pitfalls of Data on Foreign Direct Investment: Scope and Limits of FDI Data' *Management International Review,* 41, 189-218

Telesis (1982) *A Review of Industrial Policy,* NESC Report No.64, Stationery Office, Dublin

UNCTAD (2006) *World Investment Report FDI from Developing and Transition Economies: Implications for Development* New York and Geneva

UNCTAD (2011) *World Investment Report: Non-equity Modes of International Production and Development* New York and Geneva

UNCTAD (2012) *World Investment Report: Towards a New Generation of Investment Policies*, New York and Geneva

UNCTAD (2013) *World Investment Report: Global Value Chains: Investment and Trade for Development* New York and Geneva

UNECE (United Nations Economic Commission for Europe) (2011) *The Impact of Globalization on National Accounts* United Nations, New York and Geneva available at http://www.unece.org/fileadmin/DAM/stats/publications/Guide_on_Impact_of_globalization_on_national_accounts__web_.pdf

Wilkins, M. (1999) 'Two Literatures, Two Story-Lines: Is a General Paradigm of Foreign Portfolio and Foreign Direct Investment Feasible?' *Transnational Corporations*, *8*(1), 53-116.

Williamson, O. (1985) *The Economic Institutions of Capitalism* Collier-Macmillan, New York and London

Chapter Two

Pitfalls in the Use of Foreign Direct Investment Statistics

"These data are not clean.... One thing that would help is more information about the data, and how they are collected. What procedures do.....countries follow to collect these data? What are the pitfalls?" (Engel, 2003:115)

2.1 CONTEXT

This chapter explores and quantifies the incompatibilities in the balance-of-payments Foreign Direct Investment (FDI) data across time and across countries. These data are widely used in the empirical FDI literature. Incompatibilities in the data are generated by the use of different methodologies and differing interpretations of the international recommendations.

The balance-of-payments data are empirically important because although they seek to measure the financial flows and stocks of FDI they are usually viewed as much more than this, involving flows of other assets such as technology, intellectual and human capital, and entrepreneurship.[21] Increases in FDI are generally expected to increase the productive capacity of the host country. In addition to seeking to measure the financial flows and stocks of FDI, the balance-of-payments FDI data are also widely used in measures of globalisation and to proxy for the level of Multinational Corporation (MNC) activity. FDI and the activities of Multinational Corporations (MNCs) are often thought of as one and the same thing, both terms often loosely used interchangeably.[22] MNC activity, or operations, data such as employment, sales, value-added, or property, plant and equipment (PPE) data are much less widely available and their measurement has lacked standardisation. In contrast, balance-of-payments FDI data are widely reported and there are international standards for their compilation.[23] The various pitfalls in using FDI data to proxy for MNC activity data are discussed in Appendix 2.3.[24]

Intertemporal comparability of the FDI data is affected by methodological changes causing structural breaks in the time series data. At the time of writing, the current international

[21] Markusen (1997) and others, have grouped many of these assets as 'knowledge capital'. Non-equity forms of investment may also take place e.g. franchising, licensing.
[22] Indeed Markusen (1995:170) does exactly this, stating "Multinationals are firms that engage in direct foreign investment, defined as investments in which the firm acquires a substantial controlling interest in a foreign firm or sets up a subsidiary in a foreign country. The terms "multinational enterprise" and "direct foreign investment" will be used fairly interchangeably." Clegg (1992) describes the balance-of-payments FDI data and MNC activity data as 'two sides of the same coin'.
[23] Although despite these standards it is demonstrated in this chapter that there are incompatibilities in the FDI data too.
[24] It should also be noted that MNC activity data also suffer from pitfalls, this issue is also discussed in Appendix 2.3.

standard for measuring FDI is set out in the 5th edition of the *Balance of Payments Manual* of the IMF which dates from 1993 (henceforth BPM5). OECD (1996) provides a detailed operational guide on the compilation of FDI data in accordance with these IMF principles.[25] According to BPM5, FDI is further divided into three component parts: equity, intra-company loans, and reinvested earnings (RIE). For the data examined in this chapter the main methodological change was the adoption of BPM5 in the late 1990s, although countries can make other changes to their methodologies from time to time. Revisions are also common, rendering data 'out-of-date'. Furthermore, differences in the extent and speed of such revisions affect data comparability across the various data sources.

International comparability is affected because the methodology for recording and reporting of FDI can differ among countries. Firstly, despite the existence of international standards, differences arise in the interpretation and application of these standards. Secondly, data collection systems vary across countries. Thirdly, countries differ in the extent of backward revisions undertaken as a result of changes in international standards.

This chapter explores the FDI balance-of-payments data in detail, and asks:

- What do these data measure?
- How comparable are these data both intertemporally and internationally?

The remainder of this chapter is organised as follows: Section 2.2 reviews the existing literature on the pitfalls in the FDI data and then the empirical literature that uses these data. Section 2.3 describes the research approach and the various data sources examined. The various pitfalls in the data are analysed and quantified in Section 2.4, and conclusions are drawn in Section 2.5.

2.2 LITERATURE REVIEW

This section first looks at the existing literature on the pitfalls in the balance-of-payments data. Section 2.2.2 then reviews the empirical literature that utilises the various FDI data series. A summary and discussion of the literature concludes this section.

[25] A new international standard, BPM6, was not due to be implemented by EU countries until 2014 (ECB/Eurostat 2011). However, the Coordinated Direct Investment Survey published annually by the OECD since 2010 and covering direct investment from 2009 already follows BPM6.

2.2.1 Extant Pitfalls Literature

There is a small literature on the pitfalls in the FDI data including Bellak (1998), Cantwell and Bellak (1998), Stephan and Pfaffmann (2001), Barry and O'Mahony (2005), and Fujita (2008).

In common with most of the extant literature, Bellak (1998) demonstrates the various problems that data deficiencies pose for empirical research, arguing that the complexity of the international standards make them difficult to apply. He mostly uses examples of large countries (for example the UK, US, Japan and Canada) although he does also use some examples for Austria (as well as Switzerland and the Netherlands Antilles) in his discussion of pass-through investment. European countries use either settlements systems, which report balance-of-payments transactions, or enterprise surveys to compile the FDI balance-of-payments data. As Fujita (2008) points out, settlements systems cannot record RIE or stock data and lack sufficient information for adequate geographical and sectoral breakdowns. Other countries, especially developing countries, use 'administrative' data rather than balance-of-payments data when reporting FDI (Fujita, 2008). Administrative sources include data from Industrial Promotion Agencies (IPAs) and tax authorities. Fujita (2008) demonstrates that these figures can be very different from the corresponding balance-of-payments data, the 'administrative' data often being based on approvals. Barry and O'Mahony (2005) also show that, for Ireland, some OECD data were derived from grant approvals which were different from balance-of-payments data. Fujita (2008) and Stephan and Pfaffmann (2001) point out that deficiencies in the original data can be compounded later when the data are used for other purposes. Fujita (2008) suggests this is a problem when stocks are estimated by the accumulation of flows as is common with UNCTAD data (as discussed below). Stephan and Pfaffmann (2001:205) also point out that all the deficiencies in the national sources translate into the international data series stating that:

> "the combination of insufficiency, incorrectness, differences, and failure makes it extremely difficult to develop reliable estimates of global FDI stocks and flows and to analyze cross-country FDI-data"

According to Stephan and Pfaffmann (2001) differences in the periodicity of data collection can affect cross-country comparisons and "extensive time series comparisons of data from different sources" (Stephan and Pfaffmann, 2001:208). Disaggregated data are also found to suffer more from this periodicity problem due to longer time lags, as well as suffering from inaccuracies in their geographical and sectoral allocations.

Most EU15 countries produce stock data at book values, although France uses both market and book values and the Netherlands reports market value only. Efforts have been made in the UK to revalue stocks over time – resulting in significant differences in stock valuations.[26] Barry and O'Mahony (2005) argue that the estimation of UNCTAD stock data by the accumulation of flows gave rise to misleading stock data for Ireland prior to 2000. Bellak (1998) also discusses inaccuracies arising from attempts at estimating book values from accumulated flows. Cantwell and Bellak (1998) re-estimate the FDI inward and outward stocks at replacement values using a perpetual inventory model (PIM) for Japan, Germany, the US, and the UK. They find that the differences between historic and replacement values are greater for 'older' investors (US and UK) than for the 'newer' ones (Japan and Germany) since older capital stocks are undervalued. The differences are even greater when adjustments are made for exchange-rate movements, since the currencies of the 'older' investors had devalued, whereas those of the 'newer' investors had revalued on average. Therefore, revaluation may be asymmetric for a country's inward and outward FDI if the age of these stocks differs.

2.2.2 Empirical Literature using FDI Data

Studies using the FDI balance-of-payments data to proxy for MNC activity fall mainly into three groups. One group examines the effects of FDI on growth or other economic variables (see, for example, Alfaro et al, 2004, 2009; Borensztein et al, 1998; De Mello, 1999; Durham, 2004; and Li and Liu, 2005). A second group looks at the distributional effects of the liberalisation of FDI and of globalisation (see, for example, Hatzius, 2000; Breuss, 2010; and Pica and Rodríguez-Mora, 2011). A third studies the drivers of FDI (see de Ménil, 1999; Wei, 2000; Buch and Piazolo, 2001; Globerman and Shapiro, 2002; Janicki and Wunnava, 2004; Bevan and Estrin, 2004; Egger and Pfaffermayer, 2004; Bénassy-Quéré et al, 2007; Razin and Sadka, 2007; Stein and Daude, 2007; Schiavo, 2007; Petroulas, 2007; Taylor, 2008; Kolstad and Villanger, 2008; Head and Ries, 2008; Bellak and Leibrecht, 2009; and de Sousa and Lochard, 2011).

Most of these study a number of countries over sometimes lengthy time periods without any acknowledgement of the differences in the methodologies used to compile these data. Many studies attempt to use as large a dataset as possible for long time periods in order to maximise the number of observations. Alfaro et al. (2004, 2009) use 72 countries for 1975-1995. De Mello (1999) covers 32 countries over 1970-1990. Borensztein et al (1998) use

[26] For example for the UK: See Pratten (1992) and various *Bank of England Quarterly Bulletins* including Winter 2002 and 2004.

69 developing countries again for two decades over the period 1970-1989. A similar study by Durham (2004) covers 1979-1998 for 80 countries. Li and Liu (2005) use 84 countries for 1970-1999. Of these studies just Li and Liu (2005) make any reference to concerns about the data, excluding countries with 'poor quality' data and partially attributing the mixed results in the literature to 'data insufficiency'.[27] Many of these long time periods cross the implementation of BPM5 without any reference to this. Although some (see de Ménil, 1999; Borensztein et al, 1998; Alfaro et al, 2004; and Durham, 2004) mainly use data prior to the implementation of BPM5, there were also a number of earlier methodological changes made by countries which may affect their data.[28] If data covers a 20 or 30 year period there is likely to be substantial methodological change in this time and such changes are not uniform across countries either.[29]

The choice of data used in the empirical literature depends on the type of analysis being undertaken. OECD data are popular in studies which focus on industrialised countries, involve North-South investment, or where geographically disaggregated data are required (see Borensztein et al, 1998; De Ménil,1999; Wei, 2000; Hatzius, 2000; Buch and Piazolo, 2001; Durham, 2004; Janicki and Wunnava, 2004; Bevan and Estrin, 2004; Egger and Pfaffermayer, 2004; Razin and Sadka, 2007; Bénassy-Quéré et al, 2007; Stein and Daude, 2007; Schiavo, 2007; Head and Ries, 2008; Taylor, 2008; Bellak and Leibrecht, 2009; Breuss, 2010; De Sousa and Lochard, 2011; Pica and Rodríguez-Mora, 2011). If the focus is on the EU or EMU then Eurostat data are often chosen (see Buch and Piazolo, 2001; Petroulas, 2007; Taylor, 2008). IMF or UNCTAD data are more popular if a wider selection of countries is being studied, especially if developing countries are included in the study. De Mello (1999), Durham (2004), and Alfaro et al. (2004, 2009) use IMF data; UNCTAD data are used by Buch and Piazolo (2001), Globerman and Shapiro (2002), Li and Liu (2005), Kolstad and Villanger (2008).

Similarly, the choice of flow or stock, inward or outward, unilateral or bilateral, data depends on the focus and concerns of the study. Flow data have the advantage of greater availability and comprehensiveness than stock data. Flows also reflect the annual investment and divestment decisions made by MNCs (Bellak and Leibrecht, 2009) and changes in behaviour are more apparent than in the stock data (Globerman and Shapiro, 2002). Wacker (2013) suggests FDI flow data are useful to examine the effects of sudden

[27] Econometric problems arise from a large number of zeroes and missing values in the data. Authors fill missing values in a number of ways, substituting outward data reported by a partner country for missing inward data, for example (see Hatzius, 2000). As we will see in Section 4 there are substantial discrepancies between these mirror data, especially for flow measures.
[28] Although some of the data used in the latter two papers may have been revised in light of BPM5.
[29] Lane and Milesi-Ferretti (2003) refer to structural breaks in the data series which they suggest may be related to changes in estimation methodology.

changes such as policy changes. However, flow data can be very volatile and are affected by one-off large investments in some years. Consequently, many (see Bénassy-Quéré et al, 2007; Stein and Daude, 2007; Cantwell and Bellak, 1995; and Stephan and Pfaffmann, 2001) consider FDI stocks to better proxy for MNC activity than flow data.[30] A number of studies refer to the difficulties arising from lumpiness and the volatility associated with FDI flows, particularly with bilateral data.[31] Some deal with volatility by using three-year or five-year averages (see, for example, Globerman and Shapiro, 2002; Razin and Sadka, 2007; and Taylor, 2008). Stein and Daude (2007) smooth out possible valuation changes by using average stock values for 1997-1999.

Wei (2000), Stein and Daude (2007), and de Sousa and Lochard (2011) are among the few to note that different countries use different criteria for the definition and valuation of FDI. Wei (2000) introduces a set of source country dummies partially to cater for definitional differences across countries. Schiavo (2007) average the counter-party or 'mirror' data for the bilateral flows. The literature fails to mention the different valuations of stocks used by countries (i.e. whether book or market values).

Others note the difficulties that arise as a result of the inclusion of certain countries because of their roles as financial centres, tax shelters, or investment hubs. Taylor (2008), in particular, discusses the problems that arise from the role of Special Purpose Entities (SPEs), especially in relation to the transhipping of investment. Many studies include the Netherlands, and to a lesser extent Belgium (and Luxembourg), and Austria in the dataset, ignoring the specific issues with these countries in relation to their role as conduits and the reporting of SPE transactions. Petroulas (2007) and Taylor (2008) however do recognise the statistical issues that arise when Luxembourg is included. Similarly, Hatzius (2000:141, Footnote 11) omits Belgium as a partner country for German FDI because 'Belgium' was actually 'Belgium-Luxembourg' at the time and he considers German FDI with Luxembourg to have been dominated by Luxembourg-based subsidiaries of German banks established "in response to the German withholding tax on capital income". Both Petroulas (2007) and Taylor (2008) find that the EMU boost to FDI is weaker when Luxembourg is omitted, pointing to Luxembourg's role as a global financial centre and tax shelter. Petroulas (2007) further finds that the removal of Belgium and Germany also reduces the

[30] Bénassy-Quéré et al (2007) argue that because stocks represent the total value of assets attributable to the foreign investor and account for local financing, they are superior to flows as a measure of total investment. They cite Devereux and Griffith (2002) in support of using FDI stocks, however the latter have argued that FDI itself is an inadequate measure of 'real' foreign investment in the host economy. Another reason given by Bénassy-Quéré et al (2007;769) for using stock data is that they are less volatile than flows which they claim can be strongly affected by "one or two large takeovers". Head and Ries (2008) suggest that lumpiness is also an important source of variance in the stock data however.

[31] Volatility is common in flow data because of one-off large investments occurring but has also increased over time which has been attributed by UNCTAD (2013) to the use of SPEs. This chapter is concerned only with the impact of the use of different methodologies on the measurement of FDI.

effect of EMU, attributing this to the important role of these three countries as investment hubs. De Mello (1999) and Taylor (2008) mention the difference among countries in the inclusion of RIE, Taylor deciding to omit RIE altogether.

Gravity models, common in the empirical literature, use bilateral FDI data which suffer from asymmetries arising from both misleading geographical allocations and from methodological differences. Countries differ in their geographical allocation of the data as well as in their interpretation or application of the international standards. These issues are mostly unacknowledged in the literature although Petroulas (2007) and Schiavo (2007) mention asymmetries between flows as reported by host and source countries. They both attempt to correct for these by averaging out the two mirror series. However, averaging in this way mixes the outward and inward FDI data resulting in data which are neither one thing nor the other, not representing anything as such.

Some authors also mix a number of different series sourced from different agencies. Buch and Piazolo (2001) use a combination of OECD, Eurostat, and UNCTAD data. Durham (2004) uses both OECD and IMF data. Taylor (2008) uses both OECD and Eurostat data, arguing that this allows cross-checking of the data. However, as the data often derive from the same original source, the extent of cross-validation that this enables is limited.[32] De Sousa and Lochard (2011), although referring to limitations in the comparability of the data due to definitional differences, claim that for 18 countries over 1994-2002 (somewhat different countries and years then in their study) the correlation between the OECD and Eurostat stock data is 0.99. Such a correlation, however, does not measure difference in magnitude.

2.2.3 Summary and Discussion

There are four gaps in the extant pitfalls literature that this study seeks to fill: First, the existing literature mostly selects certain pitfalls and uses examples of how they apply to either a single country or a small number of countries rather than examining a time-series. Second, the countries selected are generally larger countries (i.e. the largest recipients or sources of FDI flows or stocks) rather than countries where FDI is particularly significant in the economy. Third, much of this literature was published in the late 1990s when many countries had only begun to adopt BPM5 and related guidelines, and prior to the large surge that occurred in FDI in the late-1990s. Fourth, although the pitfalls are discussed in the existing literature, they are generally not quantified.

[32] Taylor also uses some non-published detailed data from Eurostat.

As noted above, empirical studies often include large numbers of countries (more than 80 in some cases) over lengthy time periods (some use more than 20 years) in order to maximise the number of observations. However, the methodological variation identified in the pitfalls literature suggests that empirical studies are combining incompatible data. Furthermore, Barry and O'Mahony (2005) find differences between the various series produced by international agencies.

The main sources of incompatibility identified in the literature can be summarized as: Different data collection methods; differences in interpretation and application of various aspects of the international standards (including ownership criteria, the measurement and recording of the components of FDI, the measurement and treatment of reverse investments as well as indirect investment, the role of SPEs); the geographic allocation of investments; and the valuation of stocks. These differences lead to the lack of comparability over time and across countries. The lack of international comparability in the data leads to asymmetries in the mirror data.

This chapter updates and extends the existing literature on FDI pitfalls by examining time-series data, covering a later time period (encompassing the implementation of BPM5 and the surge in FDI from the late-1990s), and by the inclusion of smaller countries in the analysis. Its key contribution is the quantification of the incompatibilities in the data.

2.3 DATA AND METHODOLOGY

2.3.1 Methodology

The purpose of this chapter is to demonstrate the extent of incompatibilities in the balance-of-payments FDI data that are generated by the use of different methodologies, and differing interpretations of the international recommendations.

To minimise noise arising from methodological variation, this study focuses on what is expected to be a reasonably homogenous group of countries.[33] Blanchard et al (2008) consider that OECD countries are more in accordance with the international standards than other countries. EU members can be expected to be even more in accordance with international standards because of additional ECB and Eurostat guidelines. A selection of six EU15 countries is chosen: three large economies and three small economies.

[33] These countries have well developed data collection and dissemination systems that would be expected to be similar as members of the EU. Schiavo (2007) is limited to OECD countries to reduce the number of missing values.

The large economies studied are the UK, France, and Germany. In 2011, these were the top three 'large country' Western European recipients of FDI in terms of both inward flows and stocks (UNCTAD, 2012).[34] Most of the extant literature on pitfalls in the use of these data focuses on large economies although Bellak (1998) includes his home country of Austria as well as Switzerland and the Netherlands Antilles. It was decided to include small countries here as FDI often accounts for a larger share of GDP for small countries and hence may have a greater relative impact on real economic activity in these countries.[35] The smaller countries were also selected on the basis of being substantial recipients of FDI. In 2011 the main 'small country' recipients of FDI inflows were Belgium, Luxembourg, and the Netherlands. Belgium and Luxembourg reported a common balance-of-payments until 2002, under the Belgo-Luxembourg Economic Union (BLEU) and disentangling the balance-of-payments data for these two countries prior to 2002 is not feasible so they are generally combined in this study.[36] It may be noted that, although the criteria used here applied to 2011, this country selection would be fairly consistent over a number of years qualifying as either large recipients of FDI or through having high FDI stocks as a per cent of GDP.

2.3.2 Data Sources

For EU members the main international sources of FDI balance-of-payments data are the International Monetary Fund (IMF), the Organisation for Economic Cooperation and Development (OECD), the United Nations Conference for Trade and Development (UNCTAD), and the European Statistical Agency (Eurostat). Data are also available from national agencies. The choice of data used in the empirical literature depends on the type of analysis undertaken. OECD data are commonly used if the focus is on OECD or industrialised countries. Because the OECD produces geographically disaggregated data these are commonly used in gravity models. If the focus is on the EU or EMU then Eurostat data are often chosen. IMF or UNCTAD data are more popular if a wider selection of

[34] Here we can see the effect of revision of the series over time, discussed later on, with most recent figures tending to be less reliable as they are subject to revision. UNCTAD (2012) reports the value of 2011 FDI inflows into France at $41 billion and into Germany at $40.4 billion. UNCTAD (2013) however revised these to $38.6 billion and $48.9 billion, respectively. France and Germany in both years are the second and third 'large country' recipients of FDI but their placing is reversed between the two reports.

[35] Many smaller EU15 countries have significant amounts of investment taking place in SPEs e.g. the Netherlands and Luxembourg. UNCTAD (2006), for example, estimates that transhipped FDI would have accounted for 95 per cent of FDI inflows into Luxembourg during 2002-2005. The Netherlands largely omits Special Financial Institutions (SFIs) from its internationally reported data but does report them in its national Balance of Payments. The authors' own calculations, comparing Balance of Payments data produced by the Dutch Central Bank, De Nederlandsche Bank (DNB), with internationally reported data (by the OECD), suggests that inflows including SFIs were, on average, 203 per cent higher per annum for 1999-2004.

[36] There are some problems attached to this: First, care must be taken to deduct flows and stocks between the two countries from 2002 onwards, and second, sectoral composition of FDI differs between the countries with FDI in Belgium mostly in the manufacturing sector and FDI in Luxembourg concentrated in services. It is also common in the literature to refer to both as simply 'Belgium' whether for convenience or in error.

countries is being studied, especially if developing countries are included. Similarly, the choice of flow or stock, inward or outward, unilateral or bilateral data depends on the focus and concerns of the study.

The IMF publishes FDI data annually in the *Balance of Payments Statistics Yearbook* and, in summary form, in the *International Financial Statistics* (IFS), and also online. These data are derived directly from the balance-of-payments data reported by individual countries to the IMF and therefore may suffer from inconsistencies and discrepancies where countries use different methodologies for the collection and compilation of the data, as alluded to by Engel (2003). The IMF also publishes disaggregated data on the component make-up of FDI (equity capital, intra-company loans, and RIE). These are published in US dollars (originally in SDRs in 1980-1983). The IMF data are compiled as an element of the overall balance-of-payments. The more recent IMF data in the *Balance of Payments Statistics Yearbook 2012* onwards use the newer BPM6 presentation so the data are not directly comparable to the data reported here.

The OECD data are available in a number of formats: The data are published in the annual *International Direct Investment Statistics Yearbooks* and also in the *International Direct Investment Statistics* database in the OECD *iLibrary* (previously known as 'Source OECD').[37] The OECD produces two different types of flow data: Aggregate data on total flows and disaggregated data broken down geographically and sectorally. The OECD therefore produces more detailed data than the IMF, but with a narrower country coverage (the OECD data are concerned with OECD member states). The data are collected through a joint OECD/Eurostat questionnaire and are principally based on the balance-of-payments and International Investment Position (IIP) data, although some other sources may be used (OECD 2010). The aggregate data are published in US dollars with earlier disaggregated data published in local currencies. The disaggregated data are sometimes sourced differently from the aggregate data, perhaps referring to notifications or approvals rather than actual direct investment (DI).[38] Because of the greater level of detail, the disaggregated data are likely to be 'older' and less frequently and speedily revised. Therefore, a distinction is made between three OECD series: The two in the *International Direct Investment Statistics Yearbooks*, and an updated series from the electronic database. The total, aggregate, series from the *International Direct Investment Statistics Yearbooks*

[37]The OECD did not publish these yearbooks in the years 2005-2011 so there are gaps in the OECD1 series for 2004-2006 and in the OECD2 series for 2004-2005 (2003-2005 for stocks), making these series incomplete.

[38]For example, for Ireland, these data were approved investments eligible for grant aid and would not accurately reflect actual FDI, also largely ignoring RIE (Barry and O'Mahony, 2005). It was acknowledged by the OECD (1994) in its *OECD Reviews of Foreign Direct Investment: Ireland* that actual inward FDI flows into Ireland were likely to be larger than these data which were sourced from the Industrial Development Authority (IDA).

will be referred to as 'OECD1' and the disaggregated series as 'OECD2'.[39] There is a discontinuity in the OECD2 series for the years 2001-2006 due to the non-publication of the *International Direct Investment Statistics Yearbooks* in the years 2005-2011. Although the series obtained from the electronic database should, in principle, be the same as OECD1, this is treated separately as 'OECD3' as it is an updated series and does not always match OECD1, especially for earlier years. Eurostat period average exchange rates are used to convert data from local currencies into US dollars, this may cause some slight deviations due to exchange rate differentials.

UNCTAD data are available annually in the *World Investment Directories* and *World Investment Reports*, and online. These data come from various sources, for EU countries they came originally from IMF data but now come from national sources (the date of the switch to nationally sourced data varying between 1986 and 1999). No geographical or sectoral breakdowns are provided but there is very wide global coverage for individual countries and for regions (although there are some data gaps and there may be problems with the reliability of data or estimates in some cases). Because of their global coverage, UNCTAD data are most useful in empirical work covering a large number of countries especially when mixing industrialised, transition, and developing countries.

Eurostat data focus on the EU member states but also cover other countries. These data are available from Eurostat's *EU Foreign Direct Investment Yearbooks* and online. The sources and coverage have changed over time. Some data are estimated where there are missing data such as for RIE or SPEs, and also where geographical and sectoral breakdowns were not available. As data coverage improves, estimations are not as common but are still sometimes used to calculate EU aggregates. Partner country declarations were the main method of estimation, followed by modelling and the use of cumulative flows (Eurostat 1994).

In some cases Eurostat 'harmonised' the data to ensure that EU aggregates could be calculated and to improve consistency and comparability between member states and with the US and Japan.[40] The most important source of data for harmonisation was the national balance-of-payments publications (Eurostat, 1994) and weights were compiled from data of other member states and of US and Japan.[41] The data now follow internationally published

[39]In line with Barry and O'Mahony (2005).
[40]Eurostat has referred to a 'major lack of coherence' in the data as a result of differing concepts, classifications and collection systems of member states (Eurostat 1994).
[41]Eurostat 1994 (and others) claimed that harmonisation was the reason for discrepancies between Eurostat data and those published by national and international sources, which are not adjusted.

data more closely but large discrepancies with other series can sometimes be seen for earlier years which Eurostat attributed to these estimations and adjustments. Eurostat (1995) warned that its figures should be treated with caution due to the extent of estimation and harmonisation.[42] One discrepancy that occurs between member states is the calculation and allocation of RIE. In the earlier years, some countries did not publish these data. Where they are published, the measurement is not consistent. Different methods of calculation are used and countries allocate RIE differently with some allocating RIE according to the period where these profits will be used instead of the period where they are earned. BPM5 requires that they are allocated to the period where they are earned (Eurostat, 1994).

The IMF, Eurostat, and some national agencies, also publish data disaggregated by component and the OECD, Eurostat, and some national agencies, publish geographical and sectoral breakdowns of the data. The availability of this amount of detail has improved over the years but for earlier years it is often not available, at least for some countries. National agencies do not always disseminate these breakdowns although the data may have been collected.

Most of the metadata used in this study are available from reporting agencies. Additionally, there are a number of reports and surveys undertaken by the IMF and OECD on the implementation of the international standards which contain a lot of country detail.[43]

Although the data spans the period 1980-2012 there is not complete coverage of this period in all cases due to a number of limitations. Some flow series only begin in 1985 (1989 for stock data). Others end in 2010. Some have gaps in their coverage. Because more recent data are often subject to revision, it was considered prudent in some instances to limit the analysis up to 2010 or 2011 only. In some cases the time-series are subdivided into two parts at 1997/1998. This is for two reasons: Firstly, European countries adopted the BPM5 recommendations around 1998, with some backdating, which is likely to have caused methodological breaks at this time. Secondly, there was a surge in FDI around this time so later flows tend to be so large that they dwarf earlier flows, making it difficult to identify variation in the earlier data. A more formal structural break analysis was considered but it was not adopted because of the difficulty in disentangling the effects of the methodological changes and the FDI surge. Here we are more concerned with methodological differences

[42]For example, Eurostat produced no FDI data for Ireland for the years 1995-1998, and neither the 1998 or 2000 yearbooks include tables for Ireland or Greece, although data appear to have been estimated to generate overall EU totals.
[43] See IMF/OECD (1992) *Report on the Measurement of International Capital Flows* (known as the 'Godeaux Report'), IMF/OECD (1999) *Report on the Survey of Implementation of Methodological Standards for Direct Investment*, and IMF/OECD (2003) *Statistics: How Countries Measure FDI, 2001 edition.*

but FDI has also become more volatile in the later period, which is probably due more to the changing nature of FDI flows (in particular the increase in 'financial services' FDI) than the adoption of BPM5.[44]

2.4 ANALYSIS AND RESULTS

The following sub-sections look in turn at the sources and impact of incompatibilities in the FDI data. Section 2.4.1 examines how the international standards are applied and interpreted by the six reporting countries in the study. This draws on the metadata in the grey literature to explore the degree of variation that exists both across time and across these countries. Discrepancies in the 'mirror' or counterparty data are examined in Section 2.4.2. An analysis of the extent to which the FDI data for an individual country are different across the international data sources available, namely the IMF, UNCTAD, Eurostat, and the OECD, is contained in Section 2.4.3. Lastly, a few examples of the effects of data revision are given in Section 2.4.4.

2.4.1 Issues Treated Differently by Reporting Countries

The data examined in this chapter were compiled in line with BPM5 and its precursor from the 4th edition of the IMF's *Balance of Payments Manual* (BPM4). Most European countries implemented BPM5 in the late 1990s with some backdating of earlier data to 1996 or earlier. The methodology of EU member states also reflects European Central Bank (ECB) and Eurostat interpretations of the international standards, though even here there are differences between countries in interpretation and implementation.[45] Once a DI relationship is established, all subsequent financial flows are recorded as DI transactions except between Monetary and Financial Institutions (MFIs) and other financial intermediaries where DI transactions are confined to those of a permanent capital nature (ECB, 2002).

As noted in the literature review, the main areas where there are important methodological differences between reporting countries include data collection methods (which can have knock-on effects on a number of other areas), ownership criteria, the measurement and

[44] UNCTAD's *World Investment Report 2013* attributes this volatility largely to the transactions of SPEs located in 'SPE-favourable countries' of Belgium, Ireland, Luxembourg and the Netherlands that account for a large part of changes in European FDI flows. These countries have tax regimes that encourage the location of 'cash-pooling facilities' by MNCs creating the possibility of double-counting and inflation of the FDI flows (UNCTAD, 2013). Furthermore, UNCTAD (2013) suggests that the main reason for falling developed economy FDI flows in 2012 can be attributed to declines in Belgian and Luxembourg flows.

[45] An IMF report (1996) based on Ouddeken (1994) studies bilateral discrepancies between Germany and the Netherlands – where data collection systems at the time seemed quite compatible – and finds conceptual differences over almost every single item. These were mostly associated with different interpretations or practical applications of 'theoretical concepts' rather than deviations from the standards *per se*.

recording of the components of FDI, the measurement and treatment of indirect and reverse investments, the treatment of the transactions of SPEs, the geographic allocation of investments, and the valuation of stocks. Each of these is considered in turn.

2.4.1.1 Differences in Data Collection Methods

Countries use either a settlements system (typically the International Transaction Reporting System, ITRS) or a survey system. Settlements systems involve the reporting of balance-of-payments transactions usually via the banking system. Alternatively enterprise surveys record the FDI transactions as reported by resident enterprises. Settlements systems cannot measure RIE because these earnings do not cross country boundaries. Hence they are often supplemented by enterprise surveys to provide estimates of RIE, but coverage varies between countries. It has been argued that the type of collection system used can affect the data and that survey systems are superior as they allow FDI to be measured more accurately and be more easily distinguished from portfolio investment (Stephan and Pfaffmann, 2001; Connolly, 2005). In particular, Stephan and Pfaffmann (2001) argue that survey methods are superior because they can record RIE and valuation changes more accurately and are also able to reclassify as DI stock that may have originally been a portfolio investment but needs to be reclassified as stock if the parent subsequently owns more than 10 percent of the equity; Connolly (2005) argues that it is easier to capture all intra-company loan components through a survey system. Some countries supplement their data collection with surveys to obtain this type of detail.

The UK has always used an enterprise survey to collect FDI data and some countries have adopted survey systems. Germany and France, however, continue to rely mainly on settlement systems. For Germany, the data are collected by the Deutsche Bundesbank using a settlements system (IMF, 2001; ECB, 2007). Published sources such as company accounts and press reports are then used to cross-check the ITRS data (ECB, 2007; IMF, 2001, 2003). France's balance-of-payments is also compiled by its central bank, the Banque de France, using a settlements system combined with cross checking as in the German case (IMF 2001, 2003).

Prior to 2003 a settlements system was used to compile the Dutch balance-of-payments, complemented by an enterprise survey to cover RIE (IMF, 2001; DNB, 2003). The Netherlands changed to a survey system in 2003, as the settlement system for the collection of the balance-of-payments data was considered to have become less effective partly due to the growth and increased complexity of security transactions arising from international capital market liberalisation in the 1980s (DNB, 2003).

For the BLEU, and for Belgium itself in 2002-2006, the data have been collected mainly by a settlements system, with an annual survey of Direct Investment Enterprise (DIEs) used as a secondary source. For Luxembourg, the data are primarily collected by an annual enterprise survey (IMF, 2001, 2003). Belgium changed its collection and production methodology for the balance-of-payments after 2006, mainly to reduce the reporting burden on enterprises. Data are now collected by a number of surveys. 2006 data for inward flows to Belgium are consistent with the 'old system', 2007 data with the 'new system' (IMF, 2011), this causes an obvious structural break in the Belgian time-series.

2.4.1.2 Differences in Ownership Criteria

BPM5 requires that equity interests of 10 per cent and more are defined as DI and that no other thresholds are used, although some countries have applied, and continue to apply, thresholds on the size of investments, often to ease the reporting burden, particularly on smaller firms.

For Germany, 25 per cent ownership was required until 1990 when this was lowered to 20 per cent. The 10 per cent rule was introduced in 1999, but Germany also uses value thresholds. In France the 10 per cent rule was applied fully from 1993, prior to which a 20 per cent rule had been applied to FDI flows (ECB, 1999). According to the OECD (2001), however, this lowering of the equity requirement had no significant impact on the volume of FDI.

The Netherlands does not strictly adhere to the 10 per cent rule, requiring that the direct investor also has an effective voice in management. Enterprises in which the investor has a less than 10 per cent share but has an effective voice in management through a lasting interest and participation in policy-making are included. A value threshold was also used prior to April 2003 (ECB, 2002; IMF 2001, 2003). Also, if a large investment is found to bear the features of a DI the investor is consulted. According to ECB (2002) however, resulting quantitative differences are negligible.

For the BLEU the 10 per cent ownership rule was not strictly applied. According to OECD (2004:392) DI for BLEU was "distinguished on the basis of the description supplied by the resident making the declaration". After the separation of the balance-of-payments in 2002, Belgium appears to have continued to use the pre-2002 methodology (until 2006) while Luxembourg adopted the 10 per cent rule without any thresholds (IMF, 2001).

2.4.1.3 Measurement and Treatment of the Three Components of Direct Investment

Of the three components of FDI, the measurement of RIE is the most variable over time and across countries, particularly for those who use settlement systems to compile their balance-of-payments.

RIE were not reported by many countries in earlier years and, consequently, some of the empirical literature omits them (for example Taylor, 2008). The 1992 IMF/OECD *Report on the Measurement of International Capital Flows* ('the Godeaux Report') indicated that 11 of the industrial countries in its sample did not compile RIE at that time, although IMF/OECD (1999) reported that six of these had begun to do so by 1997, with further improvements since then (IMF/OECD, 2003).[46] Pointing to the excess of global outflows of FDI over global inflows, the *Godeaux Report* argued that the failure of many countries to compile RIE was the main possible reason for this (along with failure to include short-term loans between affiliates, to record cross-border real estate transactions, and to properly classify reverse investments) (IMF/OECD, 1992). A subsequent report found a big improvement in the compilation of RIE but fairly poor compliance in recording RIE according to the recommendations (IMF/OECD, 2000).

Furthermore the timing of the recording of RIE varies, with some countries allocating RIE to the period when they are earned, in line with IMF/OECD recommendations, and others to the period when they are used. Eurostat (1996) says that only France, the Netherlands, Finland, and the UK compiled RIE according to IMF/OECD recommendations at that time. RIE are most often subject to revisions as they tend to be estimated for the current year and can be subject to time-lags of up to 18 months in some cases.

There was debate within the IMF and the UN in the 1980s over the inclusion of RIE as DI (Eurostat, 1988). On the one hand, it was argued that RIE constitute additional investment into the DIE while, on the other hand, it was argued that the inclusion of RIE would inflate the national income of countries hosting holding companies and that countries employing settlements systems had difficulty calculating current-year RIE.

[46]The difficulty with RIE is that, since no funds cross borders, data must be collected through enterprise surveys rather than through more traditional balance-of-payments methods. Lack of RIE data may be more significant for some countries than for others. RIE are likely to be higher where FDI has been established for a number of years since the DI enterprise will have acquired the capacity to generate its own funds for reinvestment. The size of various components of the FDI data may also be attributable to tax planning, profit-shifting and interest-stripping.

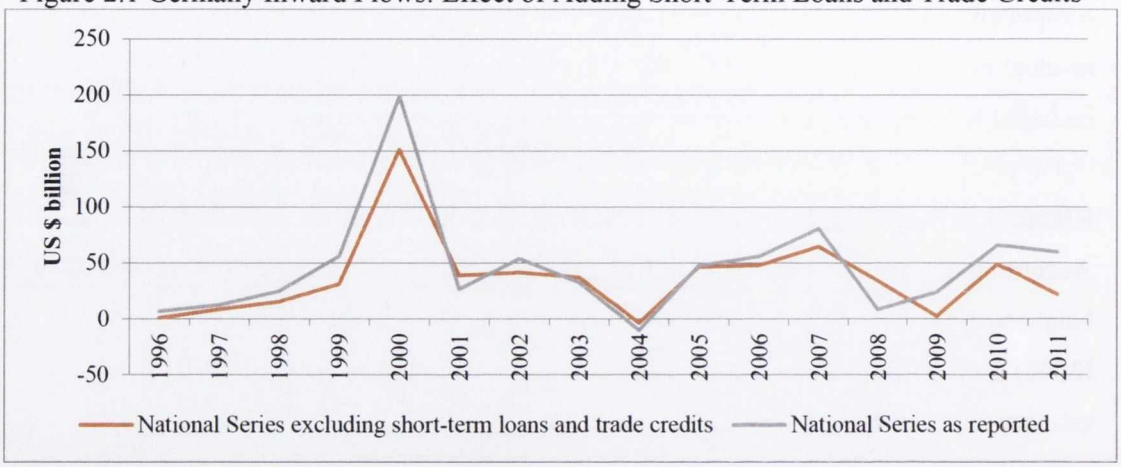
For France, the date of inclusion of RIE varies across series with some data available from 1988 and others from 1994. RIE are estimated for distant periods and forecasted for the current period using forecasted profits and are finalised from the International Investment Position (IIP) survey (IMF, 2001). German RIE are relatively small compared to the other components of inward FDI. For the time period covered here they are estimated as a residual of current operating profit and dividends distributed (ECB, 2007). The UK data included RIE relatively early, from 1983, as a survey system has always been used.

RIE are more significant for the Netherlands than for the other countries examined. According to Eurostat (1988), Dutch RIE were reported at that time but not recorded in the balance-of-payments. They appear to be included in the Dutch data from 1994, with IMF (2003) stating that they are recorded in the period in which they are earned. RIE are estimated for the current year based on a moving average of previously recorded profits and currently reported dividends (IMF, 2008). For the BLEU, RIE were not included until 1999 (UNCTAD 2000, 2001, 2004), while the RIE of SPEs are not reported by Luxembourg.

Intra-company loans can be very substantial but difficult to distinguish from other loans when settlements systems are used (Connolly, 2005). This can be the cause of asymmetries when examining mirror data, as will be seen below. Jungnickel (1995) argues that the exclusion of some intra-firm loans caused German FDI inflows to be "systematically underestimated". Many countries only began to include short-term loans from the mid-1990s, Germany from 1996 (IMF, 1996; OECD, 1999; Deutsche Bundesbank, 1995, 1999). Intra-company loans excluded trade credits in the Belgian data (IMF, 2003). A survey conducted by the IMF and OECD in 2001 on the implementation of the standards showed that, of the countries in this study, the UK had the greatest coverage of components in 'intra-company loans' with the BLEU countries not reporting long-term loans or trade credits as FDI, France not reporting financial leases or trade credits, and both Germany and the Netherlands not reporting financial leases (IMF/OECD, 2003). Earlier the *Godeaux Report* suggested that the failure to include short-term loans between affiliates as FDI and the failure to record cross-border real estate transactions were among the reasons for large global asymmetries between inward and outward data (IMF/OECD, 1992). This was followed by a survey in 1997, the results of which were published in the IMF/OECD (2000) *Report on the Survey of Implementation of Methodological Standards for Direct Investment*. This found big improvements in the inclusion of short-term financing but little improvement in the recording of cross-border real estate transactions.

To try to ascertain the effect of the inclusion of short-term loans and trade credits into the German FDI from 1996, these items have been omitted from the German inward flow series for 1996-2011, shown in Figure 2.1.

Figure 2.1 Germany Inward Flows: Effect of Adding Short-Term Loans and Trade Credits



Source: Deutsche Bundesbank Balance of Payments Statistics
Note: Converted from local currency to US $ using Eurostat period average exchange rates; other changes included a change to using the directional principle, this has not been considered here

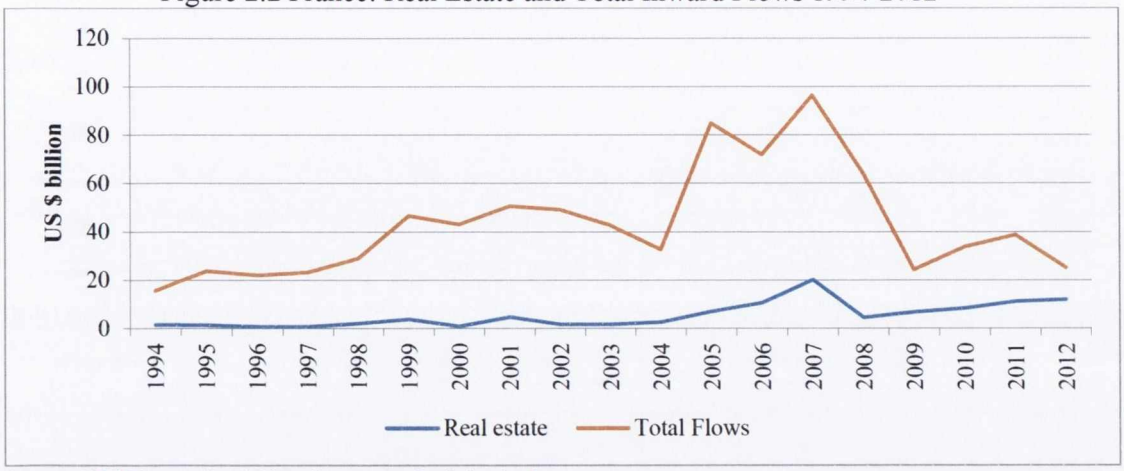
To estimate the total difference in the two series, the data were deflated using the GDP deflator for Germany with base year of 2005.[47] For the period 1996-2011, the inclusion of short-term loans and trade credits appears to have added an average of $52.20 billion (in 2005 terms) to annual inward FDI flows into Germany (the average annual inward flow increased from $46.92 billion if these are excluded to $99.12 billion). So the new series is, on average, more than double the magnitude of the old series.

As already noted, countries vary in the inclusion in their FDI data of certain items such as real estate transactions. Of the countries in this analysis, only the UK includes property bought on long-term leases in its DI, and coverage of private non-business real estate transactions varies (IMF, 2003). Lane and Milesi-Ferretti (2007) argue that foreign property investment has become an increasingly important part of FDI for some countries, so its inclusion in the data may become a more important issue over time. However, an examination of the size of inward real estate transactions compared to total inward FDI flows, for the period covered here, shows that they tended to be fairly stable and relatively small for countries other than France. For example, real estate is a substantial part of French inward FDI, accounting for 29 per cent of total inflows in 2011 and 48 per cent in 2012,

[47]Various deflators, if any, are used in the empirical literature: host country GDP deflators (see for example Pain, 1997), host country capital formation deflators (Hatzius, 2000), home country GDP deflators (see Egger and Pfaffermayer, 2004), US GDP deflator (see Schiavo,2007; De Ménil,1999), investment deflators (for example Mold, 2003) and the US CPI (Buch et al, 2003; Razin and Sadka, 2012). Some (Petroulas, 2007, for example) use real exchange rates in their analysis. It was decided to use host country GDP deflators here because we are most interested in possible real economy effects of inward FDI on the host country. The deflators are sourced from the *World Development Indictors*, World Bank. For this set of EU countries, all have the same base year of 2005.

despite real estate transactions being excluded.[48] Figure 2.2 shows the importance of real estate in French inward FDI flows over 1994-2012.

Figure 2.2 France: Real Estate and Total Inward Flows 1994-2012



Source: OECD International Direct Investment Statistics database.
Note: French data omits 'Private Purchases and Sales of Real Estate'; French real estate data are available from 1994 only.

Covering the period 1975-1995, Alfaro et al (2004:95) describe the IMF FDI flows they use, for example, as "the sum of equity capital, reinvested earnings, other long-term capital and short-term capital as shown in the balance of payments" however this is unlikely to be the case as the IMF series for many of the countries in this study only began to include RIE in 1994. Although for most countries, the RIE component is relatively small, this does mean there is a break in the time-series at this stage. Also, as we have seen, the inclusion of other items has varied across countries.

2.4.1.4 Measurement and Treatment of Indirect and Reverse Investments

Indirect investment refers to the investment by one DIE in another in the same group. BPM5 requires countries to operate a Fully Consolidated System (FCS) of accounting so that all DI relationships can be recorded. In 1997 OECD countries were found to have fairly poor compliance with applying FCS according to the recommendations (IMF/OECD, 2000). Of the six countries studied here, only the Netherlands – plus the UK from 2003 – fully apply FCS (IMF 2001, 2003). For Belgium, Germany and Luxembourg, FCS fully applies to 'equity' and 'intra-company loan' transactions, but not to RIE.

The FCS was not applied in France because of a lack of data on the indirect relationships between affiliated enterprises (IMF, 2001). In the case of the UK, FCS was only partially

[48] It should be noted that the large percentage in 2012 is due to a substantial fall in total inward flows. Note also that figures are often extensively revised for recent years, in 2009 and 2010 real estate accounted for 28 per cent and 25 per cent of total inward flows, respectively.

applied in earlier years as consolidated accounts were not required by law (IMF, 2001) but was fully applied from 2003 (IMF, 2003).

The size of investment may also be understated because of the way reverse investment is treated. Reverse investment occurs when a DIE that owns less than 10 per cent of its parent invests in that parent, through a loan for example. BPM5 requires that this should be deducted from inflows received from the parent. It is treated therefore as a disinvestment rather than as an outward investment.[49] This is known as 'the directional principle'. In this case inward FDI from the parent to the affiliate is actually a net inflow, smaller than the parent's original investment, and the reverse investment is not visible in the data.[50] This not only affects the size of FDI but also its geographical allocation. For example, if a Dutch subsidiary of a US-owned MNC lends to the US parent and owns less than 10 per cent of the parent, this investment is deducted from the US FDI into the Netherlands (thereby reducing the recorded size of US DI into the Netherlands).

As already noted, the *Godeaux Report* suggested that failure to properly classify reverse investment was among the reasons for global asymmetries between inward and outward data (IMF/OECD, 1992). Follow-up surveys found that many of the countries in this study recorded at least some types of reverse investment as portfolio investment (IMF/OECD, 2000, 2003). Reverse investments have occasionally been classified as 'portfolio' or 'other investments' in Belgium, Luxembourg, France and Germany (ECB, 2001; IMF 2001, 2003). For the BLEU, the directional principle was not used until 1999, if at all (ECB, 1999). Belgium only implemented the directional principle in 2007 (NBB, 2008) while also changing its collection and balance-of-payments production system. Luxembourg classifies reverse equity investments under portfolio investment (IMF, 2003). Up to 2003, reverse investments were not treated in the Dutch data in accordance with BPM5 (IMF, 2003).[51]

Countries differ also on the application of the directional principle to indirect investment. According to Terrein (2009) only a minority of countries including the US, Ireland and Sweden apply techniques to extend the directional principle to such transactions.[52] The application of the directional principle will affect geographical allocations and the recorded size of FDI flows.

[49] When the DIE owns 10 percent or more of the parent company it has established a direct investment relationship in its own right. In this case the loan constitutes an outward investment.
[50] 'Net' inward investment is sometimes erroneously interpreted as 'inward investment less outward investment'.
[51] ECB (2002) reports however that reverse equity investments were not common for the Netherlands and did not involve significant funds.
[52] BPM6 recommends the extension of the directional principle to loans between fellow enterprises.

2.4.1.5 Treatment of the Transactions of Special Purpose Entities

Although there is no single common definition, SPEs can be defined as entities (i) that are generally organised or established in economies other than those in which the parent companies are resident, (ii) that have few or no local operations, and (iii) are engaged primarily in international transactions (OECD, 1999). They are often foreign-owned financial holding companies but not all holding companies are SPEs (ECB/Eurostat, 2004). Different types of capital can be 'mixed or transformed' within an SPE, with funds coming from a number of different countries and companies (DNB, 2008:31). SPEs may be used for both pass-through and round-tripping investments. If a DIE resident in the one country receives funds from abroad from another enterprise in its group which it then lends on to another group company also based overseas, this should be recorded in both its inward and outward FDI, although no real contribution has been made to that economy. The inclusion of SPEs in balance-of-payments FDI data has implications, therefore, for the degree to which these data can serve as a proxy for MNC activity data. Furthermore, the inward and outward funds may be recorded differently in the balance-of-payments, sometimes appearing as portfolio flows rather than as DI, and the relative size of the components of DI are also affected by the activities of SPEs.[53]

BPM5 recommends that, in general, SPEs should be treated the same as other DIEs.[54] However, it recommends that for SPEs that have been established for the sole purpose of financial intermediation, only transactions associated with equity and permanent debt should be included as DI (IMF, 2003). Although the 1997 IMF/OECD survey on the implementation of the international standards found big improvements in the inclusion of SPE transactions (with more than 80 per cent of OECD countries reporting the establishment of SPEs in their countries) (IMF/OECD, 2000), Belgium, France, and Germany do not make this exclusion (Patterson et al, 2004); in the case of France this is because of the inability to distinguish such SPEs in the data (IMF, 2001). The UK fully follows BPM5 in its treatment of SPEs (IMF, 2001, 2003).

An enterprise established in a small country is more likely to qualify as an SPE because small countries have a larger 'rest of the world' (DNB, 2008) and SPEs are more significant for countries such as Belgium, Luxembourg and the Netherlands. Tax regimes are also

[53] In the Irish context, Forfás (2002) commented that inward flows to the International Financial Services Centre (IFSC) (which would approximate very roughly with SPEs flows) were DI but outward flows tended to be portfolio investment. The National Bank of Belgium (2007) commented that inward flows to Belgium were mainly equity and outward flows mostly intra-company loans, which it attributed to the existence of coordination centres.

[54] According to OECD (2008) transactions of SPEs are not be included in the detailed geographical and sectoral data produced by the OECD under BPM6.

likely to play a role however and tax regimes in small countries may be more configured towards attracting FDI because they lack the appeal of large domestic markets.

SPEs are included in the later BLEU data as no distinction is made between these and other enterprises (ECB, 1999). However, it is likely that they are largely omitted from earlier data as holding company transactions were recorded under 'Other Investment' rather than DI according to Eurostat (1984). Since their separation for balance-of-payments purposes in 2002, Belgium and Luxembourg have differed in their treatment of SPEs. As noted already, Belgium fully included all SPE transactions, contrary to BPM5 (IMF, 2001, 2003). In Belgium, special tax status was granted in 1982 to coordination centres (subsidiaries or branches of MNCs locating certain activities or invisible transactions in Belgium) (NBB, 2007). According to Bisciari and Piette (2007), coordination centres became the major source of corporate investment in Belgium from 1986, with the help of a special tax status (subsequently phased out by 2010 under pressure from the European Commission). When SPEs are included, inward and outward FDI flows for the period 2003-2005 come to about 10.6 per cent of Belgian GDP, declining to 5.8 per cent of GDP when they are excluded (Bisciari and Piette, 2007).

Luxembourg initially omitted SPEs from its national FDI flow data. Consequently, Eurostat began to collect these data from 1999 to add to the national data disseminated for Luxembourg. Luxembourg excludes SPE RIE transactions from its flow data and all SPE transactions from its position data (ECB, 2004). However, in more recent years some international series have begun to exclude all SPE transactions from the Luxembourg flow data. SPEs are very significant for Luxembourg, accounting for around 85 per cent of that country's total inward transactions data according to ECB (2007) and IMF (2003), although other sources have suggested a figure of around 95 per cent and this is borne out by the data shown in Table 2.1 below, which omits the RIE of SPEs.

Table 2.1 SPE Transactions as Percentage of FDI Inflows into Luxembourg

Year	SPE per cent of 'Equity and RIE'	SPE per cent of 'Intra-Company Loans'	SPE per cent of Total
2002	95.3	251.2	96.5
2003	96.9	94.9	96.7
2004	93.9	89.9	93.4
2005	86.1	100.3	94.4
2006	69.0	126.1	75.3
2007	120.4	86.9	114.8
2008	72.6	107.1	89.4
2009	95.3	131.4	89.9
2010	91.0	109.6	83.9
2011	95.3	104.2	96.8
2012	94.9	104.9	98.9
2013	97.4	-426.8	93.5
Annual Average	**92.3**	**73.3**	**93.0**

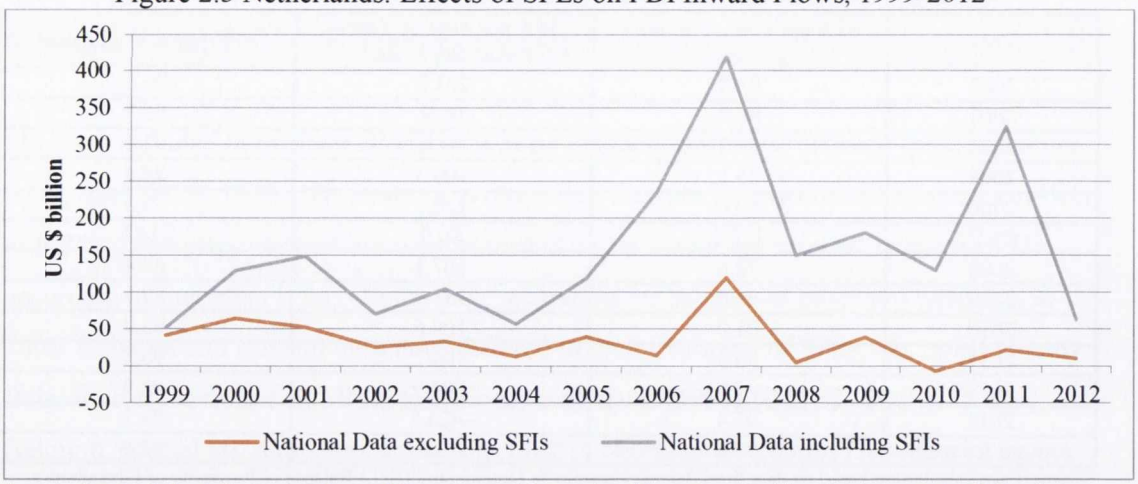
Source: Own calculations based on data from Banque Centrale de Luxembourg (BcL) Balance of Payments of Luxembourg
Notes: RIE for SPEs are not compiled (according to BcL). Figures for 2010- 2013 are provisional.

In the Netherlands, SPEs are known as Special Financial Institutions (SFIs). At the end of 2009, there were about 11,500 SFIs established in the Netherlands (DNB, 2010). FDI flows associated with SFIs are substantial but are considered to have relatively little importance for the real Dutch economy other than providing some jobs in financial services, affecting tax payments, and boosting some primary group activities in production, sales, redistribution, and R&D (DNB, 2003). Because of the weak relationship between these transactions and the real economy, they are netted out or 'neutralized' in the Dutch balance-of-payments data (ECB, 2004) but are recorded in the balance-of-payments of partner countries. As the Dutch Central Bank, De Nederlandsche Bank (DNB, 2000:27, Footnote 1) reported:

> "Such a net treatment of special financial institutions is not common practice in Europe. Other countries include the transactions of special financial institutions with the Netherlands in their balances of payments. In compiling the balance of payments for EMU, the ECB also includes the transactions of special financial institutions in gross (instead of net) figures"

From 1999, data including SPE transactions has been disseminated by the DNB but not reported to the international agencies. Figure 2.3 illustrates the substantial differences that arise when these are taken into account for the period 1999-2012. SFIs accounted for an average of 74 per cent of annual FDI into the Netherlands over the period 1999-2012.

Figure 2.3 Netherlands: Effects of SPEs on FDI Inward Flows, 1999-2012



Sources: Der Nederlandsche Bank Balance of Payments and International Investment Position data, converted to US$ using Eurostat period average exchange rates.

2.4.1.6 Differences in Geographical Allocations

BPM5 recommends using the 'debtor/creditor principle' whereby a country's FDI liabilities are allocated to the economies of residence of the non-resident creditors. This principle is used by France, Germany, the Netherlands, and the UK (IMF, 2003). Belgium and Luxembourg on the other hand have mainly used the 'transactor principle' whereby transactions are allocated to the country of residence of the non-resident party even if this is not the country of residence of the DIE or the direct investor (IMF, 2003). We saw above that the different treatments of reverse and indirect investments impact also on the geographical allocation of investments. Differences in geographical allocations are particularly relevant whenever bilateral FDI flows and stocks are used such as in gravity models. Discrepancies in the mirror data are investigated in Section 2.4.2.

2.4.1.7 Differences in Valuation of Stock Data

Stock data are also popular in the empirical literature. Analysis of the stock data here is more limited because of the poorer coverage, availability, and quality of the data. Most published series for stock data are shorter than for the flow data. In particular, of the six countries in our study, Belgium and Luxembourg (and the BLEU) have poor coverage and they have been largely omitted from the analysis as including them did not provide any additional insights. Also, as the purpose is to investigate possible pitfalls in the data, it was considered that a longer time-series is better, and that flow data are adequate to demonstrate the issues in many cases. However, the stock data potentially suffer from some additional pitfalls.

The measurement of stocks has been slower to conform to international standards than the measurement of flow data and many countries have only begun to report them in recent

years. Stock data remain prone to methodological breaks and the various differences in methodologies applied across countries and across time, that are found for the flow data. In addition, the stock data can suffer from two other problems, not applicable to flow data. First, stocks are sometimes estimated by accumulating flows. If the flows are added to an inaccurate stock figure then this inaccuracy is compounded, sometimes for a number of years. This estimation approach was more popular in the past when collection of stock data was less comprehensive. UNCTAD in its *World Investment Reports* has often resorted to calculating stocks by adding or subtracting flows for each year, and some countries report stock data which have been calculated by accumulating flows. Stock data produced in this way ignore valuation and depreciation changes which may be substantial. As noted earlier, Barry and O'Mahony (2005) argue that this resulted in misleading stock data for Ireland prior to 2000 because financial intermediation was included in later data but not in earlier data. When UNCTAD revised its estimates of earlier stock data by subtracting flow data for earlier years from later stock data it led to overestimation of UNCTAD's historical stock data for Ireland (Barry and O'Mahony, 2005).

However, because of the nature of data collection, stock data for some countries are first estimated in this way and later revised. The stock data for the most recent years in some sets of data for some countries is therefore unreliable. When comparing across countries, the extent to which these accumulations take place varies and also the stock years that flows are added to vary (it depends on the availability of stock data for the country in question). In the UNCTAD's *World Investment Report 1995*, for example, Netherlands inward stock for 1993 and 1994 (the figures used here) are estimated by adding flows to 1992 stock (the previous year), but stock for the BLEU were estimated by adding flows to 1989 stock (a number of years earlier).

Valuation changes are a second issue specific to stock data. The international recommendations in BPM5 say that market valuations are preferred, but most countries report stock data at book, or historic, value. Most countries report stock at book value only. Of the six countries in the sample: Germany, the UK, Belgium, and Luxembourg report book value only; France reports both the book and the market value; and the Netherlands reports the market value only (Lane and Milessi-Ferretti, 2003). Countries also apply different methods to the valuation of stocks (Lane and Milessi-Ferretti, 2003). Different treatment of valuation changes (exchange rate and price variations) are not taken into account over time and across countries. These changes can be substantial and quite volatile. Estimates for the UK for the end of 1999, for example, suggested that the market value of

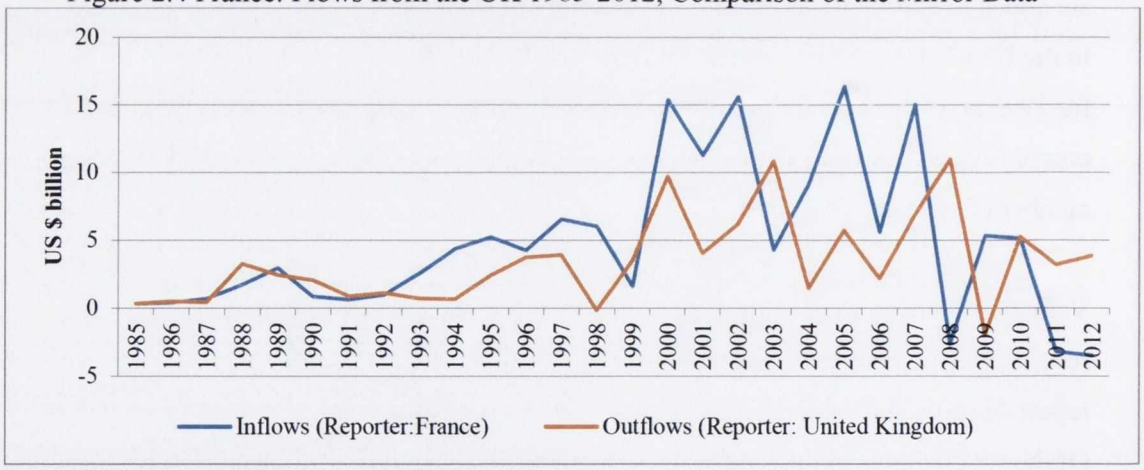
inward FDI stock was $671 billion, or 2.7 times, greater than the book value, this was attributed to growth in equity prices (Bank of England, 2000).[55]

Furthermore, some countries treat stock data differently from flow data in their methodological approach. Sometimes RIE or SPE transactions are omitted from stock data although they might be included in the flow data. Again this will affect the comparability of the data across countries.

2.4.2 Discrepancies in the 'Mirror Data'

Examining the mirror or counter-party data very clearly shows the differences that can arise in how countries measure FDI flows. Patterson et al (2004) point out that these discrepancies may result from differences in geographical allocations of FDI by the partner countries, rather than errors or gaps in reporting, and may not affect the aggregate FDI levels. However, geographical allocations are important for studies focussed on the geographical source or destination of FDI instead of on the aggregate level of FDI *per se*. The most extensive source of these data is the OECD *International Direct Investment Statistics* database. To get a picture of the differences that arise flows between large countries are looked at first. Figure 2.4 compares flows into France from the UK, as reported by France and the UK.

Figure 2.4 France: Flows from the UK 1985-2012, Comparison of the Mirror Data



Source: OECD International Direct Investment Statistics database.

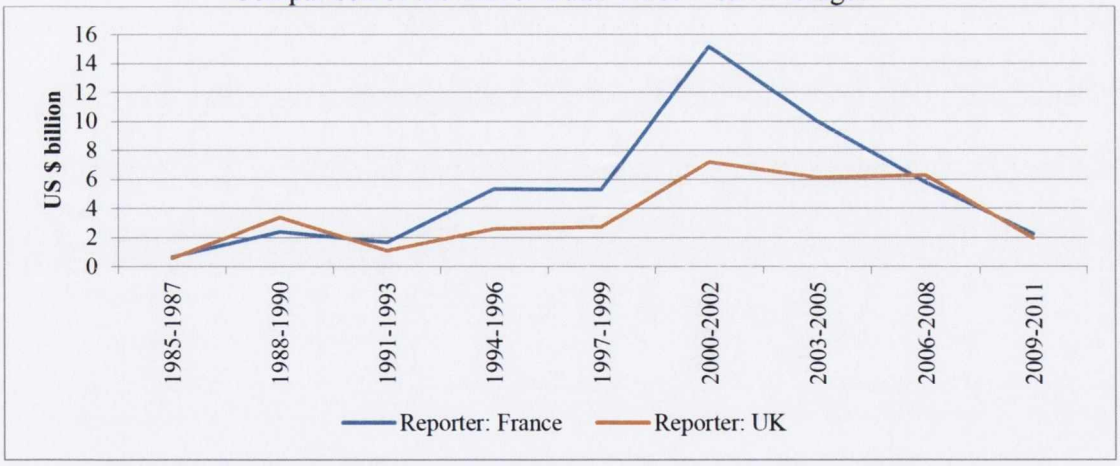
The French data are generally higher than those reported by the UK, with the largest percentage discrepancy arising in 1998. The flows for later years (after 1998) are also quite volatile. Volatility is common in flow data because of one-off large investments occurring

[55]Author's own calculation based on estimates reported in £ sterling by the Bank of England (2000), and applying Eurostat period average exchange rates. A similar calculation suggests the market value of outward FDI stock was $1705 billion, or 3.5 times, higher than the book value. The Bank of England calculations are an extension of the earlier estimates by Pratten (1992).

but has also increased over time which has been attributed by UNCTAD (2013) to the use of SPEs.

A study undertaken for the IMF (Timmermann, 1997) on the bilateral discrepancies in the balance-of-payments between Germany and Portugal suggested that the main causes were the differences in timing of recording of transactions, particularly those occurring near the beginning or end of a reporting period, and incorrect geographical allocations of the data. Consequently, the various series are deflated here using the host country GDP deflator, and averaged for the periods to make clearer comparisons. Some of the empirical literature also attempts to smooth out volatility by using three-year or five-year averages. Figure 2.5 shows three-year averages over the 1985-2011 period for flows into France from the UK. Averaging does smooth out some of the volatility, and probably makes sense when we consider the variability of timing of recording of data, but substantial discrepancies still exist.[56] The correlation between the series is 0.87 but falls to 0.37 when three-year averages are used instead. On average, over the period 1985-2011, France reported annual inflows from the UK to be $1.85 billion, or 52 per cent, higher than those reported by the UK. The difference for 1985-2012 was $1.55 billion or 44 per cent.

Figure 2.5 France: Flows from the UK 1985-2011,
Comparison of the Mirror Data: Three-Year Averages

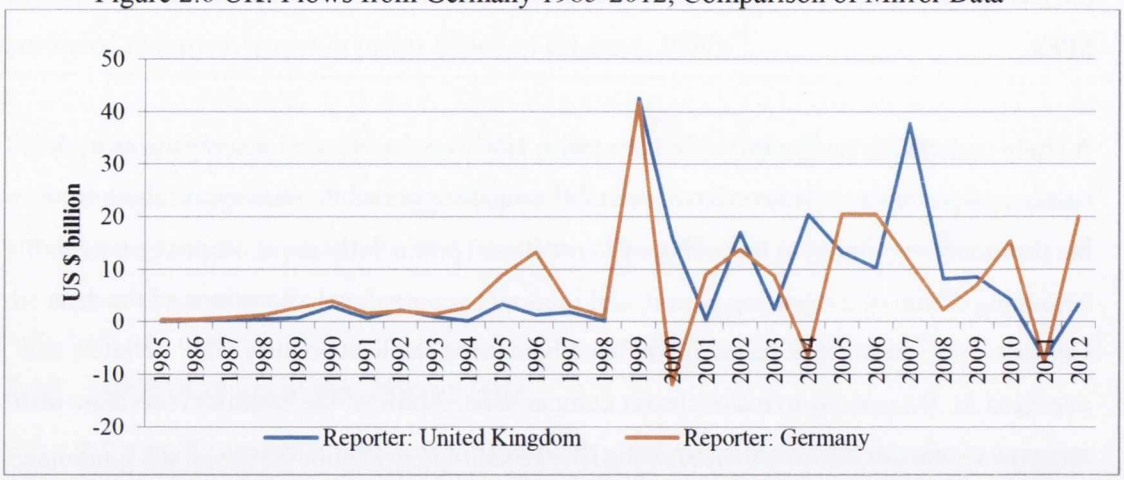


Source: OECD International Direct Investment Statistics database; World Development Indicators, World Bank (base year 2005).

Similarly, Figure 2.6 compares flows into the UK from Germany as recorded by the UK and Germany. In general, the data reported by Germany are larger and more volatile than those reported by the UK.

[56] For 1985-2011 the standard deviation for the annual French data was $5.5 billion falling to $4.4 billion when three-year averages are used. The corresponding figures for the UK data were $3.2 billion and $2.3 billion respectively.

Figure 2.6 UK: Flows from Germany 1985-2012, Comparison of Mirror Data

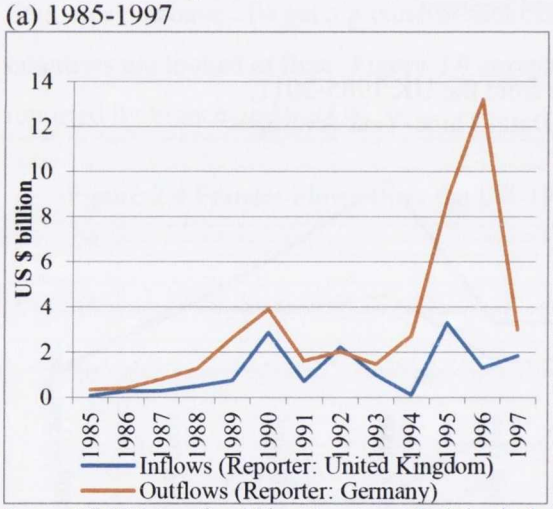


Source: OECD International Direct Investment Statistics database; World Development Indicators, World Bank (base year, 2005).

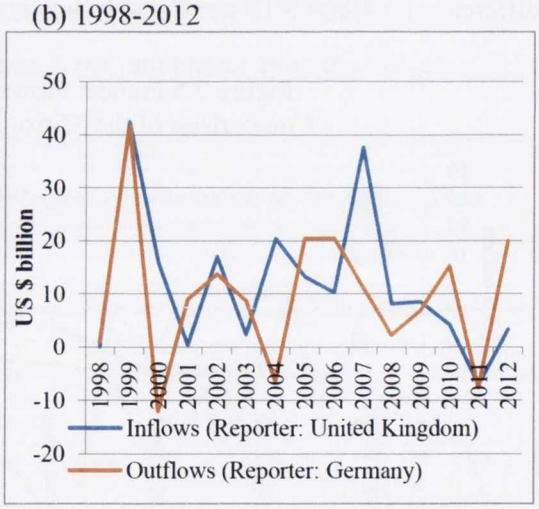
When the period is split into two, it becomes clearer that pre-1998, the German data are indeed higher (see Figure 2.7a) but this is not the case in the later period (see Figure 2.7b). However, both series are more volatile in the later period.

Figure 2.7 UK: Flows from Germany, Comparison of Mirror Data

(a) 1985-1997



(b) 1998-2012

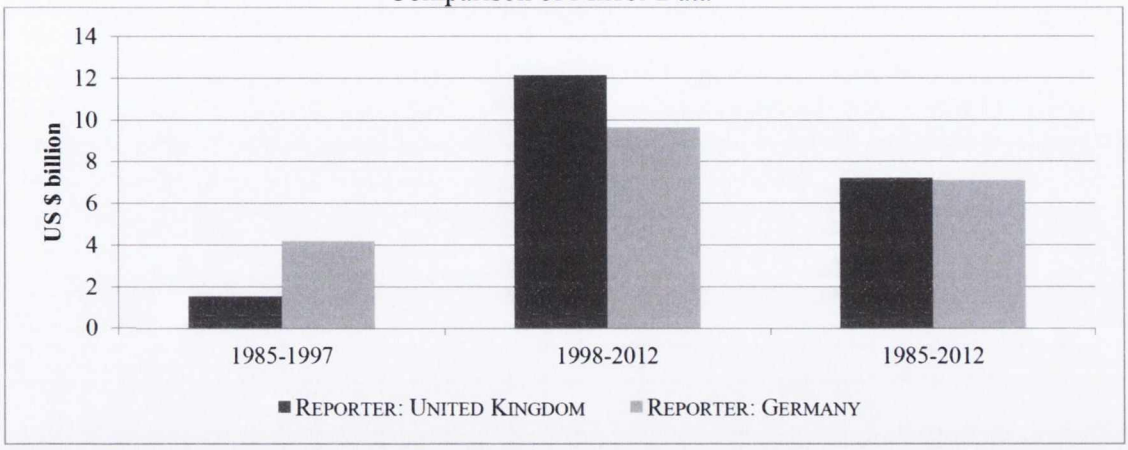


Source: OECD International Direct Investment Statistics database.

It can be seen that some of the discrepancy may be due to timing. Again both series are deflated by the host country (UK) GDP deflator and Figure 2.8 shows that, when the 1985-2012 series is deflated the discrepancies have almost entirely disappeared. This is not the case however for the two sub-periods, 1985-1997 and 1998-2012. When the series are deflated, German data are higher in the earlier period (by an annual average of $2.65 billion), but for 1998-2012 the UK data are higher (by an annual average of $2.5 billion at

2005 prices). However, the correlation between the two series is not particularly high at 0.52 for the 1985-2012.[57]

Figure 2.8 UK: Average Annual Flows from Germany (Deflated to 2005), Comparison of Mirror Data



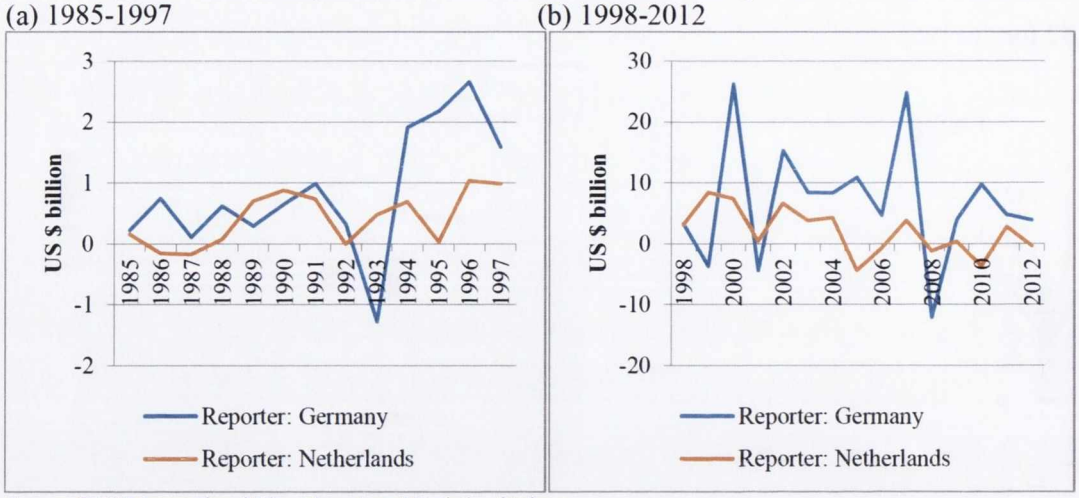
Source: OECD International Direct Investment Statistics database; World Development Indicators, World Bank (base year 2005).

Figure 2.9 provides examples of flows recorded between a large economy (Germany) and a small economy (Netherlands). Bilateral FDI flows between these two countries have been the subject of an IMF report (IMF, 1996) based on work undertaken by the Dutch Central Bank, De Nederlandsche Bank (DNB). In this report, differences were found in the estimation procedures used by the two countries, in the treatment of SPE transactions (considered above) and in the definition of DI used by each country. The report also found large discrepancies in the recorded RIE possibly due to 'fiscal considerations' (IMF, 1996) but also due to the different definitions of DI used. Prior to 1996, the German data omitted short-term loans, and the equity share required for inclusion as DI was 20 per cent until the 10 per cent rule was adopted in 1999 (IMF, 1996; OECD, 1999; Deutsche Bundesbank, 1995,1999). Germany also recorded reverse investment differently until 1996, with equity transactions recorded as portfolio investment for example (IMF, 2001; Deutsche Bundesbank, 2014). For most of the period 1985-2012 Germany's recorded inflows from the Netherlands are higher than the Dutch recorded outflows. Splitting the period in two, we can see more clearly that this is particularly the case for the period from 1998. The Netherlands, as we saw earlier, omits SPE transactions from its data so Dutch data can be expected to be lower than that reported by partner countries.

[57] The volatility, measured by the standard deviation, increased substantially in the period 1998-2012 being 13.9 for both series (compared with 1.3 for the UK data and 1.4 for the German data in the 1985-1997 period). This volatility may be a feature of the changing nature of FDI however, rather than of methodological difference. UNCTAD (2013) has linked it to the use of SPEs.

Figure 2.9 Germany: Flows from the Netherlands, Comparison of Mirror Data

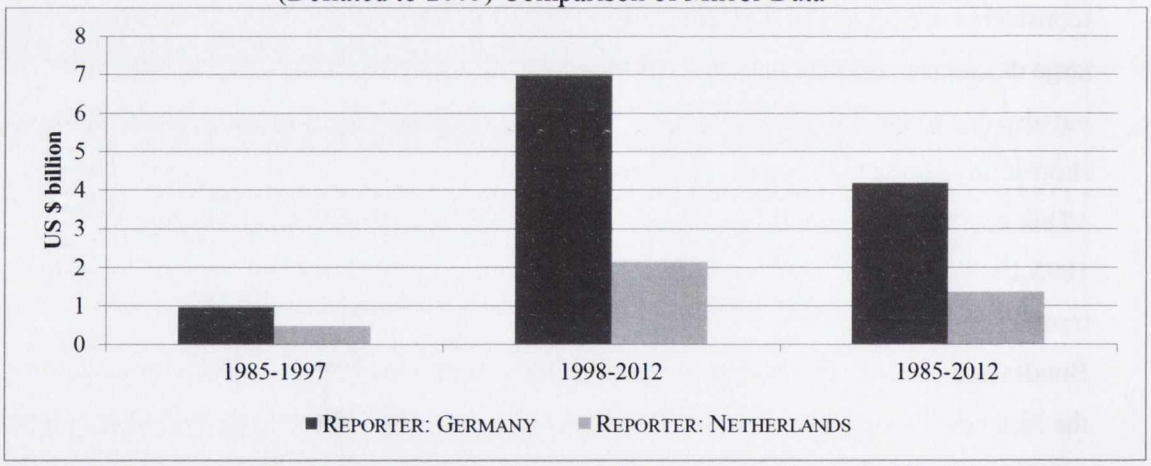
(a) 1985-1997 (b) 1998-2012



Source: OECD International Direct Investment Statistics database.

After applying the GDP deflator for the host country (Germany), we can see more clearly that the German data are higher, particularly in later years. On average the German data are $2.82 billion higher annually over the years 1985-2012 at 2005 prices. To put this in perspective, this makes the German data, on average, about two times the value of the Dutch figures (double the size for 1985-1997 and more than triple the size for 1998-2012). The differences are displayed graphically in Figure 2.10.

Figure 2.10 Germany: Average Annual Inward Flows from the Netherlands (Deflated to 2005) Comparison of Mirror Data



Source: OECD International Direct Investment Statistics database; World Development Indicators, World Bank (base year, 2005).

German outward data to the Netherlands are also higher than the Dutch-reported data, although the difference is not as great. Germany's recorded outflows were also substantially more volatile than Dutch recorded inflows. A comparison of the mirror flows into the Netherlands from Germany is shown in Figure 2.11.

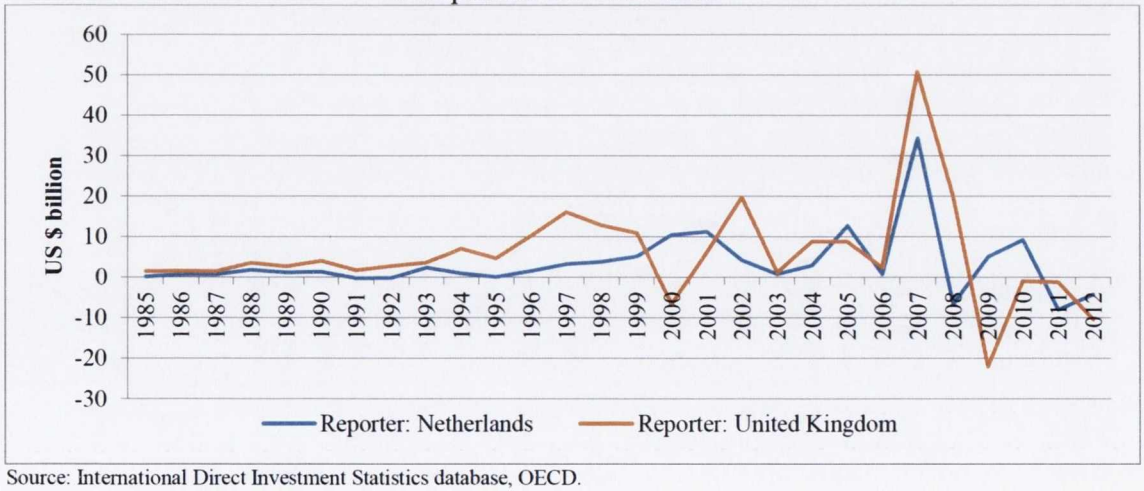
Figure 2.11 Netherlands: Inward Flows from Germany 1985-2012, Comparison of Mirror Data

Source: OECD International Direct Investment Statistics database.

The discrepancies are not as great as they were in the other direction, however, with the German data being an average of just $1.1billion or 33 per cent higher than the Dutch data, on average, over the period 1985-2012 with the relative discrepancy actually falling in the later years.

Patterson et al (2004:16) argue that the main difference between the Dutch and UK data are the transactions of Dutch SFIs which constitutes pass-through investment, concluding that "in effect the Dutch data suggest that most of the large UK investment in the Netherlands is ultimately employed in third countries, with the Netherlands acting as a conduit for tax or other reasons".

Figure 2.12 Netherlands: Inward Flows from the UK 1985-2012, Comparison of Mirror Data



Source: International Direct Investment Statistics database, OECD.

Figure 2.12 shows the two mirror series for flows into the Netherlands from the UK. As expected, UK data are generally higher by an average of $2.97 billion per annum or 80 per

cent higher, when deflated, over the 1985-2012 period. Similar large discrepancies arise in the vast majority of bilateral cases studied. Connolly (2005) warns that these are highly likely to appear unless survey reporting systems are used because settlements systems cannot record all components of FDI accurately. As noted earlier, only the UK. and to a lesser extent the Netherlands. have used such systems over the period studied here. Connolly (2005) and Stephan and Pfaffmann (2001) also point out that disaggregated data are less reliable than the aggregated data due to differences in deciding geographical (and sectoral) allocations. The correlation between series may also be relevant, although correlations can be high due to the series moving together while substantially quantitatively different. Table 2.2 is a correlation matrix for the mirror flows for the period 1985-2012.

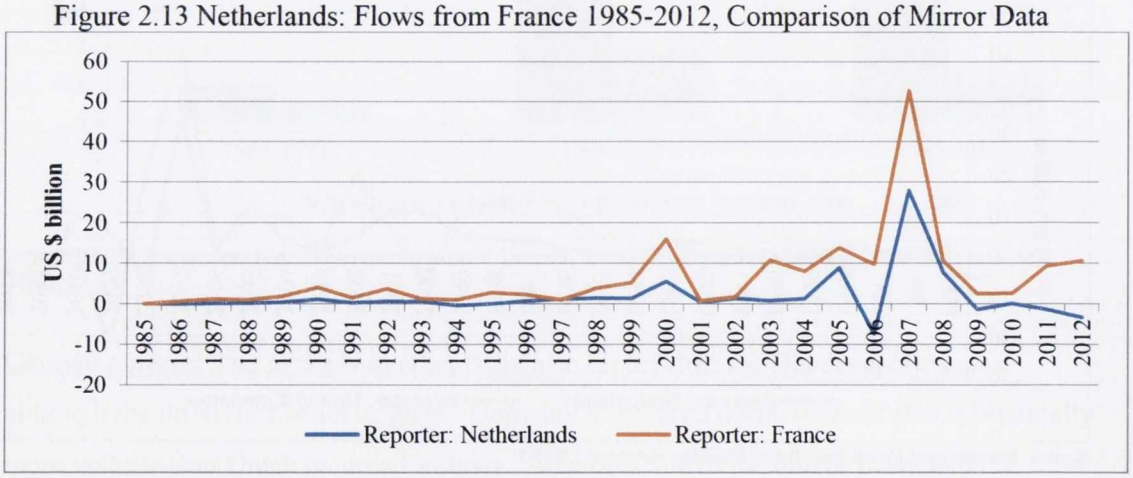
Table 2.2 Correlation Matrix for Flows, 1985-2012

	Outward Flows from:			
Inward Flows to:	**France**	**Germany**	**UK**	**Netherlands**
France		0.19	0.32	0.15
Germany	0.67		0.91	0.38
UK	0.82	0.52		0.89
Netherlands	0.85	-0.12	0.56	

Source: International Direct Investment Statistics database, OECD.

In the matrix in Table 2.2, the cells that have the highest correlations for row or column are shaded; those with the darker shading are highest in both their row and column. Best correlations tend to be with the UK data. The only exception is the Netherlands inward flows from France which are highly correlated with the counter-party outward flows from France to the Netherlands at 0.85. However, it can be seen in Figure 2.13 that the two series are far from equal, when deflated (to 2005) the average difference is $4.98 billion per annum. Comparing totals for the period, the French data are 278 per cent higher.

Figure 2.13 Netherlands: Flows from France 1985-2012, Comparison of Mirror Data



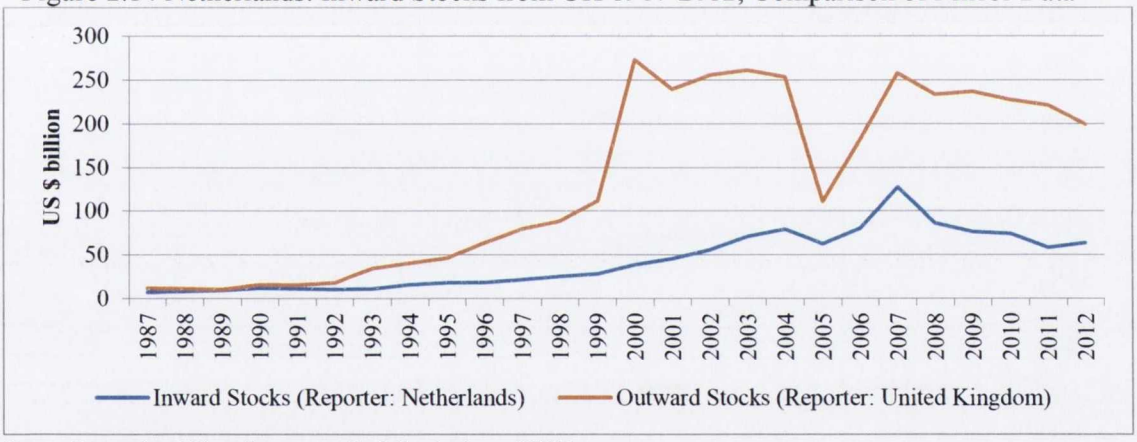
Source: International Direct Investment Statistics database, OECD.

Stock data have poorer coverage with a lot of missing values, especially for geographical and sectoral breakdowns. Pica and Rodríguez-Mora (2011) use bilateral FDI stocks for 24

OECD countries over the period 1981-2002 including France, Germany, the Netherlands, and the UK in their panel. Although the data available at the time of writing only start at 1985, or later for some countries, making it impossible to make a direct comparison, we can nonetheless see that there are several issues with respect to the use of these data.

The Dutch stock data again omit SPEs and are valued at market value rather than the book valuations used by most of the countries in this study. Comparing the Netherlands inward stocks from the UK, as reported by each country, in Figure 2.14, the UK data can be seen to be very substantially higher. After deflation, the average difference is $95.77 billion or 213 per cent per annum. Over the period 1987-2002 this difference was $70.9 billion or 275 per cent. Similarly, for the period 1985-2002, Germany, for example, reported its stocks from the Netherlands on average 200 per cent higher (and its stocks to the Netherlands 75 per cent higher) than they were reported by the Netherlands.

Figure 2.14 Netherlands: Inward Stocks from UK 1987-2012, Comparison of Mirror Data

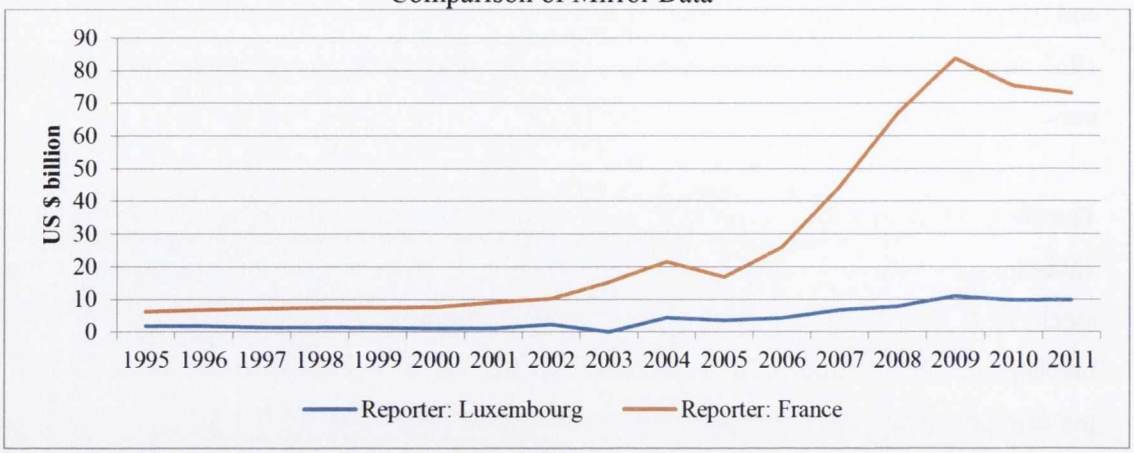


Source: International Direct Investment Statistics database, OECD.
Note: Position data with geographical breakdown were only available for the UK from 1987.

Data coverage is especially poor for Belgium and Luxembourg. Geographically disaggregated stock data are available for Belgium only from 2008. Luxembourg disseminated geographically disaggregated stock data from 1995, with a break in 2003. Luxembourg omits SPEs from its stock data but not from its flow data and the lower FDI positions reported by Luxembourg are evident in the data. Until 2005 Luxembourg also omitted intra-company loans from its stock data (OECD iLibrary metadata). There are a lot of missing values reported by Luxembourg with the UK which are attributed to confidentiality requirements. Figure 2.15 shows Luxembourg's inward position with France for 1995-2011.[58] When deflated, the average annual difference in the two series is $22.34 billion with the French data being 549 per cent higher on average.

[58] This example was chosen as it has the widest possible coverage with the longest time-series and least missing values.

Figure 2.15 Luxembourg: Inward Stocks from France 1995-2011, Comparison of Mirror Data



Source: International Direct Investment Statistics database, OECD.
Note: There is a break in the Luxembourg series in 2003; this series was also only available to 2011.

Table 2.3 shows the correlation matrix for the mirror stock series for the period 1989-2011. Belgium and Luxembourg have been omitted due to the poor data coverage. Correlations are mostly high amongst the mirror data, although some series deviate quite substantially while having the same general trend. This suggests consistency in the measurement differences between the series.

Table 2.3 Correlation Matrix for Stocks, 1989-2011

	Outward Stocks from:			
Inward Stocks to:	**France**	**Germany**	**UK**	**Netherlands**
France		0.96	0.96	0.96
Germany	0.98		0.95	0.89
UK	0.97	0.93		0.97
Netherlands	0.98	0.91	0.83	

Source: International Direct Investment Statistics database, OECD.
Note: The period 1989-2011 allows a comparison to be made, these are the years for which all series are complete.

The correlations are not always as strong throughout the full period. Dividing the time period at 1998, correlations are found to be weaker in the earlier years, as shown in Table 2.4.

Table 2.4 Correlation Matrix for Stocks, 1989-1997

	Outward Stocks from:			
Inward Stocks to:	**France**	**Germany**	**UK**	**Netherlands**
France		0.74	0.88	0.91
Germany	0.74		0.76	0.69
UK	0.68	0.84		-0.01
Netherlands	0.77	0.80	0.95	

Source: International Direct Investment Statistics database, OECD.

The generally weaker correlations in the earlier years may be attributable to the poorer recording and reporting of stock data (which were less comprehensive to flow data) but may also be due to different valuation adjustments. Correlations are much stronger for the later

years, as seen in Table 2.5. The UK FDI stocks received from the Netherlands are noteworthy as they have a correlation coefficient close to zero prior to 1998 but a strong positive correlation for 1998-2011.

Table 2.5 Correlation Matrix, 1998-2011

	Outward Stocks from:			
Inward Stocks to:	**France**	**Germany**	**UK**	**Netherlands**
France		0.96	0.91	0.92
Germany	0.98		0.71	0.95
UK	0.92	0.85		0.94
Netherlands	0.97	0.85	0.48	

Source: International Direct Investment Statistics database, OECD.

2.4.3 Discrepancies in the Country-Specific FDI Data Reported by Different International Organisations

Now turning to a country-by-country examination of differences between the various data sources: Because sources differ in the speed and extent of the revision of data, the time-series in this section are only analysed to 2010, as recent years tend to be most subject to revision and inclusion of these years might give a misleading impression of discrepancies between the series.

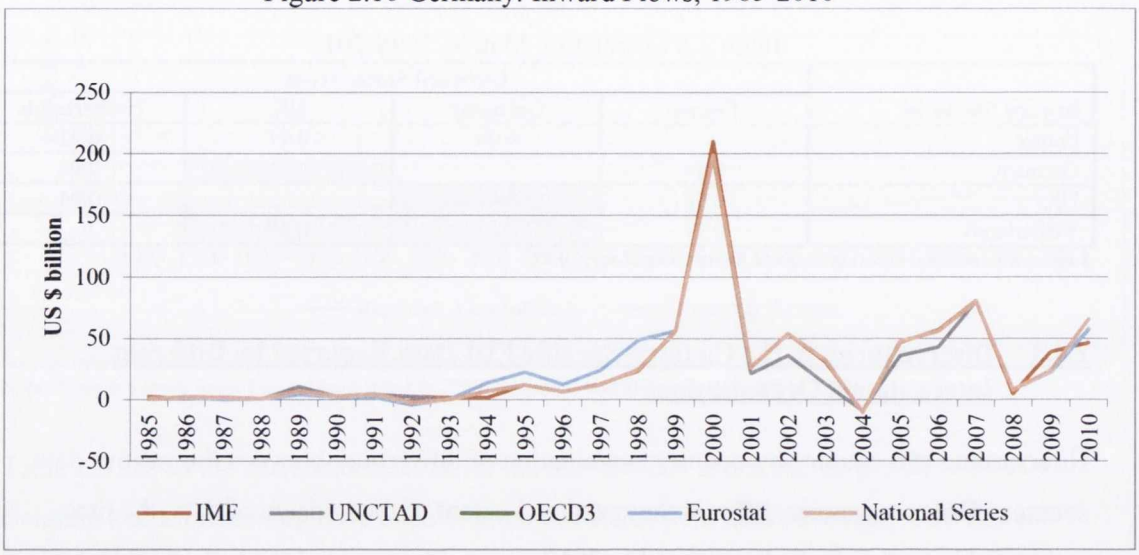
2.4.3.1 Germany

Changes in methodology tend to coincide with obvious breaks in the German time-series. As Grosch (2003) points out, the ownership threshold was reduced from 25 per cent to 20 per cent of voting rights in 1989 and in that year Germany also began to include direct loans of other associated enterprises (besides the direct investor). The reporting balance sheet threshold was increased in 1993 and again in 1999, and in the latter year the ownership threshold was again lowered, this time to 10 per cent.

BPM5 was implemented in 1999 with many changes backdated to 1996 or, where possible, earlier (Deutsche Bundesbank, 1999). BPM5 changes included the adoption of the lower ownership threshold, the inclusion of short-term loans and trade credits under DI (IMF, 2003), the application of the directional principle, and the adoption of the accrual principle in the calculation of RIE. Despite the substantial backdating of the changes (IMF, 2003), the Deutsche Bundesbank (1999:54) claimed that "as significant methodological changes have been made in the recording and presentation of direct investment the recent figures are not fully comparable with those of previous years." Structural breaks can therefore be expected in the German time series although German reunification in 1990 is generally assumed to have had little effect on the time-series. Figure 2.16 reports FDI flows into

Germany from the various data sources. For clarity, for now, OECD3 is the only OECD series shown.

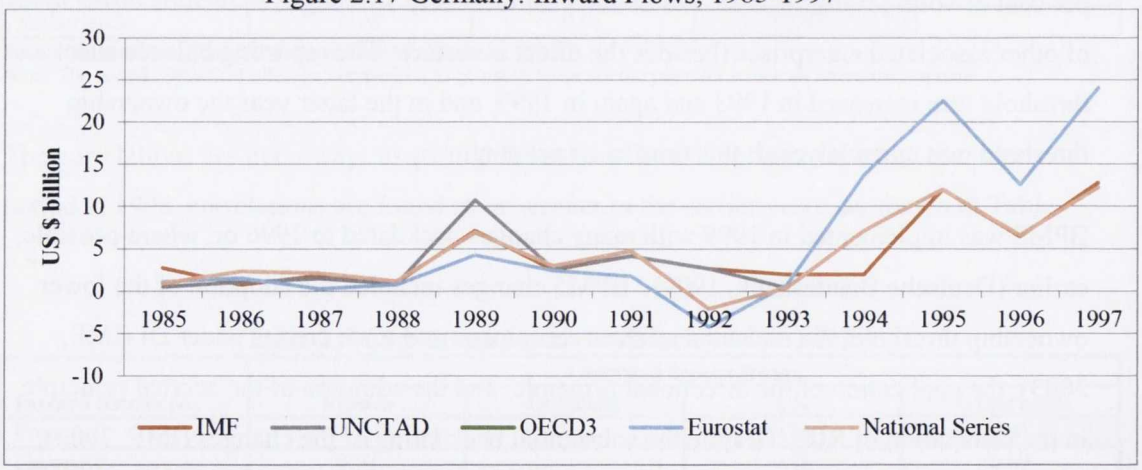
Figure 2.16 Germany: Inward Flows, 1985-2010



Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; UNCTAD Handbook of International Trade and Development Statistics 1996/1997; OECD International Direct Investment Statistics Yearbooks, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years; Deutsche Bundesbank Statistics database.
Notes: Data reported in local currencies converted to US$ using Eurostat period average exchange rates; 'OECD3' here refers to the updated/revised series.

From 1998, the time of a major surge in FDI, the series are relatively similar. In order to avoid dwarfing earlier discrepancies, Figure 2.17 shows flows over the period 1985-1997.

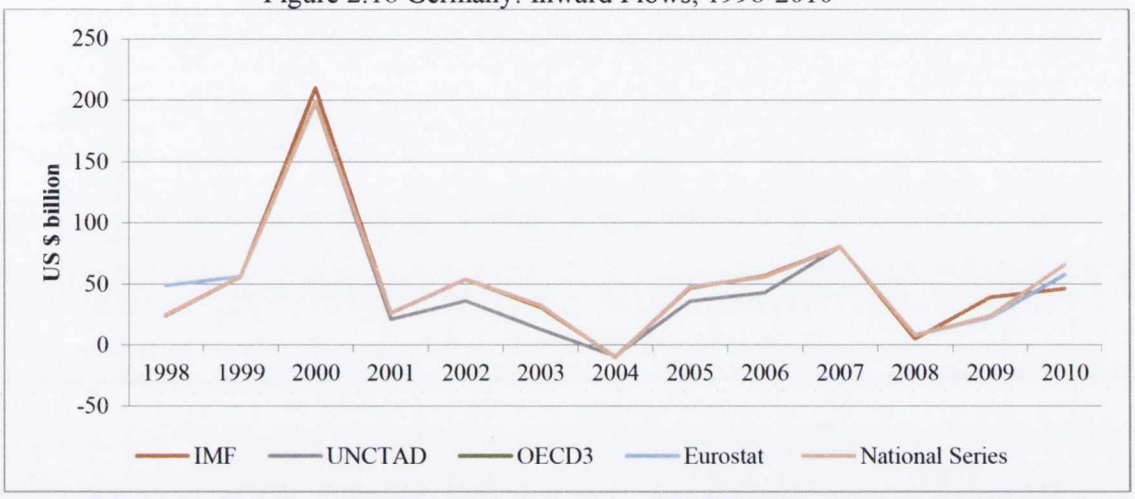
Figure 2.17 Germany: Inward Flows, 1985-1997



Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; OECD International Direct Investment Statistics Yearbooks, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years; Deutsche Bundesbank Statistics database.
Notes: Data reported in local currencies (OECD2 and Eurostat) converted to US$ using Eurostat period average exchange rates; 'OECD3' here refers to the updated/revised series.

Many of the differences are attributable to different timing of recording and revision of data, or to the use of different exchange rates to convert data. However, the Eurostat series appears quite different than the others prior to 1999. The Eurostat series does not include RIE until 1992, and tends to be lower than the other series until then. For 1992-1998, the Eurostat series continues to deviate from the other series, only aligning with them from 1999. Figure 2.18 covers the period 1998-2010.

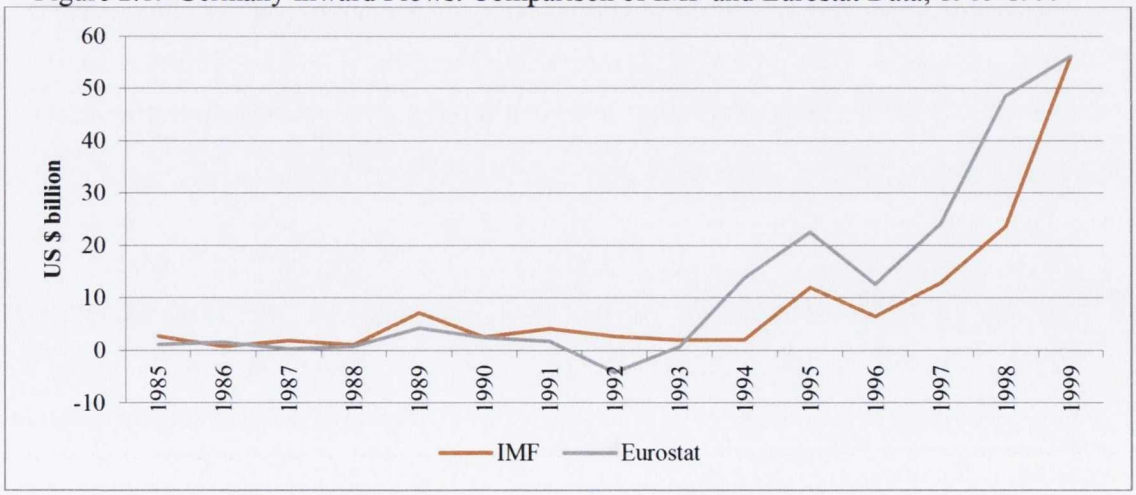
Figure 2.18 Germany: Inward Flows, 1998-2010



Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; OECD International Direct Investment Statistics Yearbooks, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years; Deutsche Bundesbank Statistics database.
Notes: Data reported in local currencies (OECD2 and Eurostat) converted to US$ using Eurostat period average exchange rates; 'OECD3' here refers to the updated/revised series.

For a clearer comparison between the Eurostat series and the other series, Figure 2.19 compares the Eurostat and IMF series for 1985-1999.

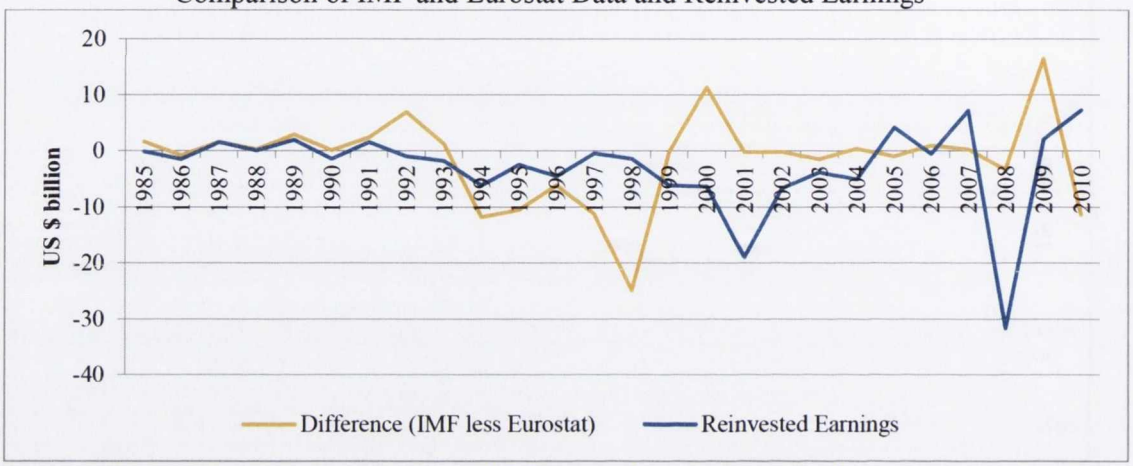
Figure 2.19 Germany Inward Flows: Comparison of IMF and Eurostat Data, 1985-1999



Sources: IMF Balance of Payments Statistics Yearbooks, various years; Eurostat Foreign Direct Investment Yearbooks, various years.
Notes: Data reported in local currencies (Eurostat) converted to US$ using Eurostat period average exchange rates.

Before 1992, the difference between the two series can be explained by the size of RIE which are not included in the Eurostat data at this stage (see Figure 2.20). From 1992, however, the two series continue to be different with the Eurostat data noticeably higher over the years 1993-1998. When deflated, the Eurostat inward flows for the years 1993-1998 are $11.2 billion higher than, or more than double, the flows reported in the IMF series on an annual average basis over this period.

Figure 2.20 Germany Inward Flows 1985-2010,
Comparison of IMF and Eurostat Data and Reinvested Earnings



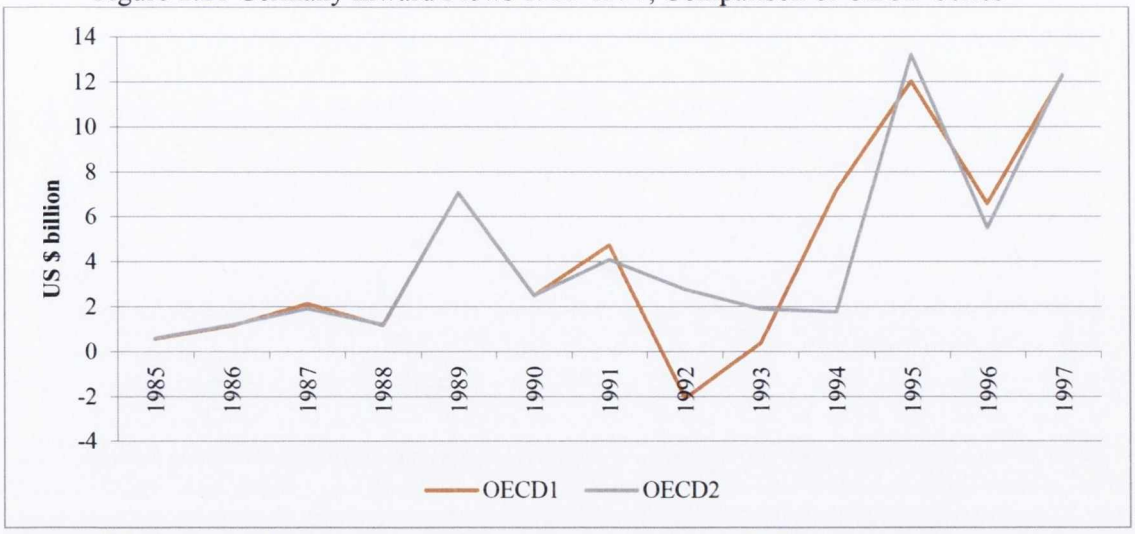
Sources: Author's own calculations based on data from IMF Balance of Payments Statistics Yearbooks, various years; Eurostat Foreign Direct Investment Yearbooks, various years.
Notes: Data reported in local currencies (Eurostat) converted to US$ using Eurostat period average exchange rates.

According to IMF (2003) there are no differences between the national data and that reported to the IMF and OECD for publication. As we will see, this does not appear to be the case for earlier years. National data may have been backdated substantially further than those reported by the agencies, while this same IMF document acknowledges that differences can arise because of the 'reporting cycle', with quarterly data reported to the IMF and annual data to the OECD.[59] According to Patterson et al (2004) an IMF/OECD survey in 2002 found that Germany excluded real estate and reverse investment from data reported to the OECD but not from the data reported to the IMF.

The three OECD series are not all equal for Germany over the period 1985-2004, in particular for the years 1992-1996. The OECD3 series aligns with OECD1 but not OECD2. This suggests that the disaggregated data may be less accurate over time possibly due to fewer, or less speedy, revisions (as the data have a greater level of detail) or due to different sources being used. OECD1 and OECD2 are compared in Figure 2.21.

[59] The Deutsche Bundesbank reports the German national data on a monthly basis. The national data reported here have been aggregated by the authors from the monthly series.

Figure 2.21 Germany Inward Flows 1985-1997, Comparison of OECD Series



Sources: OECD International Direct Investment Statistics Yearbooks, various years; OECD International Direct Investment Statistics database.
Notes: Data reported in local currencies (OECD2) converted to US$ using Eurostat period average exchange rates.

OECD2 and Eurostat tend to overshoot the other series, on average, especially in the later time period (from 1998). However, closer inspection of OECD2 series suggests the problems are in the years 1999 and 2000 which were recent years in the publication where they were recorded and therefore subject to probable revision. Deflating the data, using the German GDP deflator, and comparing averages over the three periods in Table 2.6 we can see that the Eurostat data are slightly higher on average, with UNCTAD lower in the later period (1998-2010).

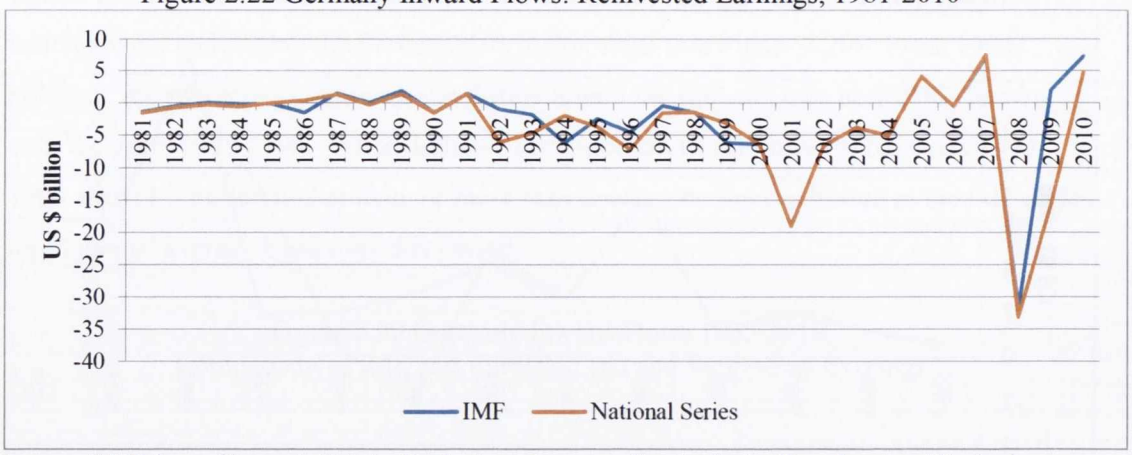
Table 2.6: Germany: Average Annual Inward Flows (US $ billion) (deflated to 2005)

	IMF	UNCTAD	OECD1	OECD2	OECD3	Eurostat	National Series
1985-2010	28.95	26.07	na	na	28.45	30.38	28.85
1985-1997	5.33	5.75	5.06	5.13	5.25	7.09	5.26
1998-2010	52.57	46.40	na	na	51.64	53.67	52.44

Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years; Deutsche Bundesbank Statistics database.
Notes: Data reported in local currencies converted to US$ using Eurostat period average exchange rates; average annual flows for the periods shown; GDP deflator for Germany from World Development Indicators, World Bank (base year 2005).

Until 1990, OECD3 tends to overshoot all the other series, in some cases very considerably. For example, in 1989 it is almost double the Bundesbank, IMF and OECD1 and OECD2 figures. The data seen here suggest that UNCTAD began to use national rather than IMF data from 1993. Some of the discrepancies occur because of different ways of calculating or including RIE, although RIE are relatively small compared to the other components of German FDI inflows. Figure 2.22 compares RIE from the IMF and German Bundesbank:

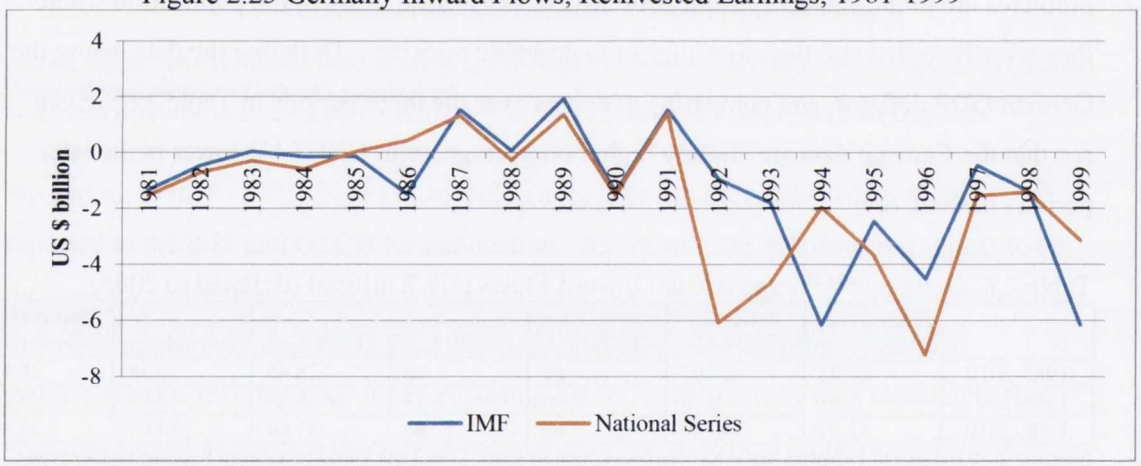
Figure 2.22 Germany Inward Flows: Reinvested Earnings, 1981-2010



Sources: IMF Balance of Payments Statistics Yearbooks, various years; Eurostat Foreign Direct Investment Yearbooks, various years; Deutsche Bundesbank Statistics database.
Note: Eurostat data converted to US$ based on Eurostat exchange rates.

The main discrepancies are prior to 2000 and also in 2009 and 2010, the later years possibly due to one series being revised earlier than the other. Figure 2.23 examines the period prior to 2000 more closely.

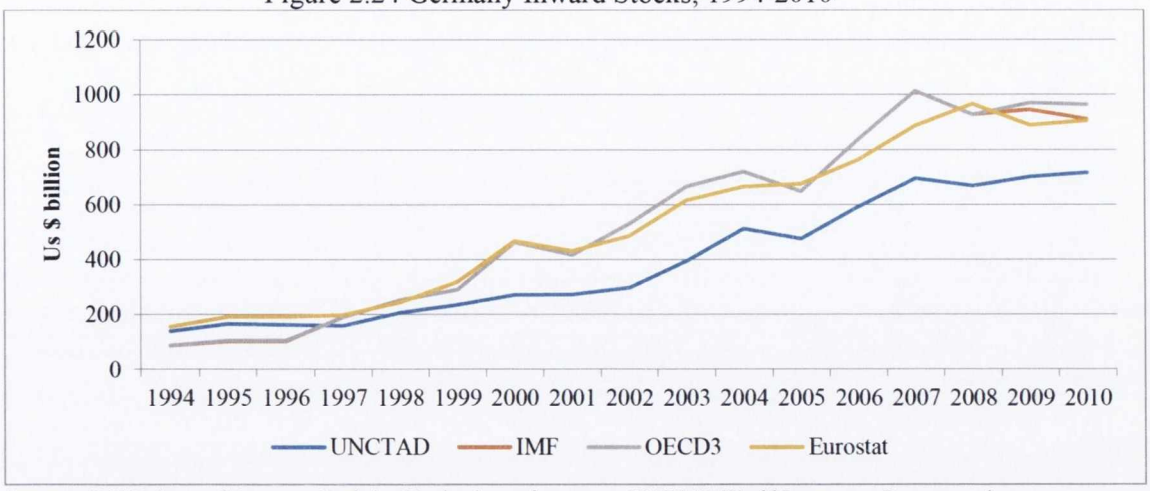
Figure 2.23 Germany Inward Flows, Reinvested Earnings, 1981-1999



Source: Deutsche Bundesbank Statistics database.
Note: Deutsche Bundesbank data converted to US$ using Eurostat period average exchange rates.

Deflating the two series finds that, on average, RIE inflows were negative for both series for 1981-1999, with an annual average size of RIE inflows in the IMF series of -$1.39 billion (in 2005 terms) compared to an average of -$1.78 billion in the Bundesbank data. As part of its implementation of BPM5 in 1999, Germany changed to the accrual principle of RIE measurement (Bundesbank, 1999) with RIE calculated by deducting dividends distributed (monthly) from the estimated profits for that year. RIE began to be recorded for the period in which they are earned (IMF, 2001) whereas previously they were allocated to the year after they were earned as they were derived from balance sheet information (Bundesbank, 1999).

Figure 2.24 Germany Inward Stocks, 1994-2010



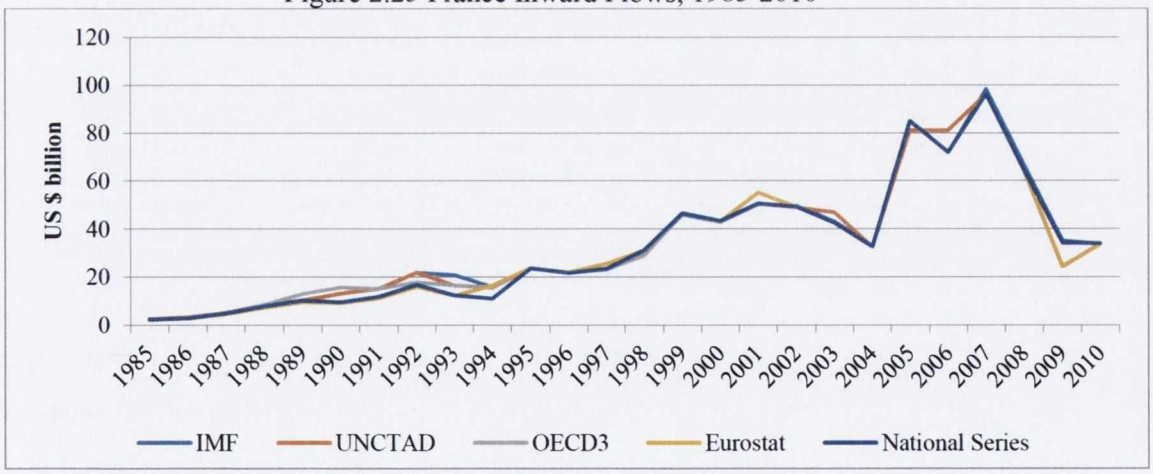
Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years.
Notes: Data reported in local currencies converted to US$ using Eurostat period average exchange rates

Briefly looking at the main stock time-series in Figure 2.24, discrepancies can again be seen, with UNCTAD data generally substantially lower than the other series. The IMF series is almost identical to OECD3 so is not evident in the chart.

2.4.3.2 France

For France the international series are quite similar although, as a large economy, minor differences can be very large in monetary terms. Figure 2.25 compares the various international series for 1985-2010.

Figure 2.25 France Inward Flows, 1985-2010



Sources: IMF Balance of Payments Statistics Yearbooks; UNCTAD World Investment Reports; OECD International Direct Investment Statistics Yearbooks, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years; Banque de France Balance of Payments database.
Note: Data in local currencies converted to US$ using Eurostat average period exchange rates.

In Table 2.7 the various OECD series are deflated by the GDP deflator for France over the years 1982-2003 and then 2007-2010, no substantial difference between them was found, on average so the OECD1 and OECD2 series are omitted from now on in this analysis.[60]

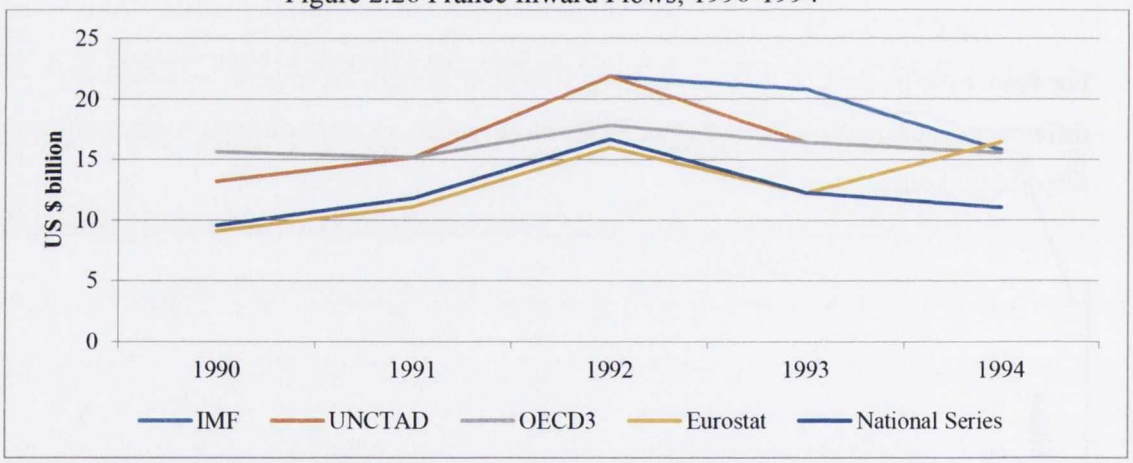
Table 2.7 France: Average Annual Inward Flows (US $billion) in 2005 terms

Period	OECD1	OECD2	OECD3
1982-1997	14.24	14.21	14.25
1998-2003	48.25	48.77	47.07
1982-2003	31.25	31.49	30.66
2007-2010	50.47	50.47	51.16

Sources: OECD International Direct Investment Statistics Yearbooks, various years; OECD International Direct Investment Statistics database; World Development Indicators, World Bank.
Note: Data in local currencies converted to US$ using Eurostat average period exchange rates; there are gaps in the OECD1 and OECD2 series due to gaps in the publications of the Yearbooks.

The main deviations between the various series for France occur over the period 1990-1994, shown in Figure 2.26. The Eurostat and national data were lower over the years 1989-1993, with Eurostat matching the other series again in 1994. The difference between the Eurostat series and the IMF series in 1992, for example, was $5.86 billion (the IMF figure was 37 per cent higher than the Eurostat figure).

Figure 2.26 France Inward Flows, 1990-1994



Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; OECD International Direct Investment Statistics Yearbooks, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years; Banque de France Balance of Payments database.
Note: Data in local currencies converted to US$ using Eurostat average period exchange rates.

One change that occurred in 1993 was the reduction in the required participation from 20 per cent to the 10 per cent, although according to OECD (2001) this had no significant impact on the volume of FDI. The more likely reasons for the deviations between the series, is the inclusion of various items under FDI. RIE are included in the Eurostat data from 1992 and in the IMF data from 1994 for the aggregated inward flows, but the national (Banque de France) aggregated data only include RIE from 1995. RIE are initially estimated and

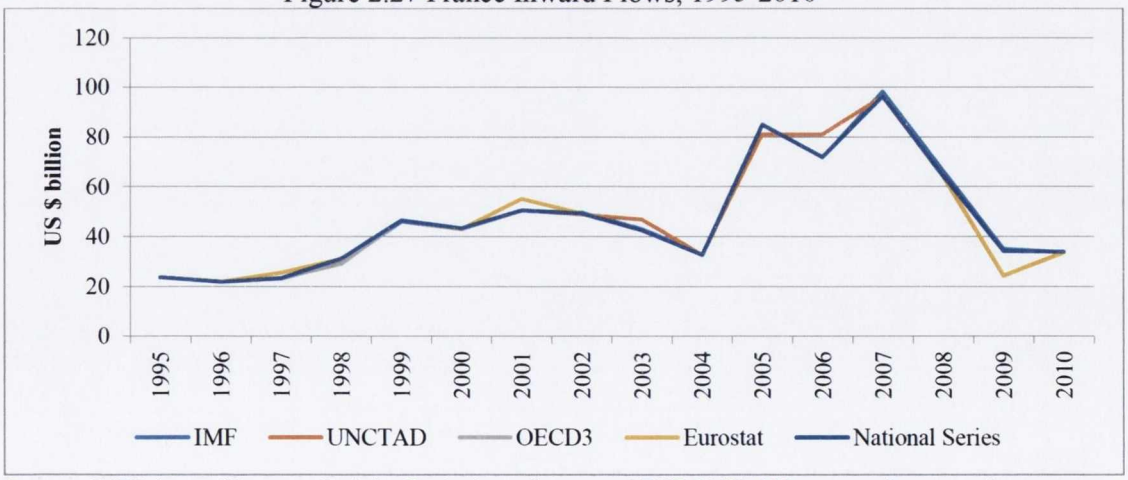
[60] As previously mentioned, there are breaks in these series due to the non-publication of the OECD's *International Direct Investment Statistics Yearbooks* in the years 2005-2011.

subsequently revised from the International Direct Investment Position survey (IMF, 2003). The data reported here suggests however that Eurostat and the Banque de France series are the same before 1994.

According to the Banque de France some short term intra-company loans were included from 1989 (IMF, 2003). Other sources suggest that short-term credits along with RIE are included only from 1994 (Eurostat, 2001) and there does appear to be a break at this point in most of the series. The inclusion of RIE and short-term loans in the data in 1994 is likely to be a contributory factor in the sharp increase in recorded inflows in 1995.

The original source of the UNCTAD data was the IMF data but UNCTAD then switched over to nationally sourced data. According to UNCTAD (various *World Investment Reports*) the switch was originally made in 1990 and data were later backdated to 1986. However, the UNCTAD data are exactly equal to the IMF data up to 1992. The national data are lower especially from 1990, until all three series become equal in 1995. Figure 2.27 compares these three series for the period 1990-1994 when the UNCTAD series is closer to the IMF data than to the Banque de France data. Over this period, the UNCTAD/IMF series was more than 30 per cent higher. In 1992, for example, the UNCTAD/IMF data are 31 per cent higher, equivalent to $6.23 billion in 2005 prices. The correlation between the UNCTAD series and the national data was very high at 0.99. The data suggests that from 1995 the international series for France became more comparable, with just a few discrepancies for the UNCTAD and Eurostat series as can be seen in Figure 2.27.

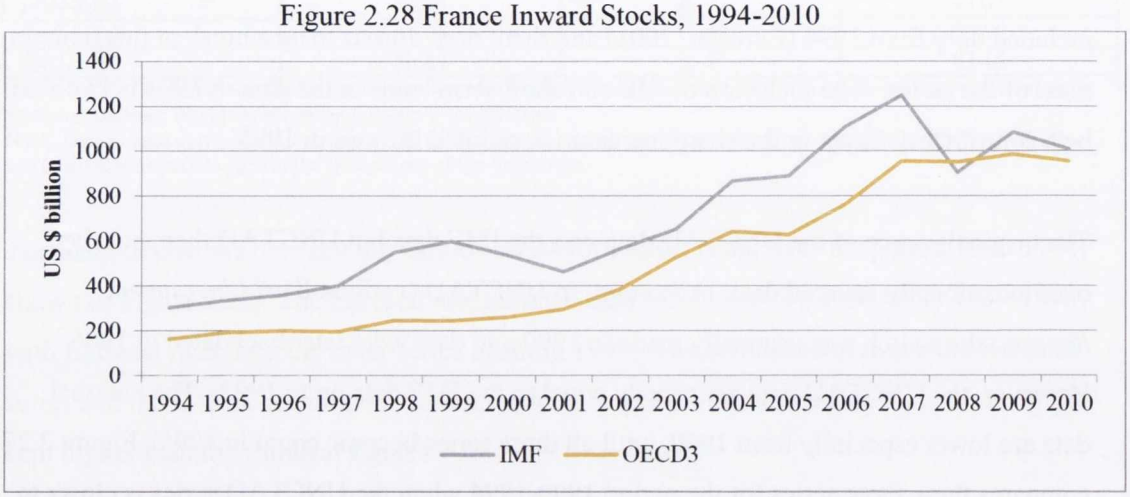
Figure 2.27 France Inward Flows, 1995-2010



Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years, and database; Banque de France Balance of Payments database.
Note: Data in local currencies converted to US$ using Eurostat average period exchange rates.

For France there are essentially two series for the stock data: the IMF series is higher than OECD3 but the correlation between the two is high at 0.94 for the period 1990-2010 (the most extensive period for which both sets of data were available). UNCTAD data follow the IMF series, Eurostat is similar to OECD (all the OECD series are similar). The IMF and OECD3 series are shown in Figure 2.28.

Figure 2.28 France Inward Stocks, 1994-2010

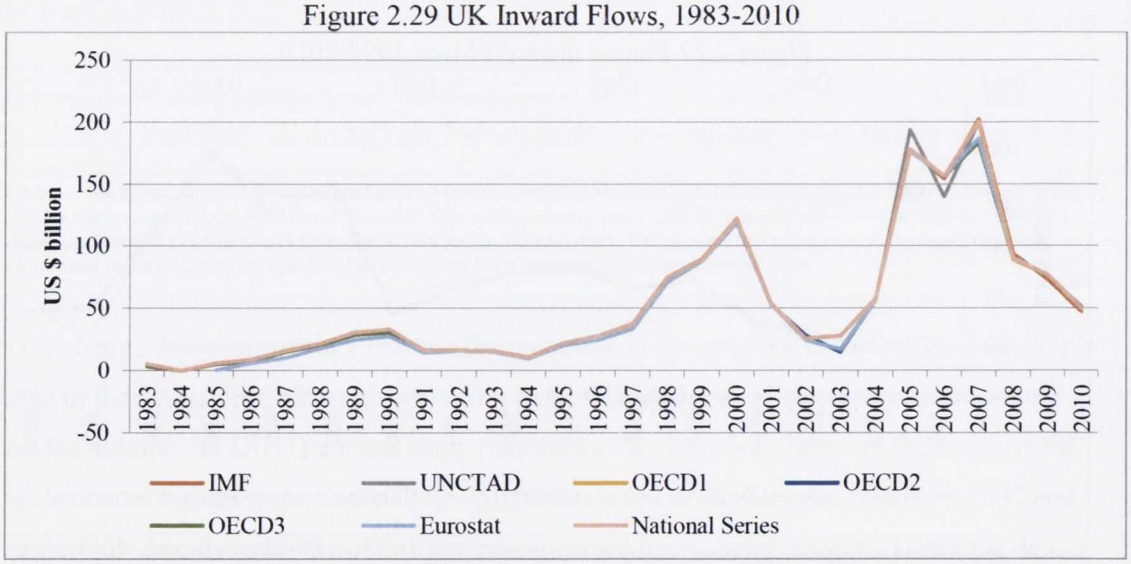


Source: Balance of Payments Statistics, IMF; OECD International Direct Investment Statistics database.

2.4.3.3 United Kingdom

The UK is the only country in this group of six that has had an enterprise survey system for collecting DI data throughout, although questionnaires were revised when BPM5 was adopted. The series for the UK are all rather similar over the period 1983-2010, as can be seen in Figure 2.29.

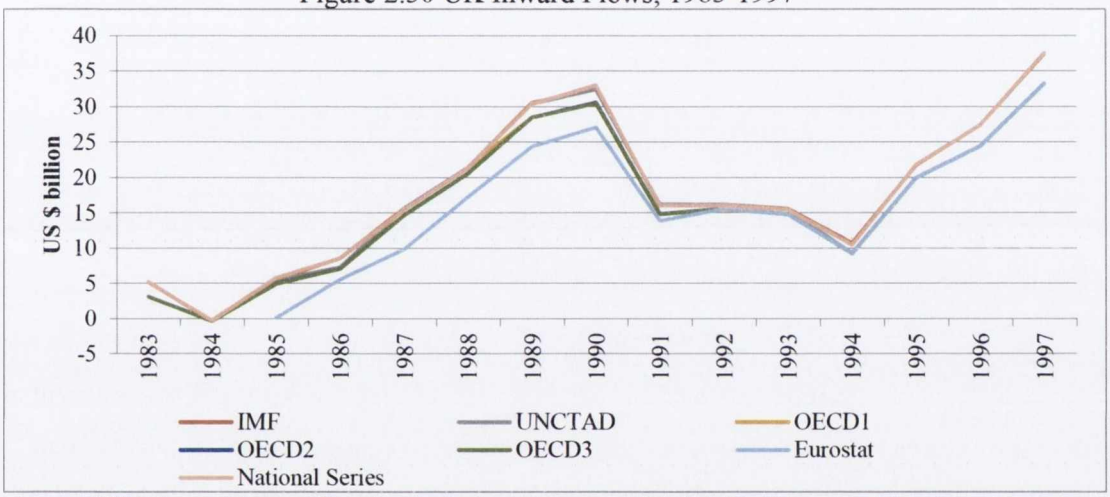
Figure 2.29 UK Inward Flows, 1983-2010



Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; OECD International Direct Investment Statistics Yearbooks, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years; ONS: Balance of Payments (Pink Book).
Note: Data reported in local currencies converted to US$ using Eurostat exchange rates.

There are several structural breaks in the UK data nevertheless. Oil company DI transactions began to be included only in 1984. Bellak (1998) argues that their omission would lead to an underestimation of FDI because of their importance in the UK economy at the time. Thus the dip in FDI flows in 1984 signals a stronger than apparent drop in FDI inflows or disinvestments elsewhere in the economy. Short-term capital flows between security dealing concerns in the UK and their overseas related companies were excluded in 1989 and this change was revised back to 1988. The ownership threshold dropped from 20 per cent to 10 per cent in 1997 with the adoption of BPM5 which led also to the removal of the Channel Islands from the UK DI statistics.

Figure 2.30 UK Inward Flows, 1983-1997

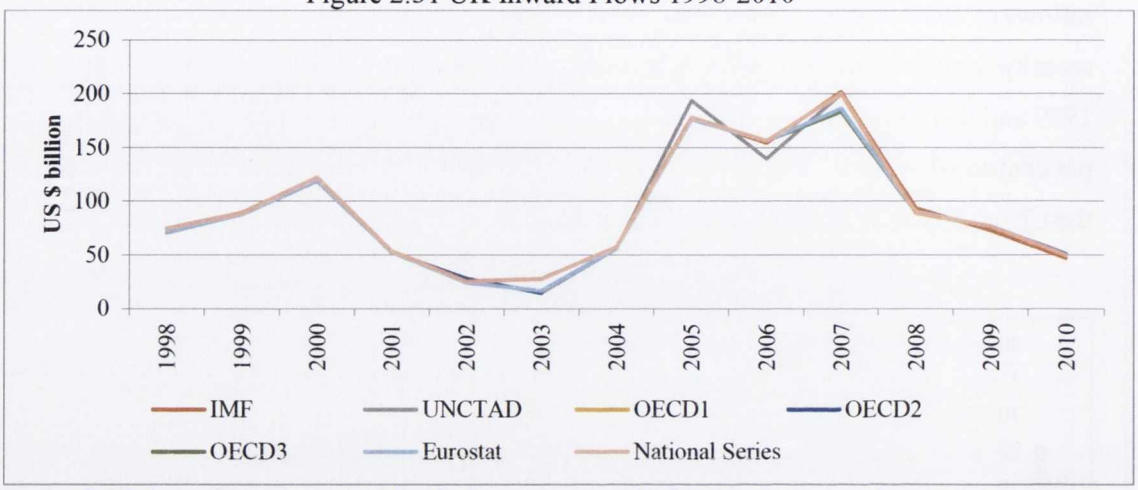


Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; OECD International Direct Investment Statistics Yearbooks, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years; ONS: Balance of Payments (Pink Book).
Note: Data reported in local currencies converted to US$ using Eurostat exchange rates.

Splitting the series at 1997/1998, divergences become clearer. Figure 2.30 shows the main international series for the period 1983-1997. The Eurostat series is clearly lower than the others particularly until 1992 when RIE were included in the Eurostat series. The OECD2 series equals the Eurostat series from 1992. Figure 2.31 shows that the data series are more similar in later years. There are essentially three different series being reported. One is the IMF/national series as these seem very similar for most of the time from 1983. Before 1989 the OECD1 series was also equal to these. A second series is the OECD3 series which is mostly equivalent to the OECD2 series and lower than the IMF/national series generally. In 1986, for example, the difference between the IMF and OECD3 figures was around $1.5 billion, which amounted to 21 per cent of the OECD3 inflow. In 1997 the monetary difference was over $4 billion which was only 12 per cent higher due to the greater magnitude of FDI. The Eurostat series can be considered as a third series, being much lower than the others, particularly prior to 1989. In 1986 the IMF figure was $3 billion or 54 per cent higher than the Eurostat figure, and the OECD3 figure was $1.55 billion or 28

per cent higher. From 1992 the Eurostat series becomes equal to the OECD2 series. The situation is more complicated for the UNCTAD data, which largely followed the OECD series from 1989 and the IMF/national data prior to this, with some exceptions.

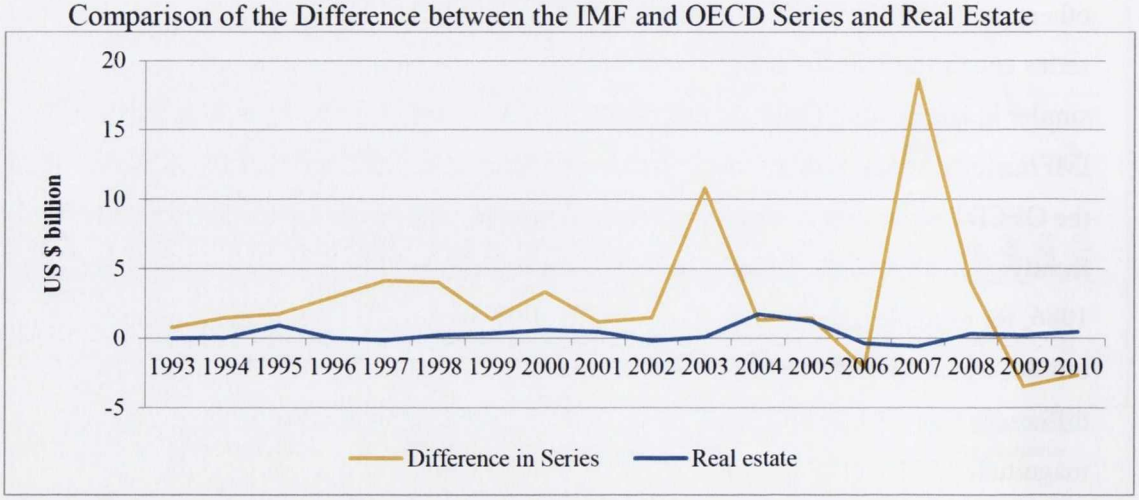
Figure 2.31 UK Inward Flows 1998-2010



Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; OECD International Direct Investment Statistics Yearbooks, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years; ONS: UK Balance of Payments (Pink Book).
Note: Data reported in local currencies converted to US$ using Eurostat exchange rates.

As already stated, differences in the timing and extent of data revision is one explanation for these differences. Another explanation is that the OECD2 data, which are here equivalent to the OECD3 series, are disseminated with a geographical breakdown whereas the IMF data are in aggregate form. According to the IMF (2003) the geographically disaggregated data reported to the OECD and Eurostat omits transactions of the property sector whereas the aggregate data, reported to the IMF, includes them. Otherwise, according to the IMF (2003), there are no differences between the series.

Figure 2.32 UK Inward Flows, 1993-2010:
Comparison of the Difference between the IMF and OECD Series and Real Estate

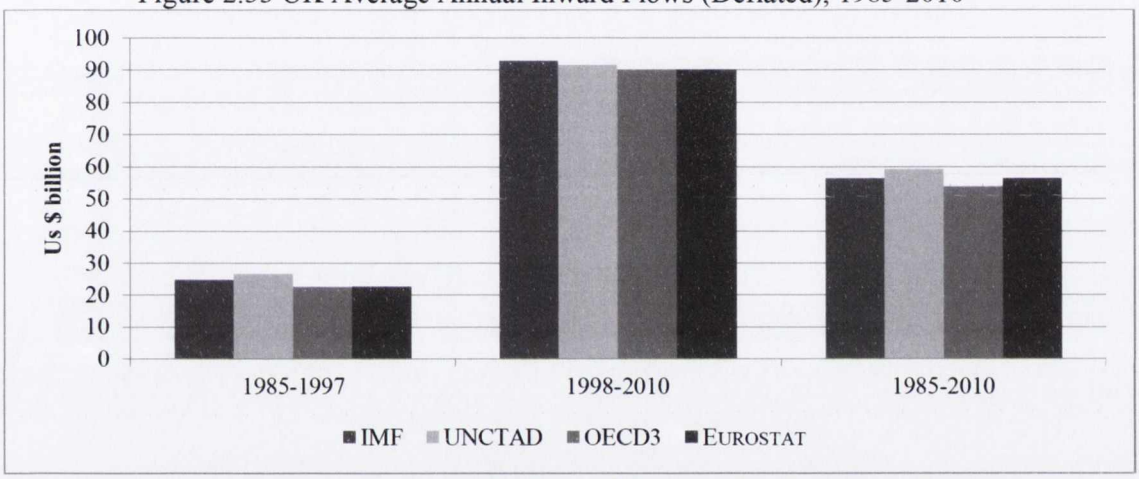


Sources: Author's own calculations based on data from IMF Balance of Payments Statistics Yearbooks, various years; OECD International Direct Investment Statistics database.
Note: Data reported in local currencies converted to US$ using Eurostat period average exchange rates

Data on real estate inflows to the UK are available from the OECD from 1993 but real estate is unlikely to be a full explanation for the discrepancies, as can be seen in Figure 2.32. The largest gap between the two series is $18.66 billion in 2007 but in that year real estate inflows were -$0.59 billion.

Some differences are attributable to different timings and extent of revisions. Figure 2.33 shows averages for the deflated data over three different time periods, some differences remain. The IMF/national data and the UNCTAD data are, on average, higher than the others. Compared to the OECD series for the overall period 1985-2010 the IMF data are five per cent higher and the UNCTAD data 10 per cent higher.

Figure 2.33 UK Average Annual Inward Flows (Deflated), 1985-2010



Sources: Author's own calculations based on data from IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks; various years; World Development Indicators, World Bank.
Note: Data reported in local currencies converted to US$ using Eurostat exchange rates. Data are at 2005 values.

2.4.3.4 Netherlands

BPM5 was adopted for the Dutch FDI series in 1998 with the data revised back to 1996 (DNB, 2000). The data collection system changed in 2003; prior to this a settlements system was used, complemented by an enterprise survey to cover RIE (IMF, 2001; DNB, 2003). In 2003, the Dutch Central Bank (DNB) switched to using a full survey system.

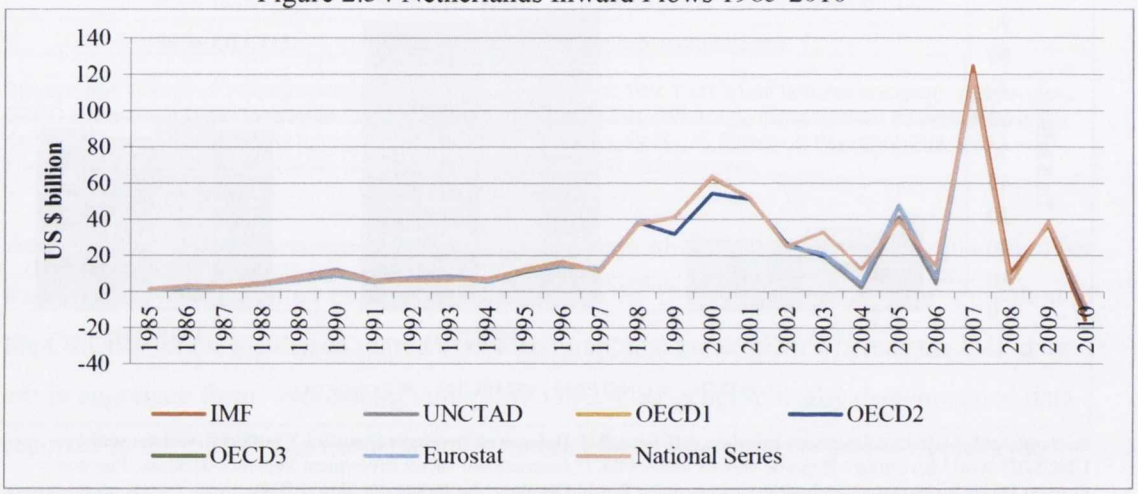
The Netherlands FDI data are also different from the other countries because transactions of SPEs (known as SFIs in the Netherlands) are largely excluded from the data reported to the international agencies.[61] Their exclusion should not affect the comparison of the various series for the Netherlands as they all have SPEs excluded in the same way. However, it severely affects comparisons between the Netherlands and most other countries, and biases

[61] There a small number of other countries that also do this, but they are not contained in our sample. EU members who also exclude SPE transactions from the FDI data are Austria, Cyprus and Hungary.

any dataset that includes the Netherlands as one of the countries without controlling for this issue. As already noted, SPEs are more significant in certain economies than in others. However, most of these economies do not exclude SPEs from their data. The Dutch central bank does, however, report FDI both inclusive and exclusive of SFIs, allowing us get a picture of the significance of their exclusion from the internationally published data.

Eurostat includes SPEs in EU aggregates from 1999 but this does not apply to individual country data produced by Eurostat. This situation was due to change in September 2004 with the data reported to the OECD and Eurostat to include the activities of SFIs. These were to continue to be excluded from the data reported to the IMF for publication (IMF, 2003). However, the data collected for this study do not appear to include them.

Figure 2.34 Netherlands Inward Flows 1985-2010



Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; OECD International Direct Investment Statistics Yearbooks, various years ;OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years; Der Nederlandsche Bank Balance of Payments database.
Note: Data reported in local currencies data converted to US$ using Eurostat exchange rates.

Looking at Figure 2.34, prior to 1992, the IMF and the national data are very similar and higher than the OECD2, OECD3, and Eurostat series. We can therefore see a picture of two series emerging: IMF/national and OECD3. The OECD1 series is equivalent to the IMF/national series until 1989 when it aligns with the other OECD series. The UNCTAD data aligns with the IMF/national series throughout. There are some exceptions, of course, but these may be attributable to revision. The IMF series includes RIE from 1994, the Eurostat series from 1992. Deflating (using the GDP deflator for the Netherlands) shows that on average the international series are fairly similar, and do not include SPE transactions.

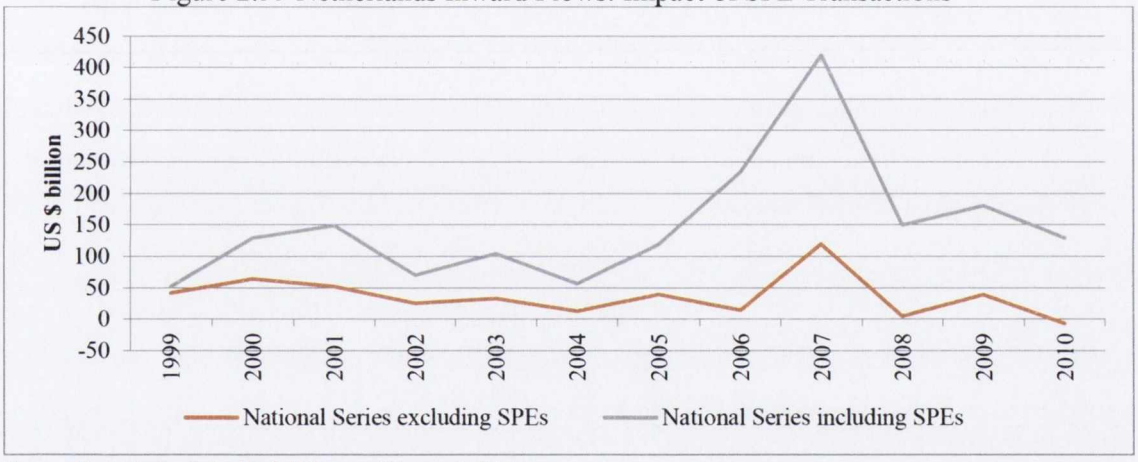
Table 2.8 Netherlands: Average Annual Inward Flows (Deflated)

Average Flow ($billion)	IMF	UNCTAD	OECD3	Eurostat	National excluding SFIs	National including SFIs
1986-1997	28.11	28.60	27.94	28.09	28.04	
1998-2010	27.49	23.45	25.47	25.52	27.05	169.01

Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years, and database; Der Nederlandsche Bank Balance of Payments database.
Note: Data reported in local currencies data converted to US$ using Eurostat exchange rates.

Comparing data with and without the SPE transactions, in Figure 2.35, we can see that the differences are very substantial. On average FDI inward flows including the transactions of SPEs were more than three times the reported FDI that excludes them. Although the Netherlands is a relatively small economy, its FDI flows are very significant globally. When SPE transactions are included, inward FDI flows to the Netherlands were more than nine per cent of global FDI inflows in 2010.[62]

Figure 2.35 Netherlands Inward Flows: Impact of SPE Transactions



Source: De Nederlandsche Bank Balance of Payments database

Tables 2.9 and 2.10 are correlation matrices between Netherlands flows and counter-party (mirror data) to see if the switchover to a survey system in 2003 had any impact. Both tables show an improvement between the Netherlands and the UK from 2003, and the two countries operating survey systems is a possible reason for this.

Table 2.9 Correlation between Partner Country Inward Flows and Netherlands Outward Flows

Netherlands Outward Flows to:	1985-2002	2003-2012
France	0.37	0.13
Germany	0.59	0.28
UK	0.47	0.89

Source: International Direct Investment Statistics database, OECD

[62] Author's own calculation based on the DNB data reported here and data from UNCTAD's World Investment Report (2013) reporting 2010 global FDI inflows of $1409 billion.

Table 2.10 Correlation between Partner Country Outward Flows and Netherlands Inward Flows

Netherlands Inward Flows from:	1985-2002	2003-2012
France	0.94	0.89
Germany	-0.34	-0.42
UK	0.02	0.65

Source: International Direct Investment Statistics database, OECD

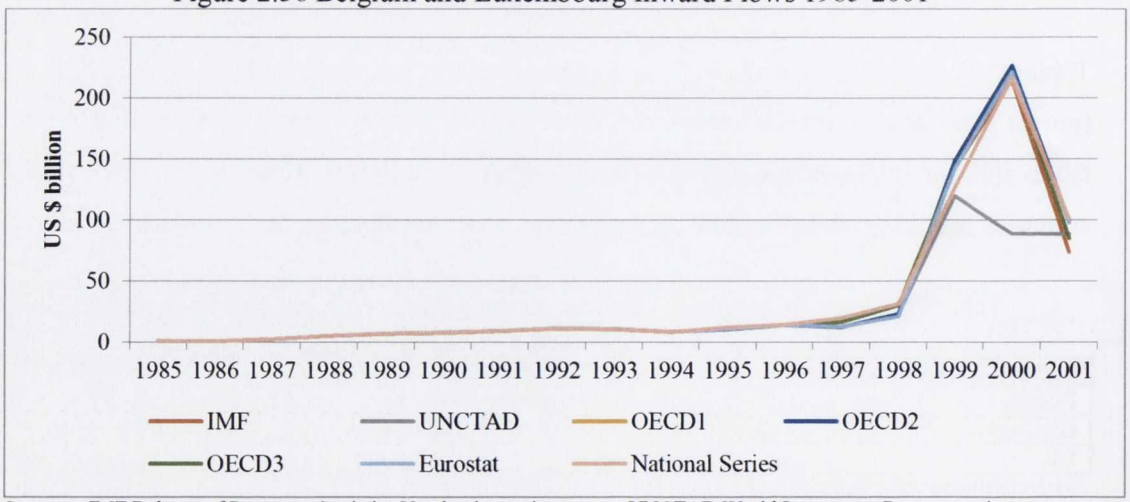
2.4.3.5 Belgium and Luxembourg

FDI is very significant relative to the size of the economy in these countries, and both – along with the Netherlands – have tax regimes that are conducive to attracting FDI.

Until 2002, Belgium and Luxembourg formed the BLEU with a combined balance-of-payments compiled by the National Bank of Belgium (NBB). In 2002, at the inception of EMU, each began to compile separate balance-of-payments. As it is not possible to disaggregate the earlier BLEU data, the time-series for BLEU as a whole is examined. However, a break occurs in 2002 due to methodological differences between the NBB, which continues to compile the balance-of-payments for Belgium, and the Luxembourg's Central Bank, Banque Centrale du Luxembourg (BcL), which assumed compilation duties for Luxembourg. Belgium continued to use the pre-2002 methodology while Luxembourg introduced a number of changes.

Figure 2.36 shows that until 1998 the main international series of the IMF, UNCTAD, OECD, and Eurostat are largely in line, with small deviations possibly arising from differences in updating periods or currency conversion.

Figure 2.36 Belgium and Luxembourg Inward Flows 1985-2001

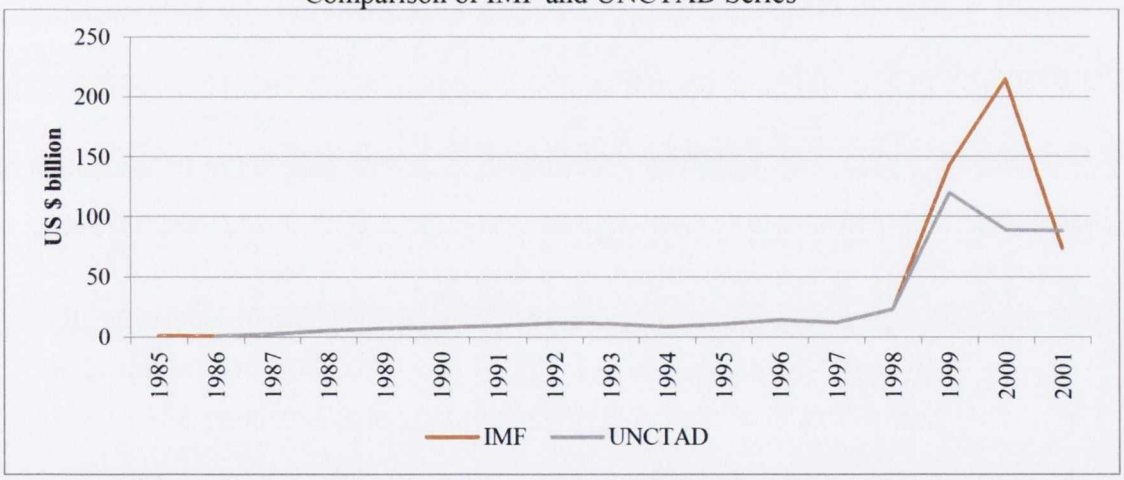


Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years; OECD International Direct Investment Statistics Yearbooks, various years; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years; Eurostat Foreign Direct Investment database; National Bank of Belgium Balance of Payments database.
Note: Data in local currencies converted to US$ using Eurostat period average exchange rates.

The UNCTAD data deviated sharply from other sources from 1999 and spectacularly from 2003. UNCTAD shifted its source from the IMF to the national (NBB) data in 1999 but, as we will see below, this does not account for the break in the UNCTAD series where it is lower than the others from 1999, although this may be due to timing of reporting or differential revisions. The data does show that UNCTAD data no longer align with the IMF data from 1999, but the recorded UNCTAD data are also quite different from the national data. It is likely that the national data were revised but the UNCTAD data were not. All series began to include RIE from 1999 (UNCTAD, 2000, 2001, 2004).

For 1989-1998, the IMF, UNCTAD and Eurostat series are essentially the same, and are greater than the various OECD series and the national data, although the differences are generally not large. OECD1 is the same series as OECD3 throughout, but OECD2 deviates from them over a number of years. The national data are similar to the OECD series until 1995, when they seem to deviate slightly from all the other series, this may be due to revision. Comparing UNCTAD with IMF in Figure 2.37, the break in 1999 is evident.

Figure 2.37 Belgium and Luxembourg Inward Flows 1985-2001
Comparison of IMF and UNCTAD Series

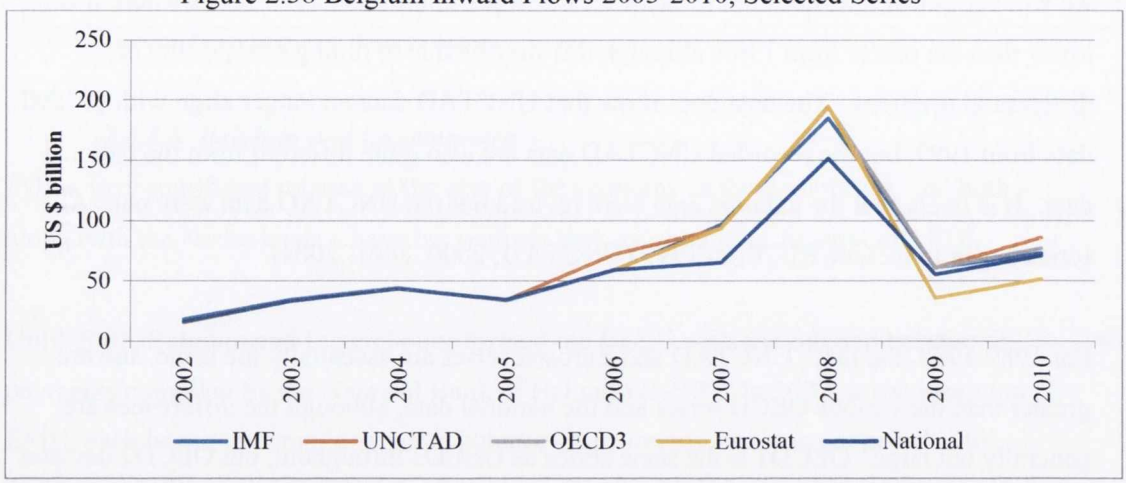


Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years.

From 2002, the two countries have been reporting separate balance-of-payments. These reveal that over the period 2002-2005 Luxembourg attracted more FDI from third countries (other than its BLEU partner) than did Belgium. Belgium received an annual average of 60 per cent of its inflows from third countries, while Luxembourg received an annual average

of 95 per cent over these years. The international series are only available for Belgium as a separate country from 2002.[63]

Figure 2.38 Belgium Inward Flows 2003-2010, Selected Series



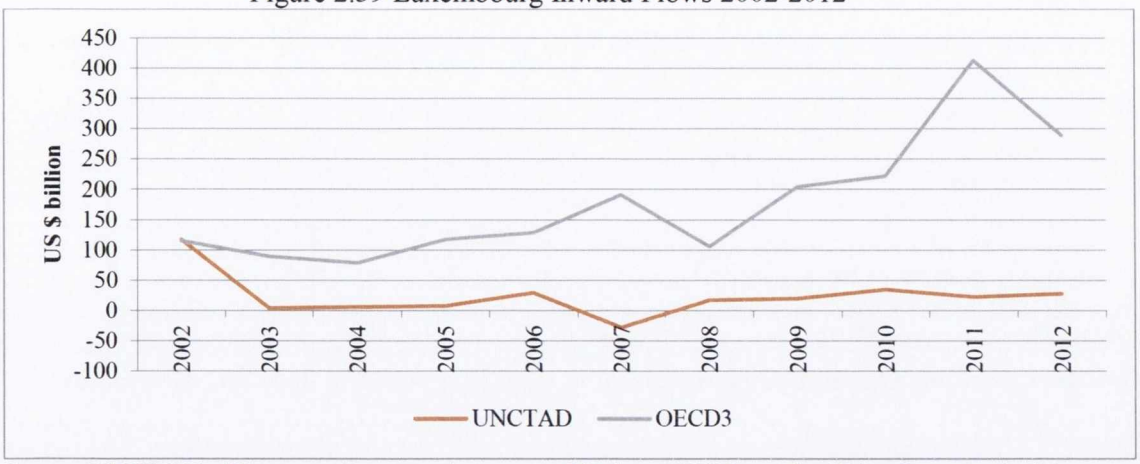
Sources: IMF Balance of Payments Statistics Yearbooks, various years; UNCTAD World Investment Reports, various years, and database; OECD International Direct Investment Statistics database; Eurostat Foreign Direct Investment Yearbooks, various years; Eurostat Foreign Direct Investment database; National Bank of Belgium Balance of Payments database.
Note: Data in local currencies converted to US$ using Eurostat period average exchange rates.

From 2007 the national data are lower than the other series, most likely due to the change in methodology that took place between 2006 and 2007 causing a structural break in the series. The National Bank of Belgium acknowledges that 2006 and 2008 data are not comparable (NBB, 2008).

Luxembourg does not include the RIE of most SPEs in its flow data, and SPEs account for a large proportion of inward FDI. The UNCTAD and the OECD1 data no longer include transactions of SPEs in their Luxembourg flow data and there is a large difference from 2003 between these two series and the others. The data for 2002 data are similar for all series, but from 2003 these become essentially two series: UNCTAD/OECD1 and all the others. Accordingly, only UNCTAD and OECD3 are compared in Figure 2.39.

[63]OECD1 and OECD2 are not reported here for these two countries separately because of the lack of data from the OECD International Direct Investment Statistics Yearbooks. For BLEU the OECD1 and OECD3 series were the same, and any differences with the OECD2 series were not large.

Figure 2.39 Luxembourg Inward Flows 2002-2012



Sources: UNCTAD World Investment Reports, various years, and database; OECD International Direct Investment Statistics database.

When the series for 2003-2012 are deflated by the GDP deflator for Luxembourg, on average the OECD3 flows are higher (US$160.45 billion per annum) than the UNCTAD flows (US$12.07 billion). This is attributable to the UNCTAD data excluding SPE transactions. As was the case for the Netherlands, it will matter which data source is used for Luxembourg in any research.

2.4.4 A Note on the Effects of Revision

Data for this research has been collected over a period of time, which allows us see the effects of revisions in the various series. The UNCTAD, OECD1 and OECD2 series all appear to be older (less revised) than the IMF, OECD3 and national series. Some of the effects of revision for the UK inward flows are shown in Table 2.11.

Table 2.11 Effect of Revisions Example, UK Inward Flows (US $ billion)

	Older IMF	Revised IMF	Older National	Revised National
2004	77.95	57.33	77.74	57.20
2005	195.55	177.41	159.61	178.02

Sources: IMF Balance of Payments Statistics Yearbooks, various years; ONS: UK Balance of Payments (Pink Book).
Note: Data reported in € or £ converted to US$ using Eurostat exchange rates.

Revision of the 2004 data reduced these flows by approximately 26 per cent. The older data for 2005 were substantially larger in the IMF series than in the national data: $35.94 billion or 23 per cent higher. The two series are only equal for 2005 when they were revised. It therefore matters when data are collected and it is wise not to use recent years in a dataset as these are the most in need of, and subject to, revision.

The exact source of the data can be important, often due to revisions. For the UK, for example, different measures of stock data appear for the years 1994-1996 in the UNCTAD series depending on which publication is used. These are shown in Table 2.12 below. The

large change between the data reported in 1997 and that reported in 1998 may be due to a methodological break at 1998 or to other revisions as a result of earlier data being estimated.

Table 2.12 Inward Stocks ($billion) to the UK, Various World Investment Reports (WIR)

Year	WIR 1996	WIR 1997	WIR 1998	WIR 1999
1994	213.23	na	na	na
1995	244.14*	314.65	199.77	213.85
1996	na	344.7*	237.47	na

Source: World Investment Reports, UNCTAD
*Estimated by adding flows to previous stock

The inward stock data for Germany also gives a good example of the effect of revisions. For example, the inward stock figure for 2000 for Germany in the *World Investment Report 2005* is $271.61 billion (this is the value used in Figure 2.26) and stays at approximately this level in all subsequent reports (the most recent at the time of writing is the 2013 Report) but had been $470.93 billion in the *World Investment Report 2004* and at a similar level in earlier *World Investment Reports*, and the figures for 2001 and 2002 relate more to the higher figure than the lower one. Most other series report the much higher figure. Interestingly, the online UNCTAD database reports the lower figure for 2000 ($271.61 billion) and subsequent lower figures for the next few years also. The reason for the change in the UNCTAD figure is unclear. It is most likely due to revision or some change in the methodology used. The *World Investment Report 2005* states that data contained in it may not always be comparable to that in the *World Investment Report 2004* due to countries switching over to the BPM5 methodology, for example, but European countries switched to that methodology around 1998. The source of the German data is reported to be 'national sources' throughout 1980-2002 (UNCTAD, 2004). The other series (OECD, IMF, and Eurostat) all use the higher figures for 2000-2003. Patterson et al (2004) argue that IMF and UNCTAD stocks differ for various countries not just because of the different timing of publications and hence the recording of revised data but also because UNCTAD tries to use book values in most cases and also includes estimates where data are unavailable.

Another example is provided by the Netherlands. Inward flow data for 2003 is recorded in the IMF's 2004 *Balance of Payments Statistics Yearbook* as $4.8 billion or 23 per cent higher than in the 2009 *Yearbook*. The data in the OECD online database and from Eurostat appear to have been revised in line with the data reported as OECD2. The newer data in the *OECD International Direct Investment Statistics* database were seven per cent lower in 1995 and 12 per cent lower in 1996 than the figure previously collected from the same database. The older series was in line with data collected for IMF and UNCTAD, suggesting these are 'out-of date'. The newer series is in line with the Eurostat data. Much of the IMF and UNCTAD data used here, together with OECD1, are from printed publications and online

data can be expected to display revisions. However, given delays between data collection and publication of research, it is likely that the data used are commonly 'out-of-date' regardless of source. Also not all online data are regularly updated.

2.5 CONCLUSIONS

This study differs from previous studies by examining time-series data; by selecting small as well as larger economies; and by updating the existing literature by covering a later period (up to 2012) – this is a period of particular interest as it spans the adoption of BPM5 and the large surge that occurred in FDI in the late-1990s. The results show that countries use different interpretations of the international standards and therefore the FDI data are not directly comparable across countries. Furthermore, countries changed their measurement of FDI over time and therefore the FDI are not directly comparable across time. This study's key contribution to the literature is in quantifying the size of the discrepancies in the data to ascertain their practical significance for researchers and policy-makers. Some of the quantitative differences resulting from methodological variation are found to be very substantial. Changes in methodology over time can cause large structural breaks in a time-series. It is estimated here, for example, that the inclusion of short-term loans and trade credits in the German data from 1996 increased the recorded German inward FDI flows by an average of $52.20 billion (in 2005 terms) per annum over 1996-2011, making the new series (that includes short-term loans and trade credits) more than double the magnitude of the old series.

This study also finds that data disseminated with geographical or sectoral breakdowns are 'older', being less frequently or speedily revised, so are less accurate than aggregate data. On the other hand, aggregate data will, by their nature, always appear more accurate due to the smoothing effects of aggregation. Being closer to the original collection point of the data is also better. For this reason the IMF and OECD data, and more recently Eurostat data are superior to the UNCTAD data. However, Eurostat data in the earlier years compared poorly with the other series, due mainly to the use of estimated data and the exclusion of RIE. National sources are the most up-to-date but these need to be treated with extreme caution in any cross-country study. The data reported to the international agencies is presented to comply, as much as is feasible, with the requirements of these agencies, but countries may choose to disseminate another version of the data in their own publications. National data are therefore more likely than the international data to display methodological variation across countries.

Gravity models are commonly used to examine country-specific determinants of FDI. Such models use bilateral FDI data which suffer from two problems: First, due to misleading geographical allocations (an investment received from Germany may originate in the US and be merely passing through a German affiliate) and, second, because of asymmetries due to methodological differences. Inspection of the mirror data shows that the measurement of FDI varied across countries and there were important differences in the geographical allocation of FDI. Although some series are highly correlated as they are moving in the same direction, they are often of very different magnitude – this will affect quantitative results from models. Table 2.13 summarizes the larger asymmetries found in counter-party flows for 1985-2012. These generally involve the Netherlands and can be mainly attributed to the exclusion of most SPE transactions from the Dutch data. Transactions that involve large economies have larger discrepancies in value terms. The largest example is for inward FDI flows into the Netherlands from France which are reported in the French data as almost $5 billion higher, on average per annum, than those reported in the Dutch data.

Table 2.13 Largest Asymmetries in Mirror Flows, 1985-2012

Direction of Flow	Percentage Average Discrepancy Per Annum	Size of Discrepancy ($ billion, 1995 Prices)
France Inflows from the UK	French data 44% higher	1.55
Germany Inflows from the Netherlands	German data 207% higher	2.82
Netherlands Inflows from Germany	German data 33 % higher	1.10
Netherlands Inflows from the UK	UK data 80% higher	2.97
Netherlands Inflows from France	French data 278% higher	4.98

Note: The source of the geographically disaggregated data is the updated series in OECD International Direct Investment Statistics database, available only from 1985.

Some empirical studies also mix together series from different data sources; these are found to be not directly comparable. It has been shown that different series can display similar patterns but one may be consistently higher than the other. This leads to empirical results that are quantitatively different although they may be qualitatively similar. As an example, Table 2.14 summarizes some results for the various published series for inward flows to the UK in 1986. The IMF data are $3 billion (in 1995 terms) higher than the Eurostat data, on average per annum, which is a difference of more than 50 per cent. The greatest discrepancy found between any two series was between the UNCTAD and OECD3 data for inflows into Luxembourg 2003-2012. Deflated to 1995 prices, the UNCTAD flow is US$12.07 billion, on average per annum, compared with an average of US$160.45 billion per annum in the OECD3 series. This huge discrepancy is most likely caused by the role of SPEs which are excluded from the UNCTAD data for Luxembourg in more recent years.

Table 2.14 UK Discrepancies in Selected Series, 1986

Series Comparison	Percentage Average Discrepancy Per Annum	Size of Discrepancy (US$ billion, 1995 Prices)
IMF vs Eurostat	IMF 54% higher	3.00
IMF vs OECD3	IMF 21% higher	1.50
OECD3 vs Eurostat	OECD 3 28% higher	1.55

Note: OECD3 refers to the updated series in the OECD International Direct Investment Statistics database.

Importantly, the many pitfalls in the use of these data have been demonstrated for a relatively homogenous group of countries with long-established collection and reporting systems in place. These pitfalls will therefore be compounded when pooling countries across regions and with different economic and social structures, stages of development, and statistical systems. It has been shown that many empirical studies use large numbers of countries (in some cases more than 80), over very long time periods (20 years or more) in order to maximise the number of observations. This increases the heterogeneity in the data, mixing together countries which use different systems and interpretations of the international standards. Furthermore, the lengthy time periods often used increase the chance of structural breaks occurring in the data, and we have seen that these breaks are not uniform across countries.

Methodological difference has improved over time but the changing nature of FDI and the significance of financial services FDI, and the role of pass-through investment in particular, increases the disconnect between the actual size of MNC investment in the economy and the FDI data. This suggests that when the FDI data are used to proxy for MNC activity they now overstate the size of this activity to a greater extent than in the past. This affects the comparability of the data over time, especially when lengthy time periods are used. The gulf between MNC investment and the FDI data is also wider for some economies than for others. Many authors include the Netherlands, Belgium, Luxembourg, Ireland, Austria, and Switzerland among the European countries in their datasets, ignoring the specific issues with these countries in relation to their role as conduits and to the differential reporting of SPE transactions. Bevan and Estrin (2004), for example, remark on the "unusually large" investment by small countries and limited investment by large source countries into Central and Eastern European Countries (CEECs) but some of this is likely to be due to the role of conduit entities. Mintz and Weichenreider (2010) find that Austria, mentioned by Bevan and Estrin (2004) as one of these small countries, was an important conduit country for German FDI, for example.[64] Wacker (2013) suggests that countries such as Ireland and Switzerland should be omitted from datasets because of the problems associated with profit

[64] Austria omits SPE transactions from its FDI data.

shifting by MNCs. In a similar vein, UNCTAD (2013) describes the Netherlands, Belgium, Luxembourg, and Ireland as "SPE-favourable" economies.

The role played by SPEs is worthy of further exploration in future research. As briefly discussed in Appendix 2.2, Mintz and Weichenrieder (2010) use the Deutsche Bundesbank's *MiDi* database to study the role of conduit entities in German FDI. An alternative source of firm-level data is Bureau van Dijk's (BvD) *FAME* database which contains an extensive range of financial and ownership information for the UK and Ireland.[65] Mintz and Weichenrieder (2010) identified 'stepping-stone companies' within ownership chains. A similar tracing of ownership chains would be possible with the data on shareholders and subsidiaries contained in *FAME* and other databases produced by BvD. Unique identification numbers allow the matching of firms across these databases. An alternative research approach involves the identification of SPEs. This is difficult as there is no commonly accepted international definition of an SPE and most countries do not collect data on these entities. However, as discussed in Appendix 2.2, a number of reports have tried to improve on this and these can be utilised in this regard. These include ECB/Eurostat (2004), Eurostat (2009), UNECE (2011), and OECD (2012).

The key contribution of this chapter is in quantifying the extent of the incompatibilities in the balance-of-payments FDI data. The FDI data are used, not just in the empirical literature on international capital flows and MNC activity, but also in measures of globalisation. Care needs to be taken in reaching conclusions based on data which are not comparable both across time and across countries. Researchers using FDI data need to consider which countries are included, what time periods are chosen, what data sources are used, and when the data are collected. Annual flow data, in particular, cause problems due to volatility and variation in the timing of recording and revising of the data. However, stock data also display some of these problems and additionally have poorer availability and quality, and their valuation may be inaccurate. As Fujita (2008:122) has said, the quality of the FDI statistics is "determined by the comprehensiveness, timeliness, reliability and international comparability of data."

REFERENCES

Alfaro, L., S. Kalemli-Ozcan, and S. Sayek (2004) 'FDI and Economic Growth: The Role of Local Financial Markets' *Journal of International Economics, 64*(1), 89-112

[65] The use of BvD's European-wide *AMADEUS* database is restrictive as it does not contain any holding companies for Ireland and we have seen that many holding companies, although not all (ECB/Eurostat 2004). Mintz and Weichenrieder (2010) also found that conduit entities were not always holding companies. However *AMADEUS* can be utilised to follow up shareholders and subsidiaries outside the UK and Ireland.

Alfaro, L., S. Kalemli-Ozcan, and S. Sayek (2009) 'FDI, Productivity and Financial Development' *World Economy, 32*(1), 111-135

Bank of England (2000) *Quarterly Bulletin* November 2000

Barry, F. and C. O'Mahony (2005) 'Making Sense of the Data on Irish Inward FDI' *Journal of the Statistical and Social Inquiry Society of Ireland, 34*, 28-57

Bevan, A., and S. Estrin (2004) 'The Determinants of Foreign Direct Investment into European Transition Economies' *Journal of Comparative Economics, 32*(4), 775-787

Bellak, C. (1998) 'The Measurement of Foreign Direct Investment: A Critical Review' *The International Trade Journal, 12*(2), 227-257

Bellak, C. and M. Leibrecht (2009) 'Do Low Corporate Income Tax Rates Attract FDI?– Evidence from Central-and East European Countries' *Applied Economics, 41*(21), 2691-2703

Bénassy-Quéré, A., M. Coupet, and T. Mayer (2007) 'Institutional Determinants of Foreign Direct Investment' *World Economy, 30*(5), 764-782

Bisciari, P. and Piette, CH (2007) 'Direct investment and Belgium's attractiveness' in *Economic Review*, National Bank of Belgium (June 2007)

Blanchard, P., C. Gaigné, and C. Mathieu (2008) 'Foreign Direct Investment: Lessons from Panel Data' in L. Mátyás and P. Sevestre (eds.) *The Econometrics of Panel Data: Fundamentals and Recent Developments in Theory and Practice* (Vol. 46), 663-696 Springer, Berlin Heidelberg

Borensztein, E., J. De Gregorio and J-W. Lee (1998) 'How Does Foreign Direct Investment Affect Economic Growth?' *Journal of International Economics, 45*, 115-35

Breuss, F. (2010) 'Globalisation, EU Enlargement and Income Distribution' *International Journal of Public Policy, 6*(1), 16-34

Buch, C. and D. Piazolo (2001) 'Capital and Trade Flows in Europe and the Impact of Enlargement' *Economic Systems, 25*(3), 183-214

Cantwell, J. and C. Bellak (1998) 'How Important is Foreign Direct Investment?' in *Oxford Bulletin of Economics and Statistics, 60*(1), 99-106

Clegg, J. (1992) 'Explaining Foreign Direct Investment Flows' in Buckley, P and M Casson (eds) *Multinational Enterprises in the World Economy* Edward Elgar, Cheltenham

Connolly, J. (2005) Discussion of F.Barry and C. O'Mahony (2005) 'Making Sense of the Data on Irish Inward FDI' *Journal of the Statistical and Social Inquiry Society of Ireland, 34*

De Mello, L. (1999) 'Foreign Direct Investment-Led Growth: Evidence from Time Series and Panel Data' *Oxford Economic Papers, 51*(1), 133-151

De Ménil, G. (1999) 'Real Capital Market Integration in the EU: How Far Has It Gone? What Will the Effect of the Euro Be?' *Economic Policy, 14* (28), 165-201

De Nederlandsche Bank (DNB) (2000) *Statistical Bulletin* March 2000

De Nederlandsche Bank (DNB) (2003) *Statistical Bulletin* Special edition 2003

De Nederlandsche Bank (DNB) (2008) *Statistical Bulletin* December 2008

De Nederlandsche Bank (DNB) (2010) *Statistical Bulletin* December 2010

De Sousa, J. and J. Lochard (2011) 'Does the Single Currency Affect Foreign Direct Investment?' *Scandinavian Journal of Economics*, *113*(3), 553-578

Deutsche Bundesbank (1995) 'Changes in the Methodology of the Balance of Payments' *Deutsche Bundesbank Monthly Report March 1995, 47*(3)

Deutsche Bundesbank (1999) 'German Balance of Payments 1998' *Deutsche Bundesbank Monthly Report Marc*h 1999

Deutsche Bundesbank (2014) *Balance of Payments: Statistical Supplement 3 to the Monthly Report* March 2014

Durham, J. Benson (2004) 'Absorptive Capacity and the Effects of Foreign Direct Investment and Equity Foreign Portfolio Investment on Economic Growth' *European Economic Review 48*(2), 285-306

ECB(1999) *EU Balance of Payments Statistical Methods* November 1999

ECB (2001) *European Union Balance of Payments /International Investment Position Statistical Methods'* May 2001

ECB (2002) *European Union Balance of Payments /International Investment Position Statistical Methods,* November 2002

ECB (2007) *European Union Balance of Payments / International Investment Position Statistical Methods* May 2007

ECB/Eurostat (2004) *Foreign Direct Investment Task Force Report*

ECB/Eurostat (2011) 'Coordinated Implementation in the European Union of BPM6' at the Twenty-Fourth Meeting of the IMF Committee on Balance of Payments Statistics October 2011http://www.imf.org/external/pubs/ft/bop/2011/11-05.pdf

Egger, P and M. Pfaffermayer (2004) 'The Impact of Bilateral Investment Treaties on Foreign Direct Investment' *Journal of Comparative Economics 32*, 788-804

Engel, C. (2003) Comment on P. Lane and G. Milesi-Ferretti (2003) 'International Financial Integration' *IMF Staff Papers Vol. 50 Special Issue*

Eurostat (1984) *Methodology of the Balance of Payments of the Belgo-Luxembourg Economic Union*

Eurostat (1988) *Methodology of the Balance of Payments of the Netherlands:*

Eurostat, *European Union Direct Investment Yearbook,* Various

Eurostat (2009) *Task Force on the Recording of Certain Activities of Multinationals in National Accounts: Final Report* (17th Meeting of the GNI Committee 7-8 July 2009, Luxembourg). Available at http://www.unece.org/fileadmin/DAM/stats/groups/wggna/Report_TF_recording_activities_multinationals_national_accounts.pdf)

Feenstra, R. (1999) 'Facts and Fallacies about Foreign Direct Investment' in M. Feldstein (ed) *International Capital Flows* University of Chicago Press and NBER

Forfás (2002) *Half-Year Trade and Investment Brief*

Fujita, M. (2008) 'A Critical Assessment of FDI Data and Policy Implications' *Transnational Corporations 17*(2)

Globerman, S. and D. Shapiro (2002) 'Global Foreign Direct Investment Flows: The Role of Governance Infrastructure' *World Development, 30*(11), 1899-1919

Grosch, U. (2003) Discussion on N. Pain (2003) 'Fiscal Policies, European Integration and Structural Changes in the Location of German FDI' in Hermann, Heinz and Robert Lipsey (eds) *Foreign Direct Investment in the Real and Financial Sector of Industrial Countries* Springer

Hatzius, J. (2000) 'Foreign Direct Investment and Factor Demand Elasticities' *European Economic Review 44*(1), 117-143

Head, K. and J.Ries (2008) 'FDI as an Outcome of the Market for Corporate Control: Theory and Evidence' *Journal of International Economics 74*(1), 2-20

IMF (1993) *Balance of Payments Manual*, 5th edition.

IMF (1996) 'Comparing Bilateral Balance of Payments Statistics: The Case of Germany and the Netherlands' *Balance of Payments Newsletter* June 1996 based on F. Ouddeken (1994) 'A Comparison of the Bilateral Balances of Payments of Germany and the Netherlands' *De Nederlandsche Bank, Statistical Information and Reporting Department, SIR-papers* Number 94.3, October 1994

IMF (2001) *Direct Investment Compilation Practices, Data Sources and Methodology* Various countries

IMF (2003) *Direct Investment Compilation Practices, Data Sources and Methodology* Various countries

IMF (2008) 'Kingdom of the Netherlands – Netherlands: Report on the observance of Standards and Codes – Data Module, Response by the Authorities and Detailed Assessment Using the Data Quality Assessment Network (DQAF)' *Country Report No.08/6* January. Available at http://www.imf.org/external/pubs/ft/scr/2008/cr0806.pdf

IMF (2011) *Balance of Payments Statistics Yearbook*

IMF/OECD (1992) *Report on the Measurement of International Capital Flows* (known as the *Godeaux Report*)

IMF/OECD (2000) *Report on the Survey of Implementation of Methodological Standards for Direct Investment*

IMF/OECD (2003) *Foreign Direct Investment Statistics: How Countries Measure FDI*

Janicki, H. and P. Wunnava (2004) 'Determinants of Foreign Direct Investment: Empirical Evidence from EU Accession Candidates' *Applied Economics, 36(5), 505-509*

Jungnickel, R. (1995) 'Foreign Direct Investment, Trade and Employment: The Experience of Germany' in OECD *Foreign Direct Investment Trade and Employment* Paris

Kolstad, I. and E. Villanger, (2008) 'Determinants of Foreign Direct Investment in Services' *European Journal of Political Economy*, *24*(2), 518-533

Lane, P and G. Milesi-Ferretti (2003) 'International Financial Integration' *IMF Staff Papers Vol. 50 Special Issue*

Lane, P and G. Milesi-Ferretti (2007) 'The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004' *Journal of International Economics, 73*(2), 223-250

Li, X. and X. Liu (2005) 'Foreign Direct Investment and Economic Growth: An Increasingly Endogenous Relationship' *World Development*, *33*(3), 393-407

Lipsey, R. (2003) 'Foreign Direct Investment and the Operations of Multinational Firms: Concepts, History and Data', in E. Kwan Choi and J. Harrigan (ed) *Handbook of International Trade*, Blackwell. Also available as NBER Working Paper No. 8665

Lipsey, R. (2010) 'Measuring the Location of Production in a World of Intangible Productive Assets, FDI, and Intrafirm Trade' *Review of Income and Wealth*, *56*(s1), S99-S110

Markusen, J. (1995) 'The Boundaries of Multinational Enterprises and the Theory of International Trade' *Journal of Economic Perspectives, 9*(2), 169–189

Markusen, J. (1997). 'Trade versus Investment Liberalization' *National Bureau of Economic Research WP*6231

Mintz, J. and A. Weichenrieder (2010) *The Indirect Side of Direct Investment* CESifo Book Series, MIT, Cambridge

Mold, A. (2003) 'The Impact of the Single Market Programme on the Locational Determinants of US Manufacturing Affiliates: An Econometric Analysis' *Journal of Common Market Studies*, *41*(1), 37-62

National Bank of Belgium (NBB) (2007) NBB Working Paper No. 107 January 2007

National Bank of Belgium (NBB) (2008) *Statistical Bulletin 2008-II*

OECD (1994) *OECD Reviews of Foreign Direct Investment: Ireland'*

OECD (1996) *Benchmark Definition of Foreign Direct Investment* (3rd edition)

OECD (2004) *International Direct Investment Statistics Yearbook 1992-2003*

OECD (2008) *Benchmark Definition of Foreign Direct Investment* (4th edition)

OECD (2012) 'Holdings, Head Offices and SPEs: Issues and Way Forward' Working Party on International Trade in Goods and Trade in Services Statistics, note by M. Chavoix-Mannato and S.Hagino. Available at http://search.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=STD/TBS/WPTGS%282012%2919&docLanguage=En

Ouddeken, F. (1994) 'A Comparison of the Bilateral Balances of Payments of Germany and the Netherlands' *De Nederlandsche Bank, Statistical Information and Reporting Department, SIR-papers* number 94.3 October 1994

Pain, N. (1997) 'Continental Drift: European Integration and the Location of UK Foreign Direct Investment' *The Manchester School* 65.S (1997), 94-117

Patterson, N., M. Montanjees, J. Motala and C. Cordillo (2004) *Foreign Direct Investment: Trends, Data Availability, Concepts, and Recording Practices* International Monetary Fund

Petroulas, P (2007) 'The Effect of the Euro on Foreign Direct Investment' *European Economic Review, 51* (6), 1468-1491

Pica, G. and J. Rodríguez Mora (2011) 'Who's Afraid of a Globalized World? Foreign Direct Investments, Local Knowledge and Allocation of Talents' *Journal of International Economics, 85*(1), 86-101

Pratten, C. (1992) 'Overseas Investments, Capital Gains and the Balance of Payments' *Research Monograph No. 48* Institute for International Affairs, London

Razin, A and E. Sadka (2007) 'Corporate Transparency, Cream-Skimming and FDI' *European Economic Review 51*(5), 1263-1276

Razin, A. and E. Sadka (2012) *Foreign Direct Investment: Analysis of Aggregate Flows* Princeton University Press

Schiavo, S. (2007) 'Common Currencies and FDI Flows' *Oxford Economic Papers, 59*(3), 536-560

Stein, E. and C. Daude (2007) 'Longitude Matters: Time Zones and the Location of Foreign Direct Investment' *Journal of International Economics* 71, 96–112

Stephan, M and E. Pfaffmann (2001) 'Detecting the Pitfalls of Data on Foreign Direct Investment: Scope and Limits of FDI Data' *Management International Review 41*, 189-218

Taylor, C. (2008) 'Foreign Direct Investment and the Euro: The First Five Years' *Cambridge Journal of Economics, 32* (1), 1-28

Timmermann, B. (1997) 'Comparison of Bilateral Balance of Payments between Portugal and Germany' *Working Paper of the International Monetary Fund Balance of Payments Committee* (CBOP WP/97/2).

UNCTAD (1995) *World Investment Report: Transnational Corporations and Competitiveness* New York and Geneva

UNCTAD (2000) *World Investment Report: Cross-border Mergers and Acquisitions and Development* New York and Geneva

UNCTAD (2001) *World Investment Report: Promoting Linkages* New York and Geneva

UNCTAD (2004) *World Investment Report: The Shift Towards Services* New York and Geneva

UNCTAD (2006) *World Investment Report FDI from Developing and Transition Economies: Implications for Development* New York and Geneva

UNCTAD (2012) *World Investment Report: Towards a New Generation of Investment Policies* New York and Geneva

UNCTAD (2013) *World Investment Report: Global Value Chains: Investment and Trade for Development* New York and Geneva

UNECE (2011) *The Impact of Globalization on National Accounts* United Nations, New York and Geneva. Available at http://www.unece.org/fileadmin/DAM/stats/publications/Guide_on_Impact_of_globalization_on_national_accounts__web_.pdf

Wacker, K. (2013) 'On the Measurement of Foreign Direct Investment and its Relationship to Activities of Multinational Corporations' *ECB Working Paper* No. 1614

Wei, S. (2000) 'How Taxing is Corruption on International Investors?' *Review of Economics and Statistics*, *82*(1), 1-11

Chapter Three

New Grant-Aided Industry in Ireland Prior to EU Entry: An Establishment-Level Analysis

"Much of Irish manufacturing prior to EU entry in 1973 and prior to the large influx of multinationals consisted of firms, domestic and some older foreign ones, located in traditional sectors, mostly producing for the domestic market."

Görg and Strobl

(2002b:25)

3.1 CONTEXT

This chapter examines the characteristics and survival rates of new grant-aided plants that established in Ireland over the period 1955-1972, before EU entry, a period largely neglected in the literature. These plants were mostly foreign-owned, many in 'modern' sectors, and represent the beginning of the change in the Irish industrial landscape that gathered momentum after EU entry. As described by Görg and Strobl (2002b) in the above quotation, the incumbents at the time were largely Irish-owned and in traditional sectors. Foreign-ownership was limited to older firms, mostly British, and to plants manufacturing under licence for the domestic market (known as 'tariff-jumping') or via joint ventures (O'Malley, 1989). The Control of Manufactures Acts had been introduced in the 1930s to protect against foreign ownership and suspicion of foreign ownership continued in some quarters, with these Acts not being repealed until 1964.[66]

The first non-repayable cash grants were made available on a small scale for plants establishing in economically undeveloped areas with the establishment of An Foras Tionscal (The Grants Board) in 1952. The Industrial Development Authority (IDA), which had been established in 1949, began to actively target export-oriented foreign firms from around 1953. Fiscal inducements in support of the new outward-looking policy were introduced in 1956 in the form of the extension of industrial grants to plants establishing outside the undeveloped areas and the introduction of Export Profits Tax Relief (EPTR). EPTR provided for 50 per cent tax remission on profits earned from increases in export sales but this was increased to 100 per cent in 1958. It was initially available for a period of ten years for firms that were established, or otherwise eligible, by April 1964 (Donaldson, 1965). These policies were further extended and expanded in subsequent years and even more

[66] Kennedy et al (1988:64) claim that these Acts "had been circumvented readily enough" but their continued existence suggested a political prejudice against foreign ownership.

generous fiscal incentives were offered for firms establishing at Shannon Free Airport, one of the world's first export processing zones.[67] The opening of a factory at Fermoy, County Cork, by German pencil manufacturer Faber-Castell in 1955 was an early significant IDA success. As a result, 1955 is taken as the starting point for this study.[68]

Prior to EU entry, other advantages Ireland offered were tariff-free access for manufactured exports to the UK and Commonwealth markets and a plentiful (and relatively low-cost) supply of labour at a time when much of the rest of Western Europe was experiencing labour shortages. A further attraction to German firms may have been that their output would be defined as Irish when offered for sale in the UK. Some German industrialists were also attracted by the idea of living in Ireland. From the early 1960s, tariff barriers were progressively reduced as part of the strategy to secure EU entry, the first application for which had been made (along with the UK) in 1961.[69] Tariffs were unilaterally reduced by 10 per cent in 1963 and 1964, and a Free Trade Area agreement was signed with the UK in 1965 removing the remaining UK tariffs on Irish manufactured goods which were mainly on synthetic textiles (O'Malley, 1989). The move to free trade did not occur merely as a result of the drive to export-led growth but was also externally influenced. There was a general shift internationally towards trade liberalisation and Britain's desire to join the EU left Ireland with little choice but to follow suit, given that Britain was Ireland's major trading partner.

Although new export-oriented indigenous industry was also eligible for grants and tax concessions, foreign-owned industry was better placed to avail of them.[70] The greater uptake of grants by foreign industry can be attributed to the greater ease at which foreign industry could engage in exports by having greater capacity, capital and access to foreign markets. Incumbent indigenous exporters were not eligible for new industry grants and few new Irish indigenous firms had the capacity to be export-oriented (Donaldson, 1965). Furthermore, EPTR was only available on increases in export sales above the 1956 level so it benefitted new firms more than incumbents as new firms establishing after 1956 could avail of relief on all export sales. Firms from the UK and Continental Europe (chiefly German and Dutch) trickled in over the 1950s, while US firms largely held off until it became clear that EU membership was likely. While the UK was the dominant export

[67] Double taxation treaties and other tax arrangements were in place with the UK, US, and Canada, as well as with many Continental European countries (for more detail see Irish Taxation Institute, 2008, Chapter 11). The success of EPTR relied on the existence of such treaties and on the type of tax system operating in the investor's home country (McAleese, 1972).
[68] O'Hearn (1987) also only includes projects that established from 1955.
[69] The economic utility of tariff barriers has also been questioned. Kennedy et al (1988) point to the lack of discrimination in tariff-setting and later findings that there was wide variation in effective tariff rates.
[70] Strictly speaking plants were expected to be internationally competitive rather than exporting *per se*, but this in practice amounted to the same thing (O'Malley, 1989). This is often referred to as 'industrialisation by invitation'. There was also an expectation that new plants would not compete with established industry on the domestic market.

destination for the early export-oriented FDI entrants, Continental Europe would later become the predominant export destination in this era.

A number of grants were available to industry in this period and it is commonly considered that most foreign-owned plants in Ireland have received some form of grant assistance at some time (Girma et al, 2007). The focus of this study is specifically on the grants that applied to new industry.[71] A distinction is made here between three types of grant paid to new industry: 'Undeveloped Areas' grants, 'New Industry' grants and 'SFADCo' (Shannon Free Airport Development Company) grants.[72] These grant types differed in their motivations, and in the level and nature of assistance offered. Furthermore, as these grant schemes were at times operated by different agencies and were discretionary, up to a maximum level, it is likely that there were differences in the selection criteria used.[73]

'Undeveloped Areas' grants, introduced in 1952, were aimed at the development of industry in areas designated as undeveloped, mostly in the West and North-West, in an attempt to boost employment and ease emigration. These represented "the first time in which direct non-repayable cash grants were given by the government to private industrialists" (Brock, 1968:155). The main objective was regional development and these grants were not initially seen as a wider industrial development tool (Donaldson, 1965). Many of the plants were small. 'Undeveloped Areas' grants were paid by An Foras Tionscal until its merger with the IDA in 1969. As part of the move to outward-looking policies, grant provision was subsequently extended country-wide through 'New Industry' grants in 1956. These were targeted at foreign, export-oriented industry although there were some indigenous plants in receipt of these too. 'New Industry' grants were initially paid by the IDA but this function was transferred to An Foras Tionscal in 1959. Grants payable in the undeveloped areas were larger. For example, by 1959 'Undeveloped Areas' grants covered a maximum of half the plant and machinery costs and 100 per cent of the building and land costs, compared to one-third and two-thirds, respectively, for grants paid in non-designated areas (O'Malley, 1989). Although the size of grants payable subsequently changed, the maximum limits remained higher in areas designated as undeveloped (McAleese, 1977; Meyler and Strobl, 2000).[74]

---

[71] Other grants payable to existing industry in the period included 'Adaptation' grants to assist established industry to adapt to free trade. These resulted from the report of the Committee on Industrial Organisation (CIO) on the state of Irish industry in 1961 which noted high productions costs caused by poor management, skill shortages, old buildings and equipment, small scale, and short production runs (O'Malley, 1989) thereby showing incumbent firms to be ill-equipped to deal with inevitable trade liberalisation. Adaptation grants were introduced in 1963 and replaced with 'Re-equipment' grants in 1969 (O'Malley, 1980). Other incentives available included more favourable allowances for depreciation of industrial buildings (including hotels) introduced in 1956, and of plant and machinery in 1958 (Kennedy et al, 1988).

[72] Some of these grants were also payable for major expansions of existing establishments.

[73] These issues are further explored in the literature review in Section 3.2.

[74] This was also the case for other grant types.

SFADCo grants were initially paid to plants setting up at Shannon although SFADCo's remit was later extended to a wider area.[75] Shannon Airport had been statutorily designated a customs-free airport in 1947 (Survey Team, 1967) but its viability was threatened by the development of jet airplanes. Consequently, it was developed as an industrial estate in 1959, incorporating manufacturing, processing, warehousing, and entrepôt trade (Donaldson, 1965; Survey Team, 1967) and SFADCo was established in the same year. The existence of the airport at Shannon was expected to attract investors from non-European countries, especially from North America, who were expected to make use of air-freight both for the importation of raw materials and exporting finished products. This was seen as a way to retain jobs in the area although the loss of jobs in the airport was ultimately not as great as had been anticipated (Munro, 1967). Inputs and outputs needed to be suitable for air-freight and industries establishing at Shannon included manufacturers of synthetic diamonds, tool parts, and scientific instruments. In 1967 it was reported that about three-quarters of the value of the output at Shannon was transported by air (Munro, 1967).[76] Services firms were also eligible for SFADCo grants at a time when grants in other parts of the country were only payable to manufacturing firms.[77] The size and nature of assistance offered by SFADCo also differed with plants initially eligible for EPTR for 25 years compared with the 10 year period elsewhere, thus offering greater security to firms establishing there. There was a difference in the nature of assistance available also with special tax arrangements to facilitate warehousing, for example. Warehousing was developed in an attempt to make greater use of the airport. Firms could use Shannon to warehouse finished output awaiting export (including output from overseas) and also for spare parts or raw materials without paying Irish custom duties, and its development coincided with a push in the US to encourage US firms to increase exports to Europe.[78] The type of activity and nationality of ownership of these plants can therefore be expected to differ from those receiving other grant types.

The lack of data may be one reason for the shortage of studies on new grant-aided industry in Ireland prior to EU entry. Here this problem is overcome by the compilation of a specially hand-collected database, discussed in detail in Section 3.3.1.1. The new grant-aided plants in the assembled database are expected to have different characteristics to the

[75] The area covered by SFADCo grants was broadened out from Shannon itself to the Mid-West region in 1968 (see *SFADCo Annual Report 1968-69* and various Oireachtas Debates). Prior to this, a new grant-aided plant establishing in Limerick or Thurles, for example, would have been in receipt of what is defined here as a 'New Industry' grant, whereas a plant establishing in Ennis would have been in receipt of an 'Undeveloped Areas' grant. Later these locations were all within the SFADCo area. This change occurred in conjunction with the move to merge the IDA and An Foras Tionscal which was finalised the following year. SFADCo's remit was later widened again to cover North Kerry and Offaly but this is outside the grant period covered here.

[76] Air-freight was more popular for exports to non-European destinations with some companies still using rail/road and sea combinations to European destinations (*The Irish Times*, 27th September 1960 and 10th January 1980).

[77] Only manufacturing plants are included in this study.

[78] *The Irish Times,* 12th February 1963.

general population of manufacturing plants with the new emphasis in this era on 'export-led growth' and an expectation that new plants would not compete with established industry on the domestic market.[79]

The research questions in this chapter are:

- What are the characteristics of the new grant-aided plants that established in Ireland prior to EU entry?
- What factors affect the survival performance of these new grant-aided plants?

This chapter proceeds as follows: The next section reviews the relevant literature. Section 3.3 explains the data and the methodology used. Descriptive statistics and the results from the survival analysis are reported in Section 3.4. Conclusions are drawn in Section 3.5.

3.2 LITERATURE REVIEW

This section first discusses new grant-aided industry in Ireland before EU entry and then reviews the literature on business survival. Survival analysis is widely used in biological and medical research and has become popular in studies of business survival. It examines a subject's probability of survival in a time interval. Commonly, hazard functions, measuring the 'hazard' or risk of failure, are estimated to show the instantaneous probabilities of a subject's risk of failing in an interval, conditional on the subject being alive at the beginning of the time interval and hence a member of the 'risk interval set'. A summary and discussion conclude this section.

3.2.1 New Grant-Aided Industry in Ireland before EU Entry

Vernon (1966:204) argued that Ireland had attracted foreign firms that had a "standardized output and self-sufficient process" in the mature stage of the product life cycle. The various stages of the product cycle can be described as formative, growth, maturity, and declining. In the formative stage there is no one standard dominant design so the industry consists of many small firms with short production runs; the growth stage is characterised by strong sales growth and larger firms, the industry becomes increasingly concentrated but innovative activity remains high; when the mature stage is reached the product is more uniform so there

[79] There appears to have been a continuation of the policy of protecting indigenous industry. Brock (1968:160) refers to the convention "which had always been accepted by the grant-giving bodies although it is not expressed in any of the legislation. This was that grants were only to be given to new firms which would not compete in the home market with existing firms." According to an article in *The Irish Times* on 10th April 1963 (Viney, 1963), An Foras Tionscal only grant-aided foreign industry that sold output on the home market if one of three situations held: the product was entirely new; the product was currently a necessary import; or there would be no direct competition with incumbents. The same article claimed that although foreign firms were entitled to sell 10 per cent of their output on the domestic market, An Foras Tionscal would not grant-aid them if they insisted on doing so in competition with incumbents.

are no advantages from technological superiority, and low growth and competitive pressures force firms to search for ways to cut costs; in the declining stage sales fall and both the industry and firms shrink in size. Vernon (1966) argued that firms chose to engage in FDI during the mature phase. FDI is easier in this stage as designs are standardised with exact specifications that are easily replicated. This reduces the costs of uncertainty and the communication difficulties associated with distance. Furthermore, labour-intensive production benefits from lower wage costs abroad. O'Malley (1989) also points to a product life-cycle effect, arguing that the early foreign-owned grant recipients in Ireland were in technologically-mature, labour-intensive, sectors producing standardised products, in the mature stage of the product life-cycle. They therefore faced poor demand growth, as well as competitive pressures from lower wage economies. New plants located in high-tech sectors (such as chemicals, electronics, and instrument engineering) in Ireland, however, were in the earlier stages of the product life-cycle and consequently experienced more rapidly growing demand although even in these plants the more high-tech functions still tended to be located outside Ireland (O'Malley, 1989). Such plants can be expected to have better survival prospects than plants in the older declining industries. Eventually, however, these newer industries are prone to 'shake-out' as the industry matures and concentration increases and, later, products become obsolete. These changes will ultimately threaten plant survival, especially for smaller plants which constitute the majority of plants located in Ireland (O'Malley, 1989). The new foreign-owned plants performed a limited range of functions using mainly unskilled or low-skilled labour, had few links in the Irish economy, imported most raw materials and exported their output (Survey Team, 1967; McAleese, 1972; Northcott, 1972; Buckley, 1974; Teeling, 1976). McAleese (1972) partially attributes the weak backward linkages to the small size of the Irish economy but points to food-processing as an exception as it used locally-sourced raw materials.

The 1967 *Survey* found the most populated sectors for new grant-aided plants were in the metals, food, textiles, and clothing sectors with 75 per cent of textiles and clothing plants establishing in undeveloped areas. The type of activities in the metals sector in the early years were 'traditional' rather than 'modern', according to O'Hearn (1987), such as aluminium extrusions, shipbuilding, cranes, and metal nuts. Similarly, the chemicals sector is generally considered 'modern' and 'high-tech' but includes fertilizers which are neither. O'Hearn (1987) points out that electronics and pharmaceutical plants only became predominant later.

Buckley (1974) points to both vertical and horizontal FDI occurring in Ireland in this era. Vertical FDI involves the establishment of a stage of production abroad, the motivation

often being the control of some crucial input. Buckley (1974) identifies vertical FDI in Ireland at this time as occurring in sectors with abundant raw materials such as the food sector (in particular in dairy). Horizontal FDI occurs where similar activities take place in different locations and relies on the availability of a large market that is difficult or expensive to service by other modes such as exporting or licensing. The existence of barriers to trade will make exporting difficult and firms with proprietary technology may be unwilling to licence local producers. According to Buckley (1974) horizontal FDI in Ireland in this era occurred in high-growth, technology-intensive, sectors servicing the UK (and subsequently the EU) market where the parent often had oligopolistic ownership advantages over potential competitors such as proprietary technology, product differentiation and lower costs resulting from the accumulation of economies of scale, learning and experience. In the Irish context, this type of FDI also benefitted from the existence of lower costs associated with cheaper labour and fiscal incentives in addition to market access.

Unsurprisingly, the 1967 *Survey* found that the motivations of the various parent nationalities differed. UK parents were attracted by the availability of local raw materials, German owners by the availability of labour, and US firms by both market access and cheap labour. According to Teeling (1976) Ireland had other advantages in attracting US investment through cultural and social ties although these could also be a hindrance through the 'green curtain' effect where Irish-Americans had a view of the Irish population as "boozy, extrovert, hot-headed people who could never settle into industrial life" (Teeling, 1976). This lack of an industrial culture was also raised by Donaldson (1965) and shows the importance of the demonstration effect resulting from the successes of these early foreign establishments. Teeling (1976) also pointed out that although US-owned subsidiaries in Ireland in this era were relatively labour-intensive, they were more capital- and technological-intensive than UK- or German-owned establishments. US-owned plants also tended to be larger (Survey Team, 1967; Teeling, 1976).

Although labour availability was considered very important, particularly by German owners, the 1967 *Survey* found that many firms had difficulty in recruiting staff. In main urban areas there was competition for labour and factory work lost out due to its low social status whereas in rural areas and smaller towns there was rapid labour turnover especially among females (Survey Team, 1967). Teeling (1976) notes that US firms considered that US staff would prefer to locate in the main urban centres. The 1967 *Survey* also found that lack of social and sport facilities in some areas contributed to high labour turnover and was a threat to plant survival.

The types of jobs provided were generally unskilled or semi-skilled with low wages and limited prospects (Northcott, 1972). The low skill levels were also commented on by the 1967 *Survey*. Educational levels were generally considered to be low by international standards and there was a lack of awareness of the requirements of factory employment especially in rural areas. Foreign investors argued that there was not enough emphasis on vocational rather than academic skills. Here the gender segregation in jobs is evident with industry calling for engineering training for boys and sewing for girls. The introduction of free secondary school education led to further debate about the adequacy of education for industrial employment (Donaldson, 1965). Traditionally, post-primary education had been directed at education for the professions which had higher social status than technical jobs. There were also complaints from management that male labour particularly lacked skills and was difficult to train especially where employees had formerly worked in agriculture (Survey Team, 1967; Teeling, 1975). However, the 1967 *Survey* cited management as generally impressed with the efficiency and competence of staff which far exceeded their low expectations with some reporting productivity levels higher than those in the parent plants. Those who felt performance was poor mostly attributed this to high labour turnover (Survey Team, 1967). Managerial incompetence has also been blamed (Donaldson, 1965; Survey, 1967).

Pyle (1990) argues that, internationally, export-led growth is associated with increased female labour force participation as industries such as assembly operations and clothing are largely female-employing sectors. Although the new grant-aided industry in Ireland prior to EU entry employed a greater share of women (Pyle, 1990) the participation rate of women did not substantially increase in Ireland which Pyle (1990:84) attributes to a social policy of maintaining "traditional familial relations". The 1967 *Survey* found that firms experienced particular difficulty in hiring female staff and that female labour turnover was high everywhere which it attributed to the lack of male opportunities and McAleese (1972) attributes to the low participation of married women in the labour force. *The Irish Times* reported in 1963 that the attraction of female-employing industry had "unforeseen sociological effects" as the lack of male jobs in the area reduced marriage prospects for young women thereby making these jobs less attractive.[80] These problems were more acute in undeveloped areas where, due to sectoral distribution, the male: female labour ratio was 1:1 compared with 2:1 in the rest of the country (Survey Team, 1967). At the time, women were paid less than men and there was a marriage bar in operation in most public sector jobs

[80] 'Industrial Training' (The Irish Times, 29th November 1963).

and elsewhere in the economy.[81] As a result, female jobs were lower paid and concentrated in lower skilled sectors (McAleese and Counahan, 1979).[82] The training and education of women was generally considered non-economic as the expectation was that most women would marry and leave the workforce. There were also fewer opportunities for women including promotional opportunities with McAleese (1977) showing that in the new grant-aided industry in 1974 less than two per cent of female employees were in 'managerial and other salaried' roles compared with almost 12 per cent of male employees. After 1969 the IDA explicitly stated that provision of male jobs was one of the criteria used in the selection process. Pyle (1990) argues that this is an example of sex discrimination but it can also be viewed as a symptom of sex discrimination where male jobs are more economically valuable in a society where females are less skilled and have shorter working lives. It does appear, however, that there was a minimalist perspective of industrial development in an attempt to avoid the social change that often goes hand-in-hand with economic development.

The 1967 *Survey of Grant-Aided Industry* found that around three-quarters of the output of the new grant-aided plants in 1966 was exported. The figure was likely to have been higher for new foreign industry as the export propensity of new foreign-owned plants was much greater than that of indigenous industry (O'Malley, 1989; Buckley; 1974) which Buckley (1974) largely attributes to sectoral differences in export performance. The 1967 *Survey* compared new grant-aided industry with the general population of 'transportable goods' plants. The new grant-aided plants were found to be larger which the 1967 *Survey* attributed to the larger scale required for exporting (and of course exporters are not limited by the smallness of the Irish domestic market). Although these grants were open to both foreign and indigenous exporters, Donaldson (1965) found that nearly 80 per cent of new investment was undertaken by foreigners. This greater uptake of grants by foreign industry can be attributed to the greater ease at which foreign industry could engage in exports by having greater capacity, capital, and access to overseas markets without having to develop new ones and foreign exporters were found to have contributed to a diversification of Irish exports (Donaldson, 1965; McAleese, 1972, 1977). Of course, the requirement that new industry did mostly not compete on the domestic market also effectively amounted to a requirement that they exported most of their output. Being a late industrialiser meant that indigenous Irish industry suffered from barriers to entry into many internationally traded

[81] This was introduced in the 1930s and required women to retire from the labour force on marriage. It applied to many clerical jobs including those in the public services and state-sponsored bodies, and was only abolished after EU entry. Its existence meant a widespread expectation that married women did not participate in the labour force.
[82] Prior to EU entry female labour was paid less than male labour even in the same job. EU membership required equal pay for equal work and this was enacted gradually in the 1970s.

sectors limiting it to sheltered non-traded activities and the limited processing of local primary resources (such as food processing for which demand grows slowly) (O'Malley, 1989). Import-substitution had been possible in the protectionist era too but the gradual dismantling of tariff barriers meant that indigenous industry was even more limited. In this era, indigenous industry found development difficult and industrial development was largely due to foreign industry. O'Malley (1989) shows that import penetration between1967-1979 was greatest in clothing and footwear, followed by textiles, although the latter sector developed exports to partially compensate for loss of domestic market share. Indigenous exporters that had already existed were not eligible for new industry grants and only eligible for EPTR on increases in their exports.

Unlike tax concessions, grants were not fixed or automatic. Grants help firms with initial expenses thus ensuring that the investment takes place and are available for all firms including smaller firms, whereas tax exemption exclusively favours those with proven profitability (Donaldson, 1965). Grants had a maximum level but the amount actually paid was usually less and this was at the discretion of the agency and subject to negotiation in each case (Donaldson, 1965; O'Malley, 1989). Girma et al (2007) argue that the amount of discretion held by project officers over the evaluation process meant that outcomes were variable. Furthermore, this process may have varied between different agencies or at different times. O'Malley (1989) argues that the IDA used its discretionary power as a bargaining tool in an attempt to minimise the amount of expenditure required to attract FDI. However this discretionary nature means that their administration is more costly and also led to a lack of transparency and the risk of favouritism, political patronage, or even corruption (Donaldson, 1965). Grants came with "no strings attached" (Donaldson, 1965:65) except that the principals were not to sell their investment for a period of five years and the fixed assets for a period of 10 years without the consent of An Foras Tionscal (Donaldson, 1965). According to Donaldson (1965) An Foras Tionscal claimed it did not have a formula to decide on grant recipients but she points out that it did appear to have reasons for the decisions it made, seeming to prioritise projects that were most likely to fulfil the joint goals of increasing exports, generating employment, and industrialising Ireland. She argues that, as a result, the largest share of grant funds were allocated to foreign firms setting up relatively large operations and hence grants may be considered to have been paid "not on the basis of need, but on the basis of not needing" (Donaldson, 1965:129) leading to debate about their political and economic value and the question of discrimination against indigenous industry. The absence of stated selection criteria, and the degree of discretion, also allowed for subtle policy shifts to take place relatively easily.

3.2.2 Factors Affecting Business Survival

The literature relates plant survival to a number of plant-specific and sector-specific variables. Chief among the former are age, size, and ownership characteristics. It has become a stylised fact that failure rates are monotonically decreasing with age. Geroski (1995) links age to the role of learning and experience in a plant's survival as these take time to acquire. Age can therefore proxy for the learning accumulated by a plant. In their study of UK manufacturing plants established over 1986-1991, Disney et al (2003) similarly link age with the acquisition of market knowledge having a positive effect on a plant's survival. They find that the association between age and survival becomes less important over time and is weaker for plants that are part of multi-plant groups as these have *a priori* market knowledge. Many survival studies, however, omit age as an explanatory variable as it is often collinear with the time variable in the model and is essentially the dependent variable. Models usually therefore examine survival over the study time rather than age *per se*. The theory suggests that hazard functions display initially high failure rates monotonically decreasing over time. This shape is found by Mata et al (1995) for plants established in Portugal during 1983-1989 and by Li (1995) for foreign-owned computer subsidiaries in the US over 1974-1989. However, many studies find inverted U-shaped hazard functions which display increasing failure rates (IFR) in the early years followed by decreasing failure rates (DFR).[83] Li (1995) finds that the pharmaceutical subsidiaries in his study have an inverted U-shaped hazard function. He also finds this shape for his aggregate sample (when both computer and pharmaceutical subsidiaries are combined). McCloughan and Stone (1998) and Delios and Beamish (2001) also find inverted U-shaped hazard functions in their studies of foreign-owned subsidiaries. The turning points from IFR to DFR in these functions vary from the 3-4 years found by Delios and Beamish (2001) and 4.7 years found by Li (1995) for his overall sample, to 8 years in the McCloughan and Stone (1998) study.

Size is the overwhelmingly statistically significant explanatory variable in survival studies. There is no agreement on how to measure size, however, with studies variously using initial, current, or average size, although employment is the variable most commonly used. Larger plants are generally expected to have lower hazard rates as they may be more efficient, have more experience and certainty, and fewer financial constraints (Geroski, 1995; Mata and

[83] IFR can also be referred to as 'positive duration dependence' where failure rates are at first low but rise monotonically over time. This is also known as 'wear-out' where a subject has a falling probability of survival as it ages. DFR is also referred to as 'negative duration dependence' or 'wear-in' where failure rates are high at the beginning but fall over time (McCloughan and Stone, 1998). DFR suggests that as a subject ages its probability of survival rises, a case of getting better with age.

Portugal, 2002).[84] Furthermore, plants that are larger on entry may have greater sunk costs making exit more difficult (Dunne et al, 1989; Mata and Portugal, 2002). Plants that are initially small, especially below the minimum efficient scale (MES), are expected to have higher hazard rates unless they experience rapid growth after entry. Mata and Portugal (2002) point to the 'judo' or 'puppy-dog' effect where new firms start small in an attempt to avoid aggressive behaviour by incumbents but plan to grow rapidly thereafter. If this is the reason for a small start-up size it may be associated with better survival outcomes. Foreign-owned firms that experience greater costs such as the costs of acquiring information may establish larger plants in order to reduce unit costs as such information costs tend to be fixed. Segarra and Callejon (2002) find a relationship between initial employment and survival, especially in the early years, with larger enterprises having better survival outcomes. Audretsch and Mahmood (1995) also find a positive relationship between initial size and survival, suggesting the plants that are larger on entry have already assessed their probability of survival to be higher. Dunne et al (1989) find that initial size only had an effect on survival for plants that belonged to multi-unit firms but not on those that were single-units. Mata and Portugal (2002) argue that the greater the gap between initial size and sectoral MES, the greater the risk of failure. Other studies find initial size to be less important than other measures of size, however.[85] Agarwal and Audretsch (2001), for example, find that initial size only affects survival rates for firms in the formative stage of the product life-cycle or in low-tech sectors with this relationship not holding in the mature stage of the product life-cycle or in high-tech sectors. McCloughan and Stone (1998) and Godart et al (2012) find a positive relationship between average size and survival. McCloughan and Stone (1998) argue that initial size is a weaker indicator of survival as MNCs may often open subsidiaries on a small scale initially because of the 'puppy-dog' effect. Mata et al (1995) and Disney et al (2003) include both initial and current sizes in their models, finding current size to be a better indicator of survival, having a positive effect. Disney et al (2003) also find that the influence of size, both initial and current, becomes less important with age. Görg and Strobl (2003a) and Girma et al (2007) also find a positive relationship between the current employment level and survival. Indeed, current size is the only consistently statistically significant explanatory variable for the control group of non-grant-aided plants used by Girma et al (2007). Mata and Portugal (2002) find current size a better measure of size, pointing out that young firms are often small. This may not of course be the case for MNC subsidiaries and, in the Irish context, initial size can be expected to not

[84] Although McAleese (1977) notes that plants may become small prior to closure, biasing this result. 'Average size' may therefore be a better measure than 'current size'.

[85] An issue with initial size is that it may measure only start-up size and not the size when the plant is fully operational, it therefore can be an incorrect measure. Görg and Strobl (2002b) include only plants with more than three employees as they consider that many smaller plants in their data are single-person operations or family business with different motivations than other establishments. In addition, some studies exclude very small firms or plants due to data limitations (see Mata and Machado (1996) and Girma et al (2007) for example).

be very different from average or current size as both Northcott (1970) and McAleese (1972) noted that employment growth in Ireland was achieved at this time largely through the arrival of new plants rather than the growth of existing ones. O'Farrell (1976) measures 'size' in just two categories (below and above 75 employees) and finds that smaller plants are more likely to close in earlier years.

The most common ownership characteristic included in models is the home country of the owner with the most frequent distinction being made between indigenous and foreign-ownership. Foreign-owned plants are often thought to be more at risk of exit as they are more footloose (Görg and Strobl, 2003a) and have poorer linkages in the host economy (Godart et al, 2012). On the other hand, Bandick (2010) and Godart et al (2012) argue that foreign firms can be less likely to exit because they have higher sunk costs, are larger, more technologically advanced, and are more productive. Furthermore, they may be better able to withstand demand-side shocks due to their export intensity and consequent market diversification (Bandick, 2010; Godart et al, 2012). However, results are mixed with Görg and Strobl (2003a) and Girma et al (2007), for example, finding foreign plants more likely to exit *vis-à-vis* indigenous plants but no difference found by others (O'Farrell, 1976; McAleese, 1977; McAleese and Counahan, 1979; Mata and Portugal, 2002; Godart et al, 2012). Görg and Strobl (2003a) also interact foreign-ownership with other explanatory variables to allow for differential effects related to foreign *vis-à-vis* indigenous ownership. They find that foreign-owned plants were more footloose and more likely to exit regardless of size, particularly if they were in a declining industry. As both new and incumbent plants are included by Görg and Strobl (2003a), the plants that fail include those established in the earlier protectionist era. Such plants can be expected to have higher failure rates due to the competitive pressures brought about by trade liberalisation. Like Godart et al (2012) for manufacturing firms, Mata and Portugal (2002) find no difference in exit probabilities between foreign-owned and indigenous firms after controlling for other covariates. This is not necessarily always supported by other evidence however. Godart et al (2012) group home regions into EU, North America, and rest-of-world and find a difference in exit rates between European and non-European firms in the services sector. Li (1995) also finds different results for Japanese-owned subsidiaries. McCloughan and Stone (1998) disaggregate 'foreign' into the US, Japan, Germany, the Netherlands, Sweden, Canada, and 'Others', but find home country differences to be insignificant. Harris and Trainor (2007) distinguish between British, US, EU, and 'other foreign' ownership, finding that of these, only EU-ownership improves survival rates

Generally authors make no distinction between different modes of exit. However, these may differ between foreign-owned plants and indigenous plants. Because of their global networks and weak local linkages foreign-owners may decide to relocate operations rather than closing them down as such, often unrelated to the performance of that subsidiary. Most studies lump foreign-owned plants into a single homogenous group (see Görg and Strobl, 2003a, b; Girma et al, 2007). Any exit is generally considered a failure, even in the case of a merger or acquisition, often due to data limitations.

Another ownership characteristic sometimes included is whether the plant is a single establishment or part of a multi-plant group (Dunne et al, 1989; Audretsch and Mahmood, 1995; Disney et al, 2003). Failure rates are expected to be lower for plants that are part of multi-plant firms because they will benefit from the accumulated learning of the owner and are less likely to experience financial constraints and uncertainty. Disney et al (2003) find that learning is more important for new single-plant establishments than for those who are part of multi-plant groups who already have a stock of market knowledge and experience. Plants that are part of multi-plant firms will benefit also from lower financial constraints and management expertise (Mata and Portugal, 2002). Many foreign-owned plants will be part of multi-plant groups (Mata and Portugal, 2002). Evidence from the US for the period 1963-1982 found that new plants established by multi-plant firms had better five- and ten-year survival rates than *de novo* entrants (Geroski, 1995). Similarly, Audretsch and Mahmood (1995) find better survival rates for branches and subsidiaries of multi-plant firms. Size can also have an effect with de *novo* entrants also being smaller and suffering from uncertainty about their efficiency as well as financial constraints which may be factors in their initial size being small (Jovanovic, 1982; Mata et al, 1995). If foreign-owned plants are subsidiaries of long-established firms then they may experience less market uncertainty and fewer financial constraints and the firm may be larger initially (Mata and Portugal, 2002).

Sectoral differences in survival rates were first considered by Audretsch (1991) and these are also found by Mata et al (1995), Disney et al (2003), Segarra and Callejon (2002) and, to a lesser extent, by Li (1995), McCloughan and Stone (1998), Mata and Portugal (2002), Görg and Strobl (2003b), and Godart et al (2012). Audretsch (1991) find 10-year survival rates of new plants that established in 1976 to vary, being higher for those in the chemicals sector than in the food sector. Similarly Disney et al (2003) find better survival rates for chemicals and man-made fibres with poorer survival outcomes for clothing and footwear and office machinery and computers. For Ireland, O'Farrell (1976) and McAleese (1977) also find poorer survival outcomes for plants in the textile and clothing and footwear sectors

with better outcomes for chemicals plants. The failure rates found by McAleese (1977) are higher than those found by O'Farrell (1976), which may be attributed to a number of factors: the inclusion by McAleese (1977) of plants established prior to 1960 which he suggests have relatively high failure rates; the effects of recession as McAleese's study ends in 1975 whereas O'Farrell's ends in 1973; and structural shifts with the secular decline in the textile and clothing and footwear sectors due to trade liberalisation and loss of competitiveness being captured in McAleese's study. McCloughan and Stone (1998) find most of their sectoral dummies to be insignificant with 'miscellaneous electronic equipment' being the only one ultimately retained. They attribute the poorer survival found for this sector to relatively rapid technological change in the 1980s. There can also be a relationship between ownership and sectoral location with Godart et al (2012), for example, finding a greater concentration of foreign firms in high-tech sectors (primarily pharmaceuticals, computers, electronic equipment, and medical instrumentation) and indigenous firms more concentrated in food and metals.

Most studies do not specifically include sectoral dummies in regressions, instead variously including a number of sector-specific variables such as sectoral growth rates, state of technology or the innovation rate, factor intensity, economies of scale and MES, market concentration, degree of foreign presence, and the rate of market entry. Some authors control for sector but do not report results. Görg and Strobl (2003a) and Girma et al (2007) stratify their models by NACE two-digit sector which controls for sectoral difference but provides no information on sectoral effects. Godart et al (2012) also point out that Görg and Strobl (2003a) ignore sectoral differences between indigenous and foreign-owned plants despite the latter being concentrated in high-tech sectors.

Plants in growing sectors are generally found to have higher survival rates. Various measures of sectoral growth are used in the literature, the choice of measure being partially constrained by data availability. Sales data are used by Audretsch (1991) and McCloughan and Stone (1998) whereas others use employment (Mahmood, 1995; Görg and Strobl, 2003a; Girma et al, 2007). In the Irish context, employment data are more readily available than sales data and employment is likely to be a more reliable measure because of the impact of transfer pricing (Görg and Strobl, 2002b) and other profit shifting measures. Similarly, Mata and Portugal (2002) consider profits to be an unreliable measure due both to transfer pricing and differences in opportunity costs.

Turning to examine the roles of innovative activity, factor-intensity, and economies of scale in plant survival: Audretsch (1991) and Audretsch and Mahmood (1995) compare a

'routinized' technological regime, which confers the innovation advantage to incumbents, with an 'entrepreneurial' technological regime, which benefits new entrants, and argue that new plants are not necessarily at a disadvantage in a high-tech industry. These technological regimes correspond respectively to the formative stage and mature/declining stage of the product life-cycle (Agarwal and Audretsch, 2001). Segarra and Callejon (2002) find wide variation in survival probabilities across sectors with 'labour-intensive' and 'science-based' firms having higher hazard rates. They attribute the former to competitive pressures and the latter to risk associated with innovation. Audretsch and Mahmood (1995) find that both capital intensity and the total innovation rate lower the likelihood of survival of new plants. Technological transfer is one benefit expected from a policy of attracting classical FDI and Görg and Strobl (2003b) find positive survival effects for indigenous high-tech plants which they postulate had more absorptive capacity than indigenous low-tech plants. Mata and Portugal (2002) and Audretsch and Mahmood (1995) find that the presence of economies of scale in an industry increase failure rates. The size of the plant relative to the sector's MES may be important due to new plants suffering poorer survival prospects if they are operating at a suboptimal level, especially in industries with significant economies of scale or that are capital-intensive. This can disadvantage smaller plants (Audretsch and Mahmood, 1995; Görg and Strobl, 2003a). On the other hand, Görg and Strobl (2003a) argue that industries with high MES tend to have high price-cost margins which may benefit a plant regardless of size but Audretsch (1991) finds this positive effect on survival only applies in the short-run, improving four-year survival rates but not 10-year rates.

The effects of market concentration tend to be ambiguous and non-linear. Audretsch (1991) finds that market concentration, through increasing the price-cost margin, aids plant survival in the short-run (four years) but not in the longer-run (10 years). McCloughan and Stone (1998) find the impact to be significant but ambiguous with increasing sectoral concentration having a positive effect on survival at lower levels of concentration but a negative impact at high degrees of concentration. Jovanovic (1982) also presents ambiguous results with high market concentration increasing the profitability of large, but not small, firms. Görg and Strobl (2003a) argue that ambiguous results are explained by higher market concentration leading, on the one hand, to higher price–cost margins in the industry which should increase survival probability, but, on the other hand, a lot of rivalry and aggressive behaviour reducing the survival probability of some plants.

Other variables popular in models are the degree of foreign presence in an industry, different modes of entry, and rate of entry. The effect of foreign presence, particularly the presence

of MNCs, in a sector can have either positive or negative effects on indigenous industry. Positive effects will occur through technology transfer and linkages. Negative effects may occur where higher-cost indigenous producers are unable to compete on product markets. Some authors (Li, 1995; McCloughan and Stone, 1998) have also looked at the impact of different modes of entry on survival, comparing greenfield investment with Mergers and Acquisitions (M&A). Mata et al (1995) and Mata and Portugal (2002) find that plants have poorer survival outcomes in industries with higher entry rates as there will more competition in such sectors.

Lastly, macroeconomic variables are sometimes included in business survival models to control for cyclical effects. Audretsch and Mahmood (1995) use the unemployment rate and the real interest rate, for example, finding mixed evidence with higher unemployment, but not real interest rates, increasing the hazard rate for new plants. They suggest that interest rates may be unimportant because most new plants are not reliant on external financing. Disney et al (2003) include GDP growth. Others use time dummies to capture policy or regime change (Mata et al, 1995; Girma et al, 2007; Godart et al, 2012).

There are only a small number of survival studies that focus particularly on the survival of grant-aided industry. In general, grant aid is found to be associated with better survival prospects. Two early studies, by O'Farrell (1976) and McAleese and Counahan (1979), use IDA data on grant approvals to examine survival of new grant-aided establishments in Ireland. O'Farrell (1976) covers the period from January 1960 and June 1973, overlapping with the period covered in this chapter, while McAleese and Counahan (1979) cover a later period (1973-1977). By its very nature grant-aid can cause a selection bias in a sample with such plants expected to have a higher probability of survival than those that are not grant-aided. In Ireland, for example, projects were scrutinised by the IDA and other agencies prior to grant approval so those receiving grants may be expected to have better survival prospects than others.[86] This is even more likely for larger plants which McAleese and Counahan (1979) suggest were subject to greater screening from the IDA and also subject to more public 'scrutiny' than smaller plants. Harris and Trainor (2007) also point to sample selection bias resulting from the selection process for financial assistance given to plants in Northern Ireland.

[86] McAleese (1972) cites the 1967 *Survey* that 10 per cent of foreign-owned manufacturing plants were established without grant approval, these were mainly below average size and catered for the domestic market. The 1967 *Survey* also points out that the majority of these established in Eastern counties, particularly in Dublin. These figures are from grant applications, there were no data on firms that did not make grant applications, although this number can be expected to be small.

Grants may obscure the effects of other covariates on survival probabilities. The impact of age and size on survival, for example, may be hazier where grants and other inducements to entry are involved. Girma et al (2007) conducted a study on the effectiveness of grant-aid on plant survival in Ireland for the period 1983-1998. They find 10 year survival rates of 85 per cent for grant-aided plants compared to 70 per cent for a control, non-grant-aided, group.[87] For plants in Northern Ireland, Harris and Trainor (2007) also find better survival rates for assisted plants. For MNC subsidiaries in the UK's Northern Region over the period 1970-1993, McCloughan and Stone (1998) report that greenfield plants had better survival outcomes than acquired plants and suggest that one reason is the availability of grants covering the fixed cost of new plant construction for greenfield investors. Although others also report greenfield investments to have lower failure rates (Li, 1995) and McCloughan and Stone (1998) themselves claim that it has become a stylised fact that greenfield plants have better survival outcomes than acquisitions. O'Farrell (1976) finds size to be the only statistically significant explanatory variable.[88] He suggests the insignificance of age, sector, and nationality is likely to be due to the existence of grants. His study, however, is limited to a univariate analysis.

Grant-type may also influence survival outcomes. Grants, as discussed earlier, had different motivations and were paid by different agencies at various times. They were discretionary with unclear selection criteria. O'Farrell (1976) finds that the proportion of closures for new grant-aided plants was higher in undeveloped areas than elsewhere but this result is not significant at the five per cent level, which he attributes to the greater size of grant available in designated areas helping the survival of such plants. This concurs with the 1967 *Survey* which found no difference in failure rates between undeveloped areas and the rest of the country. O'Malley (1989) suggests that as low labour costs and grant incentives were the chief advantages of locating in Ireland, the actual location within Ireland was largely irrelevant to firms. This allowed footloose mobile investment to locate in undeveloped areas in order to avail of the higher grants available.

3.2.3 Summary and Discussion

The objectives of this study are to explore the characteristics and survival outcomes of the new grant-aided industry that established in Ireland over the period 1955-1972. This period is relatively neglected in economic research on the role of classical FDI and of grant-aided industry in Ireland, which largely focuses on the era post-EU entry. Better survival rates among plants which have acquired knowledge and experience of their competitive

[87] Girma et al (2007) use propensity score matching to match these plants, in order to control for selection bias.
[88] Size is predicted employment. Closure is defined as ceasing production by June 1973.

environment is consistent with path dependency in FDI. However, many of the new plants in this study were ploughing new furrows and both they, and the industrial agencies, lacked experience at the time.

The literature links a wide array of explanatory variables to an establishment's survival. The most important variable is size, most commonly measured by employment level, with larger plants being expected to have higher survival rates. Plant age is usually omitted as an explanatory variable because of its collinearity with time. Other popular variables of interest are nationality of ownership and sectoral location. The literature is uncertain about the effects of ownership characteristics and studies generally find that the role of sectoral location is insignificant. Most authors do not look at sectors specifically, at least not in their multivariate models, instead including sector-specific variables. This makes sense if only exploring the industry characteristics that impact survival rates. However, where there is a policy of targeting particular industries, sectoral survival rates are important. Additionally, where the data are unavailable for a range of industry-specific variables, the inclusion of sectoral dummies in models is one solution.

The new foreign-owned grant-aided plants in Ireland at this time are described in the literature as being small and generally limited to relatively straightforward manufacturing processes with few links in the Irish economy, importing raw materials and exporting most of their output. One exception is food processing, where the motivation for investment was the existence of the locally-sourced raw materials. This was particularly the case for UK investment in the dairy industry where Ireland had a comparative advantage. Another exception is the high-tech firms who invested in Ireland at an earlier stage of the product life cycle and accordingly are expected to have longer survival times. US-owned establishments were larger and more capital-intensive than European-owned plants. The literature also suggests that indigenous high-tech plants should have longer survival times than other indigenous plants due to greater absorptive capacity. For a later period, Godart et al (2012) find a greater concentration of foreign firms in high-tech sectors (primarily pharmaceuticals, computers, electronic equipment, and medical instrumentation) with indigenous firms more concentrated in food and metals, and it is reasonable to expect that there will be differences in sectoral location associated with nationality of ownership. Removal of tariff protection had differential sectoral effects with O'Malley (1989) showing that import penetration between1967-1979 was greatest in clothing and footwear, followed by textiles, although the latter did manage to develop exports to compensate for loss of domestic market share. Given this knowledge, and the findings of the business survival literature, we can expect larger plants and high-tech plants to have better survival outcomes. Plants in the food

processing sector are also expected to have relatively better survival outcomes with those in clothing, footwear, and, to a lesser extent, in textiles, to have poorer outcomes. The effects of nationality of ownership are uncertain in the literature. Indigenous plants are expected to have better outcomes if located in high-tech sectors. The larger size and high-tech nature of many US-owned plants is likely to be related to better survival outcomes. Rest-of-world plants can be expected to suffer from the negative effects of distance both geographically and culturally.

There are no available data on capital intensity, innovation rates, or economies of scale, for the new grant-aided plants. Furthermore, some measures are not appropriate in this study. All plants are new and therefore greenfield, for example, and most were part of multi-plant groups. Including a measure of market concentration is unlikely to be fruitful in this study as the new grant-aided plants were largely exporters, so domestic market concentration measures are irrelevant. There was a diverse range of markets for exports with the UK and other European destinations being particularly important, but US-owned plants also exported some of their finished product back to the US and there were world-wide markets for some other output. Furthermore, including the innovation rate, for example, does not make sense where the share of innovative activity taking place in Ireland is considered to have been negligible in most cases, and suitable establishment-level data are not available anyway. Similarly, MES may not be a relevant metric in this study, for a few reasons. First, there is no readily accessible measure of sectoral MES to be used for Irish plants in this time period. Görg and Strobl (2003a, b) solve this problem by calculating MES as the log of median size of plants in each NACE two-digit sector, using the data from the Forfás Employment Survey (FES) for this calculation.[89] This measure is a little unconvincing as their study includes all of the plants in the database so MES is calculated using the plant sizes that are then being compared to it. This is somewhat circuitous. Furthermore, the literature shows that the new grant-aided plants are mostly foreign-owned labour-intensive operations, employing semi-skilled labour with the firm's more high-end functions taking place overseas, this was the case even in high-tech sectors (O'Malley, 1989). For many of these industries economies of scale occurred at the firm rather than at the plant level (O'Malley, 1989). It is therefore unclear what measure of MES is relevant in this case. Additionally, measures of the degree of foreign presence and the rate of entry are irrelevant as most plants have been established by foreign MNCs and are mostly not operating in domestic markets.

[89] Geroski (1995) suggests that the median plant size is often used as a measure of an industry's MES.

The sectoral growth rate is one sector-specific variable that can be calculated from the available data. As noted earlier, plants in growing sectors are expected to have better survival probabilities as there is less competitive pressure on them. Görg and Strobl (2003a) and Girma et al (2007) both include measures of sectoral growth (in terms of percentage increases in employee numbers). Again, however, we need to consider the relevance of this variable for plants that are mostly exporters and have few links to the host economy. The relevant measure of sectoral growth may not be the growth rate of the sector within Ireland but some form of international measure, but this would require a great deal of more detailed data.

Sample selection bias should not be a problem, as it is in some extant studies of grant-aided industry, as all plants are new and grant-aided. However, one caveat is that there may have been different selection processes used by the different agencies at different times, and the inclusion of grant-type helps capture this effect. Given the degree of discretion held by agencies and the differing motivations for the three types of grants available to new industry in this era, grant-type is therefore worthy of investigation. Furthermore, the activities and nationalities of ownership can be expected to differ between grant-types. US-owned and rest-of-world firms, for example, were more likely to establish plants in the SFADCo area and US firms were less attracted to undeveloped areas. Studies to date have not found significant differences in failure rates among the different grant-types, however. Plants in undeveloped areas would be expected to have poorer outcomes, *ceteris paribus*, but this may not occur due to the higher level of grants available to the plants that established in these areas, as found by O'Farrell (1976).

3.3 DATA AND METHODOLOGY

3.3.1 Data Sources

Two sets of data are used in this study. One is a specially hand-constructed database of new grant-aided manufacturing plants that established in Ireland over the period 1955-1972. The other database used is the Forfás Employment Survey (FES) for the years 1972-2003 which enables the tracking of plants over this time period. It contains annual employment levels as well as details on industrial sector, ownership nationality, and location.

3.3.1.1 The 1955-1972 New Grant-Aided Plant Database

Multiple sources were used to construct the 1955-1972 new grant-aided plant database: An Foras Tionscal reports, SFADCo Annual Reports, various IDA publications, Oireachtas debates, newspaper archives, google searches, and Company Registrations Office (CRO)

records. These data differ from the grants approval data used by O'Farrell (1976) and McAleese and Counahan (1979), and also the data collected by O'Hearn (1987) which covers MNCs only.

As the data come from a diverse range of sources with which there are some accuracy concerns (see O'Hearn, 1987), a lengthy and exhaustive process of data cleaning was required to ensure confidence in the data. This resulted in a small number of plants being excluded from the database. Care especially needed to be taken to avoid double-counting. In some cases plants and parent firms changed name, so it needed to be ascertained if this was merely a name change or a change in ownership and also if there was a continuation of, or a break in, operations. Sometimes if the name changed, an additional grant was received under the new name. Additionally, in some instances, grants were recorded in the parent's name so the grant had to be matched with the actual plant. This caused difficulty in some multi-plant situations. Also, it was not always clear that a plant was 'new' as such, and it would appear that, in some cases, grants were received for a new line of business rather than new industry as such. Where there was some evidence that a plant existed prior to 1955, it was dropped from the database. Some plants received grants within the study period but searches indicated that operations didn't commence until 1973 or later, so these were also dropped. Lack of adequate data for a small number of plants caused them to be ultimately excluded from the database.[90] Year ends can also differ among sources, or may just be inaccurate. Finally, some plants were found not to be manufacturing units themselves, although part of a manufacturing firm.[91] The final database contains 415 plants, 84 of which had ceased operations by 1972, the first year of employment data, with 331 surviving to at least 1972. Further details of this database are available in Appendix 3.2.

3.3.1.2 The Forfás Employment Survey

The employment data come from the FES which is an annual survey beginning in 1972. The employment time-series enables the tracking of plants over their lifetime, necessary to undertake a survival analysis. The FES covers establishments that are 'clients' of the industrial agencies and therefore in receipt of some form of assistance but it is generally considered to cover most establishments. Lawless (2014) estimates coverage to be 80-85 per cent, while others (see Strobl et al, 1998; Meyler and Strobl, 2000; Görg and Strobl, 2003a) suggest a coverage rate of 99 per cent. The FES data also needed cleaning. In particular, there were a number of cases of plants dropping in and out of the survey with

[90] Examples are Core Memories/Data Products, Star Plastics and Veha.
[91] Also, some studies include 'Mining' as manufacturing industry; these establishments are not included in this database.

'gap' years of zero employment. Here the first year of zero employment has been recorded as the date of exit.

Strobl et al (1998) identify a number of structural breaks in the FES data but none of these are found to pose problems here. Two structural breaks occurred in 1990 when non-responders were followed up, and in some cases dropped, and SFADCo plants were reassigned new identification numbers and treated as dead under their old numbers, reappearing under their new identification numbers in 1991. A further break occurs around 1994 when the surveys ceased to cover any new plants with fewer than 20 employees. An investigation of the new grant-aided plants database suggests that none of these breaks pose a problem: an analysis of deaths around 1990/1991 did not find any issues caused by the breaks occurring around then, and the break in 1994 is not relevant as all the plants in this study established before 1980. Meyler and Strobl (2000) also point to another structural break occurring at 1984 when plants in Údarás na Gaeltachta regions began to be included in the surveys. This probably explains the absence from the FES of a small number of grant-aided plants in the Údarás areas necessitating their exclusion from this study.

3.3.2 Methodology

Survival analysis is interested in how long the subjects stay in the model and their risk of failure.[92] Aspects of survival data make it difficult to apply standard regression modelling techniques such as Ordinary Least Squares (OLS): Principal issues are censoring (due to incomplete durations, subjects being lost from the sample, or the event not being observed) and non-normality. The analysis involves following subjects (plants) over time to record an event (plant exit). The data are also likely to display a number of other problems common in microeconometrics including heterogeneity and sample selection bias.

3.3.2.1 Univariate Analysis

A univariate analysis is commonly undertaken as a first step. This enables each potential covariate to be examined for possible explanatory power and also gives an idea of the survival functions and hazards of particular groups. Results from a univariate analysis can point to potentially significant explanatory variables and also to the appropriateness of certain models. In other words, where a series of k dummy variables is being considered for inclusion in a model it is only possible to include $k-1$ dummies so the univariate analysis is useful to inform the decision about which one to omit. It is also useful to get a picture of the shapes of the survival and hazard functions. The popular Cox proportional hazards model,

[92] Also known as duration analysis, transition analysis (or analysis of transition data), failure time analysis, and time-to-event analysis.

for example, requires that the ratio of hazards between groups remains constant over time. Parametric models require that hazard functions follow specific distributions. The Kaplan-Meier Survival Function takes the form:

$$S(t) = \prod_{j|t_j \leq t} \left(\frac{n_j - d_j}{n_j} \right)$$

where n_j is number of plants alive at time t and d_j is the number of exits (deaths or failures) at time t. Age of plants is the number of years alive (survival time) during the period of the study. The years are plant survival times (or age) regardless of *when* they entered, these are not calendar years. At the beginning of each year the 'risk set' or 'risk pool' are the plants that have survived until then (the number of years). Kaplan-Meier survival functions are graphs of raw data which show what fraction of plants exit the risk set each year. These can be drawn for the full datasets and also stratified by binary variables, to give an indication of the impact of the various explanatory variables on survival. Log-rank tests are used to test the statistical significance of the variables. For continuous explanatory variables, univariate Cox proportional hazards models can be estimated, which are equivalent to the Kaplan-Meier survival functions.

The hazard rate, h(t), is the instantaneous rate of failure, the probability of the event (plant exit) occurring in time t conditional on the subject being at risk in time t (i.e. still alive). The hazard rate can vary from zero (no risk) to infinity (certainty of failure at that instant). The hazard function can take on numerous shapes, exhibiting constant (CFR), increasing (IFR), or decreasing (DFR) failure rates over time. The shape is determined by the underlying process affecting survival. Failure rates that monotonically increase or decrease over time suggest a Weibull model, or they may increase in earlier years and decrease in later years giving the inverted U-shape found by McCloughan and Stone (1998), Delios and Beamish (2001) and Li (1995), for example. A common pattern in hazard models generally, for example in human mortality, is the 'bath-tub' which exhibits DFR-CFR-IFR, where risk of death may be high in the post-natal period, then stabilises, and later rises again beyond a certain age. Because hazard rates are rates they have units 1/t, and can be written as:

$$h(t_j) = \frac{d_j}{n_j}$$

One advantage of the Cox proportional hazards model is that it does not require the baseline hazard function to be estimated so no assumptions about the shape of the hazard function are necessary.

3.3.2.2 Multivariate Analysis

Multivariate survival models fall into two categories: Proportional hazards models and accelerated failure time models.

In proportional hazards models the explanatory variables have the effect of shifting the hazard function, which is not specified. As already noted, the Cox proportional hazards model is a popular model for survival analysis. This model ranks events (i.e. failures or exits) without any assumptions being made about their distribution, and outcomes become binary (failure or not). Time's role is only to rank the data. The Cox proportional hazards model is considered to be 'semiparametric' as 'time' is distribution-free but the explanatory variables are parametric. Although this model is free of assumptions for the hazard function, it is restricted by the proportional hazards assumption which effectively requires that Kaplan-Meier Functions between groups should be parallel. If this assumption fails, then the model is not appropriate, although stratification can sometimes avoid the problem by allowing separate baseline hazards for each stratum.

Accelerated Failure Time (AFT) models are alternatives when the proportional hazards assumption has been violated. In these, the hazard function needs to be estimated and the baseline hazard is assumed to be the same for all subjects, with the explanatory variables causing the subjects to move at different rates along time depending on their values. There are a number of such models available, the choice of model being dependent on the shape of the hazard function. Parametric models require assumptions to be made with regard to the hazard function and can therefore be restrictive. In these models the effect of the explanatory variables is to accelerate/decelerate time by a factor of $exp(-x_j\beta_x)$ where x_j is each X variable $j=1..k$ and β_x are the coefficients (Cleves et al 2004).

In this study the analysis time T is the age of the plant, in order to capture the entire lifetime of a plant and obtain a fuller picture of its performance. The time period of up to 48 years in this study is considerably longer than that covered in most of the extant literature.[93]

A death, failure or exit is deemed to have occurred when operations cease and employment has fallen to zero. Subsequent reappearances are ignored, as are grants received subsequent to the initial grant. The plant may be subsequently bought and operations restarted but this would be considered a new establishment and is only counted (as a new entity) if it was also

[93] For example, Godart et al (2012) covers a four year period, Disney et al (2003) for six years, Audretsch (1991) and Audretsch and Mahmood (1995) 10 years, Girma et al (2007) is 15 years, with Görg and Strobl (2003a) among the longest at 24 years.

grant-aided.[94] Death is also considered to occur if the plant is merged into a larger organisation and disappears from the dataset as a separate entity. Evans (1987) had similar difficulties dealing with mergers and acquisitions but decided that any 'contamination' was not severe, as can also be expected here. 'Failure' therefore refers to the first closure of the plant. This approach is also used by McCloughan and Stone (1997), Görg and Strobl (2003a, b) and Girma et al (2007), although Mata and Portugal (2002) require that firms are absent from their database for two years before they are deemed to have 'failed'. Various sources of information are used for the start-up date, in some cases this is the date of first grant. 'Foreign ownership' is defined here as at least 50 per cent foreign-owned (as in Görg and Strobl, 2003a, b) or where the main shareholder is foreign (as in Godart et al, 2012), the essential issue being foreign control or management of the plant. This is the definition used in the FES and also commonly used in MNC activity databases although it differs from the international definition of FDI.[95]

The process underlying the hazard function is continuous as plants exit at any time during the year. The data distribution is therefore intrinsically continuous but recorded discretely, at annual intervals, so the data are 'grouped' or 'interval-censored' with many plants appearing to fail at the same time. This is common for any study using the FES data. Mata and Portugal (2002) also use grouped data from an annual survey.

The discrete recording of transition times leads to choppy survival and hazard graphs. More importantly, grouping of the data in intervals leads to ties in the failure times.[96] Corrente et al (2003) suggest that discrete models should be used where there are a lot of ties but Cameron and Trivedi (2005) argue that discrete models are only required when the data are intrinsically discrete. Estimating a standard Cox proportional hazards model will require correction for the number of ties, as this model ranks failure times. Several methods are available: The most common is the Breslow approximation, but this is likely to be inaccurate where there are a relatively large number of ties, so the Efron approximation is preferred here (Cleves et al, 2004). Graphical checks on models estimated by both methods indicated better fits using the Efron method to deal with ties, although results were similar. According to Cleves et al (2004) these approximations are more common than using the marginal or exact calculations. Both approximate the marginal calculation which is the

[94] This occurs in one case: *Harry Winston Diamond Company* and *The Irish Diamond Company*.
[95] As discussed in Chapters One and Two, if there is a 10 per cent ownership stake an investment is classified as FDI and there is no management interest or control requirement.
[96] Where two subjects, in this case two plants, have the same survival times then they are 'tied' and the model does not know which one to put first. Ties are more likely to occur if the data are discrete or, as is the case for this study, where the data are intrinsically continuous but recorded discretely.

appropriate one here.[97] Due to possible heteroscedasticity, robust standard errors are estimated, in common with Görg and Strobl (2003a) and others.

There are a number of possible sources of sample selection bias which should be noted here. One is due to the vetting process undertaken prior to grant-aid. If such vetting is effective then grant-aided plants can be expected to have higher *a priori* probabilities of survival. However, this should not pose any difficulty for the plants in this study, by virtue of them all being grant-aided and hence having undergone some form of vetting process although one caveat is that this process may have varied between different agencies or at different times. Another possible source of selection bias is that employment data were available only from 1972, by which time 84 (or 20 per cent) of the plants had exited. Some of the analysis that follows covers the full 415 plants, but most only covers the 331 for which the employment time series is available.[98] Girma et al (2007) faced another source of sample selection bias as they mix grant-aided plants with non-grant aided plants in their dataset in order to compare the effects of grant-aid. To control for the possible different characteristics of the new plants in receipt of grant-aid and those that were not, they use propensity score matching to select a control (or 'untreated') group of non-grant aided plants that have similar characteristics as the grant-aided plants in their study. As already noted, the inclusion of incumbents may cause greater heterogeneity between the two groups, as grant-aided plants are more commonly new plants, causing sample selection bias to be a more serious issue than in this study. Lastly, a further possible source of sample selection bias in Girma et al (2007) is the exclusion in most of their analysis of plants smaller than 20 employees. This was necessitated by their use of data from the *Irish Economy Expenditure Survey* which excluded these smaller plants. It can be seen in Table 3.7 below that, as indigenous plants are smaller than foreign-owned plants, this may disproportionately drop indigenous plants from the dataset and bias the result that grant-aid has differential effects for indigenous *vis-à-vis* foreign-owned plants.[99]

[97] The marginal calculation is, according to Cleves et al (2004) appropriate when the 'tie' is only due to imprecise measurement i.e. there is no actual 'tie' but the order of failure is unobserved, whereas the partial calculation is appropriate where ties occurred in a discrete time model.

[98] For some dead plants there are single estimates of employment but it was decided not to use these due to the absence of a time-series, and because estimates may not be reliable and are not comparable, being from different sources and for different years.

[99] The data here are from a different time-period but it was calculated from the FES that in 1983 76 per cent of indigenous plants compared to 30 per cent of foreign-owned plants had fewer than 20 employees. As grant recipients tend to be larger than the general plant population however (as shown for this study in Table 3.6), the disproportionality in the dropping of plants from the dataset is likely to be smaller than these figures suggest. Propensity score matching may also have gone some way towards resolving this bias.

3.4 ANALYSIS AND RESULTS

Section 3.4.1 looks at the characteristics of the early new grant-aided plants, including some comparison with the full population of plants in the FES in 1972. The survival analysis is then in two parts. In Section 3.4.2 a non-parametric univariate analysis is undertaken to examine the survival and hazard functions of each of the covariates, followed by the estimation of multivariate survival models in Section 3.4.3.

3.4.1 Descriptive Statistics

The early new grant-aided plants differ from those studied in much of the survival literature as they are largely exporters, foreign-owned, and mostly greenfield investments. As a first step, prior to undertaking the survival analysis, the characteristics the new grant-aided plants are examined and compared to the full population of FES plants in 1972 to obtain a picture of how they fit in the general Irish industrial landscape at the time. As well as extending previous studies of plant survival by looking at this early period, this analysis also goes further by disaggregating 'foreign' into various home countries and regions. There are a total of 415 grant-aided plants, established from 1955 to 1972, with 331 remaining in the database in 1972.

Table 3.1 compares the nationality of ownership for the various groups of plants.[100] The 331 new grant-aided plants that survived to 1972 make up around eight per cent of the full population of plants in the FES in 1972, but 47 per cent of foreign-owned plants. The new grant-aided plants were predominantly foreign-owned, mostly European with UK ownership accounting for less than one-third. Germany was the main Continental European home country owning 16.4 per cent of all new plants. The US, at 19.3 per cent, was therefore the second largest home country of new grant-aided plants after the UK. In comparison, only 13 per cent of the full population of FES plants in 1972 were foreign-owned, with UK plants accounting for more than half of these. This concurs with the general view that foreign-owned incumbents were predominantly British.

[100] Canada has been left separate from the US because of the empirical importance of US FDI in the Irish economy.

Table 3.1 Comparison of Nationality of Ownership of Plants

	New Grant-Aided Plants	New Grant-Aided Plants Remaining in 1972	Full Population of Plants in FES 1972
No. of Plants	415	331	4055
% Foreign	77.3	76.7	13.2
% UK	*25.3*	*22.7*	*6.8*
% Continental Europe	*29.6*	*30.8*	*3.5*
% US	*19.3*	*20.9*	*2.4*
% Canada	*1.4*	*1.5*	*0.2*
% Rest of World	*1.7*	*0.9*	*0.3*

Note: 'Rest-of-world' refers to countries outside Europe and North America. In the grant-aided dataset there was a total of seven such plants owned by parents in Chile (1), Japan (1), Rhodesia (1) and South Africa (4), these mainly established in the 1960s with the exception of the Chilean-owned plant which arrived in 1972.

The sectoral distribution by NACE two-digit sector and broken down by main home region for the full set of new grant-aided plants is shown in Table 3.2.

Table 3.2 Sectoral Distribution of Grant-Aided Plants (415) by Main Home Region

NACE two-digit sector	Indigenous	Foreign	UK	US	Continental Europe	Total
Manufacture of food products and drink	26	23	13	2	8	49
Manufacture of tobacco products	0	1	0	0	1	1
Manufacture of textiles	18	45	20	6	18	63
Manufacture of wearing apparel; dressing and dyeing of fur	4	34	19	5	9	38
Manufacture of leather and leather products*	3	5	1	1	3	8
Manufacture of wood and wood products	3	5	2		3	8
Manufacture of pulp, paper and paper products	1	5	1	1	1	6
Publishing and printing and reproduction of recorded media	2	5	3	2	0	7
Manufacture of coke, refined petroleum products and nuclear fuel	0	1	0	0	1	1
Manufacture of chemicals, chemical products and man-made fibres	2	30	9	9	11	32
Manufacture of rubber and plastic products	4	22	6	2	14	26
Manufacture of other non-metallic mineral products	7	11	5	3	2	18
Manufacture of basic metals and fabricated metal products	1	3	0	1	1	4
Manufacture of fabricated metal products, except machinery and equipment	9	46	10	14	20	55
Manufacture of machinery and equipment n.e.c.	3	25	9	8	8	28
Manufacture of office machinery and computers	1	4	1	2	0	5
Manufacture of electrical machinery and apparatus n.e.c.	0	12	3	5	4	12
Manufacture of radio, television and communication equipment and apparatus	1	4	0	1	1	5
Manufacture of medical, precision and optical instruments, watches and clocks	1	13	0	9	4	14
Manufacture of motor vehicles, trailers and semi-trailers	3	4	1	0	3	7
Manufacture of other transport equipment	1	6	1	1	3	7
Manufacturing n.e.c.	4	17	1	8	8	21
Total	94	321	105	80	123	415

*Includes footwear.

Clear differences can be seen in the distribution of ownership over the various NACE two-digit sectors. Indigenous plants are mostly located in food and textiles industries. Foreign-owned plants are more diverse, predominating in textiles, clothing, metals and engineering, chemicals and, to a lesser extent, in food and rubber and plastics. These differences in sectoral distribution of the new grant-aided plants by ownership can be seen more clearly in Table 3.3 which shows the three most populated sectors by home region. Irish, UK, and other European grant-aided plants can be found in the more traditional industries. For US-owned plants, on the other hand, the most populated sectors after fabricated metals were the modern and mainly high-tech sectors of chemicals and instrument engineering.

Table 3.3 Ranks of Three Most Populated NACE 2-Digit Sectors by Main Home Region (415 grant-aided plants, ranked in descending order of number of plants)

NACE Two-Digit Sector	Indigenous	UK	US	Continental Europe
Manufacture of food products and drink	1	3		
Manufacture of textiles	2	1		2
Manufacture of wearing apparel; dressing and dyeing of fur		2		
Manufacture of chemicals, chemical products and man-made fibres			2	
Manufacture of rubber and plastic products				3
Manufacture of fabricated metal products, except machinery and equipment	3		1	1
Manufacture of medical, precision and optical instruments, watches and clocks			3	

Because of the limited number of observations in some NACE two-digit sectors, three aggregated broad sectors are used for the remainder of the analysis: 'Food, drink and tobacco', 'high-tech', and 'other sector'.[101] 'Food, drink and tobacco' has been defined as a separate sector because of its special position *vis-à-vis* other sectors in the economy. In 1951, for example, the food sector provided most (81 per cent) of the value of Ireland's manufacturing exports (O'Malley, 1989: Table 4.5) and this sector was the only strong performer for indigenous industry at that time. Additionally, it was the only sector with strong backward linkages into the domestic economy (O'Malley, 1989). Table 3.2 showed that foreign-ownership in this sector was predominantly European. There were only two US-owned plants, and none from other countries.[102] For brevity this sector is henceforth sometimes referred to as 'food'. 'Other sectors' incorporates plants that are not considered high-tech and are not in the food sector. This broad sector therefore includes the declining sectors of textiles, clothing, and footwear.

[101] Included as 'high-tech' sectors here are the manufacture of most chemicals (with the exclusion of fertilisers, pesticides and paint manufacturing), rubber and plastics, and electrical and optical equipment. Görg and Strobl (2003b) also distinguish between high-tech and low-tech, using a definition broadly in line but not equal to this used here. They do not separate out the food sector.

[102] Of these one was manufacturing chewing gum, the other produced canned milk. Of the 13 UK-owned plants, nine were in the dairy sector.

The broad-sector breakdown by nationality of ownership for the new grant-aided plants is shown in Table 3.4. The two US-owned plants in the food sector amount to 2.7 per cent of all US-owned plants in the database, compared with 12.4 per cent of UK-owned plants and 27.7 per cent of indigenous plants.

Table 3.4 New Grant-Aided Plants (415)
Detailed Breakdown by Main Home Region and Broad Sector

Sector	Indigenous	Foreign	UK	US	Continental Europe	Total
Food, drink and tobacco	26	24	13	2	9	50
High-tech sectors	8	80	17	26	33	88
Other sectors	60	217	75	52	81	277
Total	94	321	105	80	123	415

Grants were disproportionately paid to new plants in high-tech sectors with 21 per cent of the new grant-aided plants located in high-tech sectors compared with less than 10 per cent of all manufacturing plants in the FES 1972, as can be seen in Table 3.5.

Table 3.5 Percentage of Plants by Broad Sector in 1972

Sector	New Grant-Aided Plants (331)	All FES Plants (4055)
Food, drink and tobacco	12.4	22.0
High-tech sectors	21.1	9.5
Other sectors	66.5	68.4

Table 3.6 shows that new grant-aided plants in general tend to be larger than the general population of manufacturing plants in the FES in 1972. Thirteen per cent of new grant-aided plants had 250 employees or more compared to less than four per cent of all plants in the FES. Just over 14 per cent of grant-aided plants in 1972 had fewer than 20 employees compared with 57 per cent of all plants.

Table 3.6 Size of Plants in 1972

Nos. of Employees	Percentage of New Grant-Aided Plants (331)	Percentage of all Plants in FES
Less than 20	14.2	57.0
20 and less than 50	30.2	22.5
50and less than 100	21.5	9.3
100 and less than 250	21.1	7.4
250 and over	13.0	3.9
Total	100	100

Table 3.7 looks in more detail at the average size of new grant-aided plants, disaggregating by the main home regions of their owners.[103] Foreign new grant-aided plants are larger. As found by the 1967 *Survey* and Teeling (1976), US new plants were especially large. Thirty

[103]Size is average size which for the grant-aided set of plants is not for their full lifetime but for the years alive from 1972-2003.

per cent of new grant-aided US-owned plants that were still alive in 1972 had an average size of 250 employees or more.[104]

Table 3.7 Size of New Grant-Aided Plants in 1972 by Nationality

Nos. of Employees	Indigenous	Foreign	UK	US	Continental Europe
Less than 20	19	28	10	6	9
20 and less than 50	22	78	24	16	35
50and less than 100	13	58	18	10	30
100 and less than 250	18	52	20	16	15
250 and over	5	38	3	21	13
Total	77	254	75	69	102

The breakdown of grant-type by nationality of ownership is shown in Table 3.8. Indigenous new plants mainly received 'New Industry' grants and only one (Irish University Press) received a SFADCo grant. More than half of the new plants with owners from Continental Europe had 'Undeveloped Areas' grants. Only 27.5 per cent of US new plants were established in undeveloped areas, a much smaller percentage than for the other main home regions.

Table 3.8 Grant Type as Percentage of Main Home Region (All 415)

Grant Type	Indigenous	Foreign	UK	US	Continental Europe	Total
New Industry	55.3	43.3	45.7	41.3	43.1	46.0
Undeveloped Areas	43.6	40.8	42.9	27.5	50.4	41.4
SFADCo	1.1	15.9	11.4	31.3	6.5	12.5
Totals:	100	100	100	100	100	100

For the grant-aided plants that survived until 1972, Table 3.9 shows numbers of each grant-type, with ownership and some sectoral details. Some corresponding percentage details are given in Table 3.10. 'Low-tech' consists of new grant-aided plants in the 'food, drink and tobacco' and 'other' sectors, there were no food, drink and tobacco new plants in receipt of SFADCo grants.

Table 3.9 Distribution of Grants by Ownership and Sector (1972)

	New Industry Grants			Undeveloped Areas Grants			SFADCo		
	Low-tech	High-tech	Total	Low-tech	High-tech	Total	Low-tech	High-tech	Total
Indigenous	41	6	47	28	1	29	1	0	1
Foreign	86	34	120	83	20	103	22	9	31
of which:									
UK	*32*	*6*	*38*	*26*	*5*	*31*	*5*	*1*	*6*
US	*19*	*11*	*30*	*17*	*3*	*20*	*11*	*8*	*20*
Continental Europe	*31*	*17*	*48*	*39*	*11*	*50*	*4*	*0*	*4*
Total	127	40	167	111	21	132	23	9	32

[104] Two of these had over 1000 employees in 1972: The EI Company at Shannon and Ecco Limited in Dundalk. Sunbeam was the only other grant-aided plant of this size in 1972.

Table 3.10 shows that a larger proportion of surviving new plants in receipt of 'New Industry' and SFADCo grants were in high-tech sectors, compared to those located in undeveloped areas. The US dominated ownership in Shannon itself at this time: Only two of the non-European owned plants in 1972 at Shannon were not US-owned, one of which was Canadian, the other South African. Furthermore, all non-European high-tech new plants at Shannon were US-owned. Compared to the dominance at Shannon, US-owned new plants accounted for just 18 per cent of plants in receipt of 'New Industry' grants and less than 16 per cent of those receiving 'Undeveloped Areas' grants. Such a discrepancy lends support to the contention that there may have been a particular policy emphasis on attracting US investment at this time. Shannon was seen as suitable for air freight which was a greater requirement for North American and rest-of-world owners. European firms were better able to make use of the ports for transport, and proximity to ports was often a reason for choice of location. For example, one reason given at the time for the establishment of a German-owned ceramics factory in Kilrush was its port which allowed the necessary clay to be imported direct from Germany.[105]

Table 3.10 Grant-Type as Percentage of Ownership and Sector
(Plants Alive in 1972)

Grant Type	% High-tech	% Indigenous	% UK	% US
New Industry	24.2%	28.1%	22.8%	18.0%
Undeveloped Areas	15.9%	22.0%	23.5%	15.2%
SFADCo	28.1%	3.1%	18.8%	59.4%

Table 3.11 gives a more detailed breakdown of SFADCo supported plants disaggregated by sector and nationality of ownership.

Table 3.11 SFADCo Grant-Aided Plants in 1972 by Nationality and Sector

Nationality	Low-tech	High-tech	Total
Indigenous	**1**	**0**	**1**
UK	*5*	*1*	*6*
Total EEC*	4	0	4
Germany	*1*	*0*	*1*
*Other EEC6**	*3*	*0*	*3*
Other European	0	0	0
Continental Europe	4	0	4
Total European[#]	9	*1*	10
North America	12	8	20
US	*11*	*8*	*19*
Canada	*1*	*0*	*1*
Rest of the World	*1*	*0*	*1*
Foreign	**22**	**9**	**31**
Total	**23**	**9**	**32**

[105] This refers to *Ceramics Limited/Celtic Ceramics*. See 'One Man's Experience in Irish Industry' *The Irish Times, 19th April 1961*

Table 3.12 shows that SFADCo plants also tended to be larger. It has already been shown in Table 3.7 that plants in receipt of SFADCo grants were more likely to be foreign-owned, particularly by US owners, both of which are associated with larger plant size.

Table 3.12 Plant Size as Percentage of Grant-Type (1972)

Nos. of Employees	New Industry	Undeveloped Areas	SFADCo	Total
Less than 50	41.9	47.7	43.8	44.4
50 and less than 250	42.5	45.5	31.3	42.6
250 and over	15.6	6.8	25.0	13.0
Total	100	100	100	100

Note: Size data are only available for the 331 plants in existence in 1972.

Table 3.13 shows the grant-type (for all 415 plants) by the broad sector of the plant. There were no plants in the food sector in the SFADCo area, with equal numbers of plants in this sector in receipt of 'New Industry' grants and 'Undeveloped Areas' grants.

Table 3.13 Broad Sector by Grant-Type (415 Plants)

Broad Sector	New Industry	Undeveloped Areas	SFADCo
Food, drink and tobacco	25	25	0
High-tech	46	26	16
Other sector	120	121	36

The new grant-aided plants established between 1955 and 1972 but their employment has been traced up to 2003. As plants exited during this time there is attrition in the dataset. Table 3.14 shows numbers and characteristics of grant-aided plants remaining in the risk-set (i.e. still alive and so at risk of failure) at approximately 10-year intervals.

Table 3.14 Snapshots of Characteristics of New Grant-Aided Plants (331)

		1972	1982	1992	2003
Total	No. of plants	331	210	129	90
	Total employment	38591	27212	16487	11279
	Mean plant size	116.6	129.6	127.8	125.3
	Median plant size	50	72.5	80	68
Indigenous	No. of plants	77	50	24	20
	Total employment	7208	4657	2415	2081
	Mean plant size	93.6	93.1	100.6	104.1
	Median plant size	41	47	64	30.5
Foreign	No. of plants	254	160	105	70
	Total employment	31383	22555	14072	9198
	Mean plant size	123.6	141.0	134.0	131.4
	Median plant size	56.5	87.5	87	74.5
Low-tech	No. of plants	261	156	86	58
	Total employment	26895	17334	9520	5334
	Mean plant size	103.0	111.1	112.0	93.6
	Median plant size	50	65.5	74	42
High-tech	No. of plants	70	54	43	32
	Total employment	11696	9878	6843	5545
	Mean plant size	167.1	182.9	159.1	173.3
	Median plant size	48	84.5	100	116
Indigenous low-tech	No. of plants	70	47	23	19
	Total employment	6552	4076	2250	1831
	Mean plant size	93.6	86.7	97.8	96.4
	Median plant size	42.5	45	61	30
Indigenous high-tech	No. of plants	7	3	1	1
	Total employment	656	581	165	250
	Mean plant size	93.7	193.7	165.0	250.0
	Median plant size	27	49	165	250
Foreign low-tech	No. of plants	191	109	63	39
	Total employment	20343	14100	7394	3903
	Mean plant size	106.5	120.5	117.4	100.1
	Median plant size	58	70	76	49
Foreign high-tech	No. of plants	63	51	42	31
	Total employment	11040	9297	6678	5295
	Mean plant size	175.2	182.3	159.0	170.8
	Median plant size	52	87	95.5	114

Some details from the life-tables are given in Table 3.15. One-year and five-year survival rates show indigenous plants performing slightly better. This difference has disappeared later on and indigenous and foreign-owned plants have the same 10-year survival rates and similar median survival times. Survival rates are poorer than those reported by Girma et al (2007) who estimate 10-year survival rates of 85 per cent for grant-aided plants. This is likely to be due to the omission of small plants (those with fewer than 20 employees) from their study. A re-estimation of life-tables for plants with 20 employees or more only found the 10-year survival rate for the new grant-aided plants rise to 84 per cent, similar to that in Girma et al (2007). Four-year survival rates have also been calculated to compare with

those that Segarra and Callejon (2002) estimate for Spanish firms: 58.7 per cent for all plants rising to 74.5 per cent for enterprises with more than 50 employees. The new grant-aided plants in this study are found to have much higher four-year survival rates of 83.1 per cent and 97.5 per cent respectively.

Table 3.15 Survival Rates of New Grant-Aided Plants

1-year survival rate	
All Plants	96%
Indigenous Plants	98%
Foreign-Owned Plants	96%
5-year survival rate	
All Plants	78%
Indigenous Plants	82%
Foreign-Owned Plants	77%
10-year survival rate	
All Plants	65%
Indigenous Plants	65%
Foreign-Owned Plants	65%
Median Survival Time	
All Plants	15.3 years
Indigenous Plants	15.5 years
Foreign-Owned Plants	15.3 years

Note: The median survival time is calculated as the number of years at which the probability of survival is 0.5 (see Cleves et al, 2004)

Table 3.16 shows details from the life-tables by grant-type. Five-year and 10-year survival rates were better for plants with 'New Industry' grants compared to those with 'Undeveloped Areas' grants. O'Farrell (1976) also finds poorer performance for plants in undeveloped areas although the difference was not statistically significant at five per cent. The record for SFADCo grants is very poor in comparison, although there are far fewer plants to base these figures on.

Table 3.16 Comparison of Survival Rates by Grant-Type

	New Industry	**Undeveloped Area**	**SFADCo**
1-year survival rate			
All Plants	97%	98%	89%
Indigenous Plants	96%	93%	
Foreign-Owned Plants	97%	97%	82%
5-year survival rate			
All Plants	84%	79%	56%
Indigenous Plants	86%	76%	
Foreign-Owned Plants	83%	80%	51%
10-year survival rate			
All Plants	73%	63%	40%
Indigenous Plants	75%	54%	
Foreign-Owned Plants	73%	66%	35%
Median Survival Time			
All Plants	18.1 years	14.5 years	6 years
Indigenous Plants	17.6 years	11.7 years	
Foreign-Owned Plants	18.6 years	15.0 years	6.4 years

Note: There was only one indigenous plant in the SFADCo area, 'Irish University Press' at Shannon, which survived for six years.

3.4.2 Univariate Analysis

Kaplan-Meier survival functions are estimated for the full dataset of new grant-aided plants, shown in Figure 3.1 and then for each of the categorical variables.

Figure 3.1 Kaplan-Meier Survival Function for 415 New Grant-Aided Plants

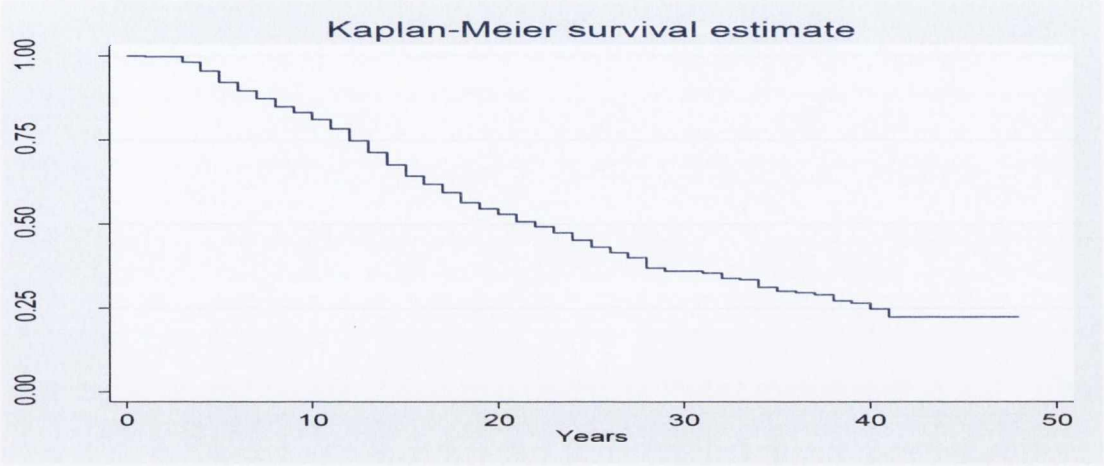
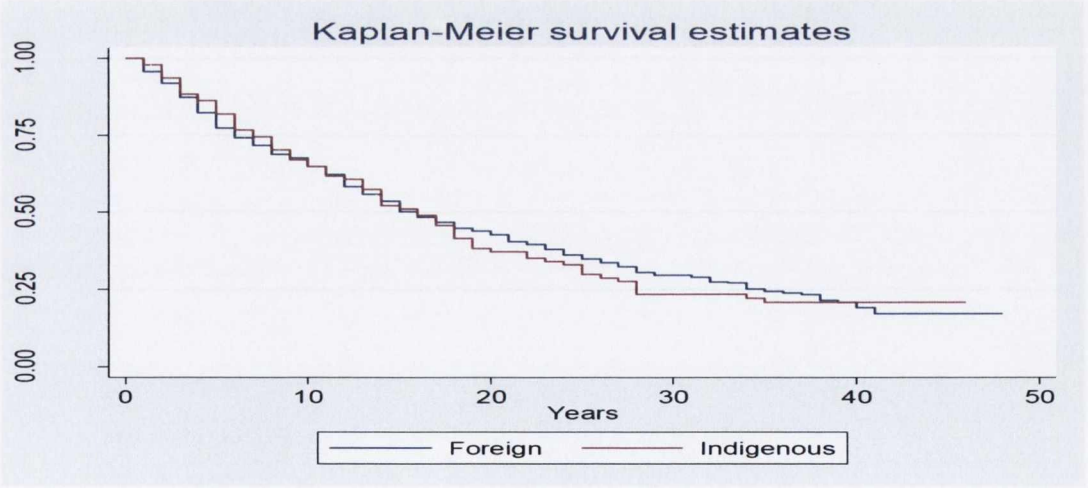


Figure 3.2 shows the survival functions for new grant-aided indigenous and foreign-owned plants. Indigenous plants had better survival rates up to year 13. Thereafter foreign-owned plants had generally better survival probabilities until plants get very old (after year 26). A log-rank test showed that the difference between indigenous plants and foreign-owned plants was not significant, supporting the graphical evidence.

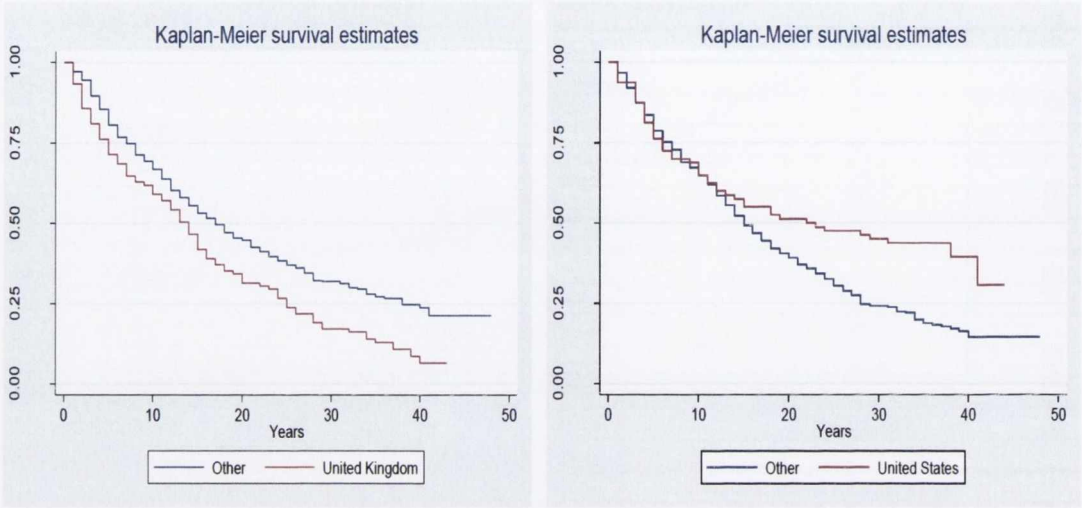
Figure 3.2 Kaplan-Meier Survival Function for Ownership



The main home countries of foreign-owned plants are the UK and the US. UK-owned new grant-aided plants had poorer survival rates than US-owned plants as can be seen in Figure 3.2 but this difference is notable only from year 14. The better outcomes for UK-owned plants in earlier years may be attributable to grant-aid, although structural change is also a

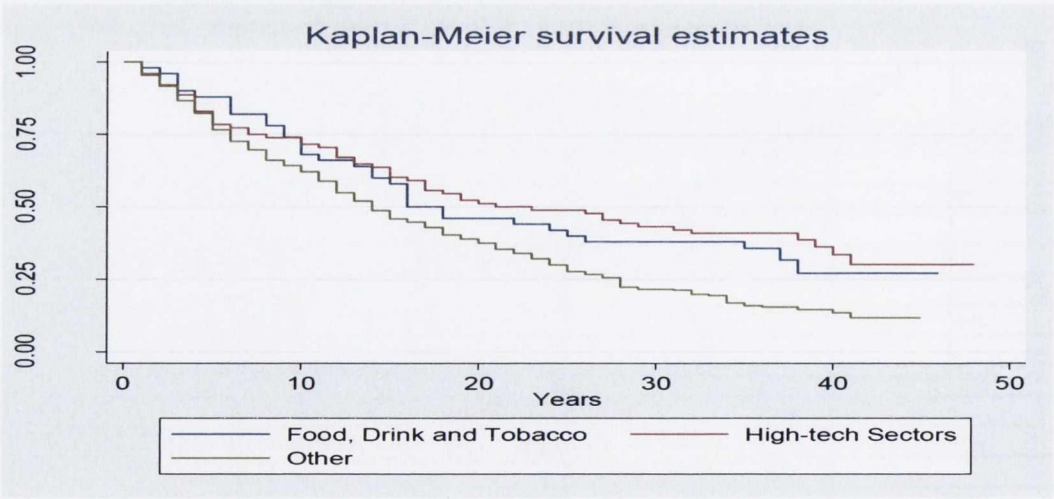
likely factor.[106] The better outcomes for US-owned plants occur after year 15. Log-rank tests showed that both UK and US ownership are statistically significant covariates at the one per cent level. Results for plants owned by parents in Continental Europe and the 'rest-of- world' were not statistically significant (these functions are contained in Appendix 3.1).

Figure 3.3 Kaplan-Meier Survival Functions for UK and US Ownership



The univariate analysis on the broad sectors, in Figure 3.4, shows that new grant-aided plants in high-tech sectors had much better survival outcomes (significant at one per cent). Those in the food sector also had somewhat better survival outcomes but this result was not statistically significant (with a p-value of 0.11).

Figure 3.4 Kaplan-Meier Survival Functions for Broad Sectors



[106] As noted earlier, UK ownership is more dominant in textiles and clothing. Appendix 3.1 shows more detailed Kaplan-Meier survival graphs. The clothing sector in particular had very poor performance.

As Kaplan-Meier functions can only be estimated for binary variables, univariate Cox regressions were estimated for both 'average size' and 'initial size' (based on numbers of employees), both measures being statistically significant at the five per cent level. Table 3.17 summarizes the prob-values from the various tests on the main explanatory variables, to show their statistical significance. To obtain a better picture of hazard rates, and to aid model specification, hazard functions and cumulative hazard functions were also drawn for all binary variables (see Appendix 3.1 for the full set of survival, hazard and cumulative hazard graphs).

Table 3.17 Summary of Prob-Values for Main Explanatory Variables

Covariate	Prob-Value
Indigenous	0.773
UK	0.001
US	0.002
Continental Europe	0.317
Rest of World	0.000
Food, drink and tobacco	0.101
High-tech	0.001
Other sector	0.000
New Industry	0.005
Undeveloped Areas	0.125
SFADCo	0.021
Initial Size	0.026
Average Size	0.047

3.4.3 Multivariate Analysis

The objective in the multivariate analysis is to examine how the various factors identified from the literature review impact on the survival performance of new grant-aided industry. These are ownership and sectoral differences, plant size, and grant-type. We are concerned here in estimating the model of 'best fit'. As many of the potential explanatory variables are binary, the univariate analysis is used to inform the decision about which are to be included in a multivariate model. Because of its popularity, despite dodgy Kaplan-Meier survival functions in respect of the proportional hazards assumption, a Cox proportional hazards model was first estimated.

Plant size is omitted at first, in order to utilise the full set of 415 plants in the analysis.[107] The statistically significant ownership covariates in the univariate analysis are: UK, US,

[107] Even the full set of 415 grant-aided plants is a much smaller dataset than used in some other models estimated for Ireland e.g. see Görg and Strobl (2003a) and Girma et al (2007). However it is comparable to that used by McCloughan and Stone (1998) who have just 252 multinational subsidiaries. Here there are 321 foreign-owned plants altogether of which 254 (79 per cent) were alive in 1972 and for which employment data are therefore available. The small number of observations is likely to be a contributory factor for the violations of the proportional hazards assumption found when estimating the Cox proportional hazards models.

and rest-of-world.[108] The statistically significant broad sector covariates are the high-tech and 'other' sectors but as 'food, drink and tobacco' is more empirically relevant than the diverse 'other sector' it is selected instead.[109] 'New Industry' and SFADCo grants are the statistically significant grant dummies so they are included first. Initially a Cox proportional hazards model was estimated with these covariates. The results shown in Table 3.18 are hazard ratios. Values greater than one suggest an increase in the hazard ratio and values less than one show a reduction in hazard. The results from Model One suggest that UK-owned plants have a 36 per cent greater risk of failure and rest-of-world owned plants are 2.8 times more at risk, with US plants having 39 per cent lower risk of failing. Plants in the food and high-tech sectors and with 'New Industry' grants all experienced better survival prospects than other plants, with 35 per cent, 38 per cent and 18 per cent lower risks of failure, respectively. Plants receiving SFADCo grants performed poorly with a more than 60 per cent greater risk of failing. This is somewhat related also to the high risk for rest-of-world plants who were disproportionately based at Shannon.

Table 3.18 Model One for 415 New Grant-Aided Plants (Cox)

Covariate	**Hazard Ratio**
UK	1.348055** (0.165069)
US	0.609689 *** (0.1167594)
Rest of World	2.765727** (1.15061)
Food, drink and tobacco	0.6539573** (0.1252879)
High-tech	0.6205379*** (0.0963566)
New Industry Grant	0.8227249* (0.094132)
SFADCo Grant	1.604785** (0.37102)
Wald test (7df)	48.45***
Log likelihood (psuedo)	-1734.7001

Heteroscedasticity-consistent standard errors in parentheses; Efron method for ties
*, **, *** denote 10%, 5% and 1% significance levels respectively

At first glance Model One performs well, with signs as expected, from the literature and the descriptive statistics above, and the effects of all covariates being significant (albeit the 'New Industry' grant dummy is only significant at 10 per cent). However, diagnostic checks reject the proportional hazards assumption, the SFADCo dummy being the chief culprit although the US dummy is also statistically weak having a p-value of 0.05 in the proportional hazards test. This assumption, that hazards between groups must be proportional over time, is an important restriction of the Cox model. More detailed hazard

[108] As already noted: Because of its empirical importance US has been separated from Canada; the use of 'North America' being originally considered as an alternative. There are just six Canadian-owned new grant-aided plants.
[109] As food, drink and tobacco has a p-value of 0.1007 it qualifies under the 'rule of thumb' to select covariates with p-values below 0.25 on the log-rank test.

functions and log-log graphs in Appendix 3.1 will show the reader that this assumption fails in a number of cases. For example, the univariate tests show US-ownership violates the proportional hazards assumption. This is an empirically important covariate, given the importance of US FDI in the Irish economy generally and the increase in US investment in this period. A number of other estimations using the Cox proportional hazards model confirmed violations of the proportional hazards assumption. One method to overcome this problem is stratification. If two groups have different baseline hazards and hence fail the proportional hazards test, stratifying by them can overcome this because it allows baseline hazards to differ for each group while keeping the coefficients in the model constant (Cleves et al, 2004). Both Görg and Strobl (2003a) and Girma et al (2007) stratify their models by NACE two-digit sectors.[110] Here, stratifying by NACE two-digit sectors in Model Two does appear to overcome the proportional hazards assumption violation although significance levels were not good, as shown in Table 3.19 below.[111] Results from Model Two are as expected: UK-owned, rest-of-world, and SFADCo new grant-aided plants with higher hazards, US-owned plants having lower hazard. All explanatory variables are statistically significant.

Table 3.19 Model Two for 415 New Grant-Aided Plants (Cox)
Stratified by NACE 2-Digit Sectors

Covariate	**Hazard Ratio**
UK	1.310069* (0.176689)
US	0.655863** (0.120708)
Rest of World	1.72757* (0.811266)
New Industry Grant	0.873603 (0.107065)
SFADCo Grant	1.553009** (0.309454)
Wald test (7df)	*22.1***
Log likelihood (psuedo)	*-877.64167*

Heteroscedasticity-consistent standard errors in parentheses; Efron method for ties
*, **, *** denote 10%, 5% and 1% significance levels respectively

As already noted, the most important explanatory variable in the literature is plant size. Because of the lack of employment data prior to 1972, models that include size can only be estimated for the 331 plants that survived until 1972. Models are estimated using both 'initial' and 'average' size measured as numbers of employees.[112] These gave similar results but the (log of) average size is chosen as the preferred measure of plant-size as it is better at

[110] It appears that this successfully overcame the proportional hazards violation problem in both cases, but both have much larger datasets than the grant-aided data being analysed here.
[111] The model was also estimated stratified by broad sector and by ownership but all violated the proportional hazards assumption despite stratification.
[112] Consideration was also given to using size classifications ('small', 'medium', 'large') to enable some of the 84 'dead' by 1972 plants to be used but this loses substantial information for the other 331 pre-EU entry plants so this was not proceeded with.

capturing the lifetime employment of a plant.[113] Model Three is again stratified by the NACE two-digit sectors, results are given in Table 3.20.

Table 3.20 Model Three for 331 New Grant-Aided Plants (Cox)

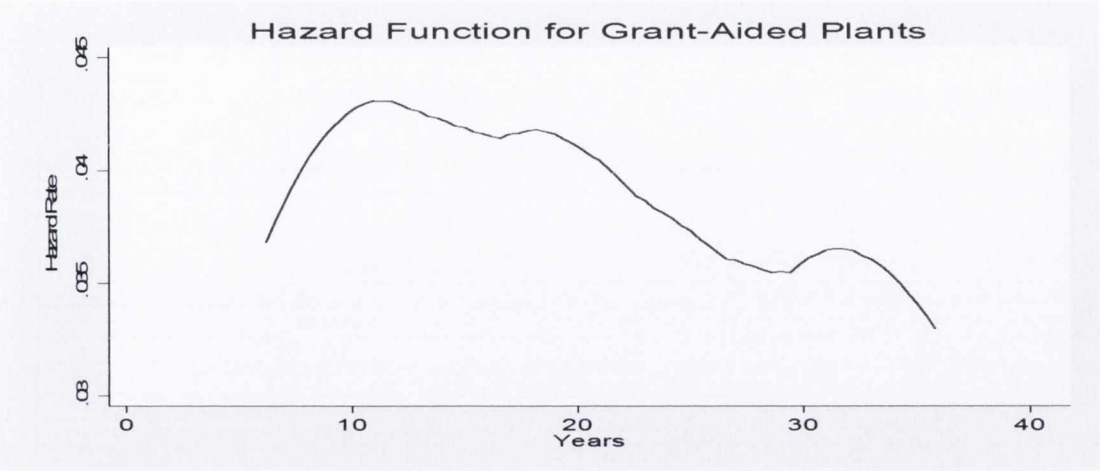
Covariate	Hazard Ratio
Size	0.838435*** (0.056063)
UK	1.210861 (0.195873)
US	0.759559 (0.173584)
Rest of World	2.941257** (1.323911)
New Industry Grant	1.081466 (0.156967)
SFADCo Grant	1.5304* (0.38815)
Wald test (6df)	20.38***
Log likelihood (psuedo)	*-613.052*

Heteroscedasticity-consistent standard errors in parentheses; Efron method for ties
*, **, *** denote 10%, 5% and 1% significance levels respectively
Note: Employment data was only available for the 331 plants alive in 1972.

However, Model Three (and other models estimated with various other measures of size) violates the proportional hazards assumption, in this case US-ownership being the chief culprit. It seems then, despite its popularity, that the Cox proportional hazards model is inappropriate for these data. Furthermore, stratification, which is used in Models Two and Three to overcome the proportional hazards violation, is only suitable if the strata are groups that are not of any particular interest. Sectoral differences in plant survival are likely to be important in this study, especially considering the greater proportion of new grant-aided plants in high-tech sectors than in the general population of manufacturing establishments. An appeal back to the hazard functions, to examine the distribution of failure times and consider the nature of the underlying process, is appropriate. Because the proportional hazards assumption is found to be invalid, an AFT model may be more suitable for these data. Figure 3.5 shows the overall hazard function for the new grant-aided plants.

[113] In addition, as already noted, 'initial size' is not the actual start-up size for these establishments but rather the employment level at 1972 so it is a relatively meaningless being a single point measure of employment. Although 'average size' is only the mean employment level from 1972, rather than for the plant's total lifetime, it gives a more complete picture of employment. The log of 'average size' is used as it improved model specification. Disney et al (2003) also use the log of size.

Figure 3.5 Estimated Hazard Function for New Grant-Aided Plants



The hazard function shows an IFR-DFR pattern similar to that found in McCloughan and Stone (1997), Delios and Beamish (2001), and Li (1995). A log-normal or log-logistic regression model is likely to be the most appropriate for this shape of distribution. As a further check the Akaike Information Criterion (AIC) criterion was applied to a non-stratified version of Model Three to compare the available parametric models, although the hazard functions are clearly non-monotonic.[114] The AIC is defined as:

$$AIC=-2(Log\ Likelihood) + 2(k+c)$$

Where k is the number of explanatory variables in the regression and c is the number of model-specific distributional parameters, equal to two in most cases, equal to one for the exponential distribution, and equal to three for the generalised gamma distribution (Cleves et al, 2004). The criterion penalises each model's log likelihood to reflect the number of parameters being estimated and then compares them. The model with the lowest AIC is preferred (Cleves et al, 2004) which Table 3.21 shows to be a log-normal regression.

Table 3.21 Results for Akaike Information Criterion (AIC) (331 Plants)[115]

Distribution	Log-likelihood	k	c	AIC
Exponential	-420.65636	6	1	855.31272
Weibull	-401.74041	6	2	819.48082
Gompertz	-412.15749	6	2	840.31498
Log-normal	-391.87741	6	2	799.75482
Log-logistic	-393.37165	6	2	802.74330
Generalised Gamma	-407.65637	6	3	833.31274

Model Three is then essentially re-estimated using the log-normal regression but instead of stratifying by sector the food and high-tech sectors have been included as covariates. The results for this model, Model Four, are reported in Table 3.22.

[114] This criterion is useful to compare non-nested models (Cleves et al, 2004) and is also used in Corrente et al (2003). Although a log-logistic regression model is generally considered indistinguishable from the log-normal with similar results (Cleves et al, 2004), the AIC check showed the log-normal to be the preferred distribution.

[115] Other models estimated also suggested the log-normal was the preferred parametric model.

Table 3.22 Model Four Log-Normal Regression for 331 New Grant-Aided Plants

Covariate	Time Ratios
Size	1.215283*** (0.055403)
UK	0.822826* (0.090398)
US	1.141326 (0.179174)
Rest of World	0.427529* (0.211939)
Food, drink and tobacco	1.582116*** (0.240581)
High-tech	1.604913*** (0.213312)
New Industry Grant	1.017175 (0.103578)
SFADCo Grant	0.743392 (0.153714)
Wald test (8df)	*50.36****
Log likelihood (psuedo)	*-382.297*

Heteroscedasticity-consistent standard errors in parentheses
*, **, *** denote 10%, 5% and 1% significance levels respectively
Note: Employment data was only available for plant surviving until 1972.

For ease of interpretation, time ratios are reported in Table 3.22. These show the factors by which time-to-failure or exit is accelerated or decelerated by each explanatory variable. Time ratios greater than one decelerate time-to-failure and hence the associated covariate improves a plant's survival probability. Time ratios of less than one accelerate time-to-failure and hence plants with these covariates have a greater hazard of failure. Size (measured again as the log of the mean number of employees), US-ownership, 'New Industry' grants, and the food and high-tech sectoral dummies all have time ratios greater than one. Of these, the size and sectoral dummies results are statistically significant at one per cent. Therefore, larger plants or those located in the food or high-tech sectors have better survival prospects than others. The time ratio for the food sector dummy, for example, is 1.582116, meaning that survival time has been increased by just over 58 per cent. An establishment in this sector that would otherwise have been expected to fail at time t=1, is now predicted not to fail until time t=1.582116. If it would have been expected to fail at t=5 its failure time is predicted now to be at t=7.91058 (i.e. 1.582116*5, again an increase of just over 58 per cent). Similarly, being UK-owned will accelerate time-to-failure so a UK-owned establishment that would otherwise have failed at t=1 would now be predicted to fail at t=0.822826 (a reduction in its survival time of almost 18 per cent) although this result is only statistically significant at the 10 per cent level.

The grant covariates are now dropped from the model, as they are statistically insignificant. Table 3.23 reports the results for Model Five that excludes the grant dummies. These results are similar to those obtained for Model Four. A likelihood ratio test was not statistically significant suggesting that the restricted model (Model Five) is as good as the unrestricted

model (Model Four). This again suggests that the type of grant received is unimportant, once size and differences in sectoral location and ownership are controlled for. To see why, the reader may wish to return to Tables 3.8, 3.12, and 3.13 which show that there are relationships between grant type and ownership nationality, plant size, and broad sector, respectively.

Table 3.23 Model Five Log-Normal Regression for 331 New Grant-Aided Plants

Covariate	**Time Ratios**
Size	1.214336*** (0.055856)
UK	0.81063* (0.089424)
US	1.066304 (0.158752)
Rest of World	0.390471** (0.18348)
Food, drink and tobacco	1.62147*** (0.247015)
High-tech	1.615045*** (0.214496)
Wald test (6df)	*45.71***
Log likelihood (psuedo)	*-383.788*

Heteroscedasticity-consistent standard errors in parentheses
*, **, *** denote 10%, 5% and 1% significance levels respectively
Note: Employment data was only available for plant surviving until 1972

Once size is introduced into models, the 84 plants that did not survive until 1972 are omitted from the analysis. The attrition rate prior to 1972 is 20 per cent overall, greater for foreign-owned plants at 21 per cent compared with 18 per cent for indigenous plants. Therefore, there are no employment data, and hence no size estimates, for about one-fifth of these plants. This may lead to sample selection bias when size is included in the regressions.

Table 3.24 Investigating Sample Selection Bias Model One (Log-Normal)

Covariate	**Time Ratios**	
	415 Plants	**331 Plants**
UK	0.692281*** (0.092141)	0.836095 (0.095707)
US	1.325135 (0.248591)	1.236852 (0.263996)
Rest of World	0.360655*** (0.143663)	0.42952 (0.263996)
Food, drink and tobacco	1.417042* (0.275616)	1.526975*** (0.24421)
High-tech	1.50305** (0.244568)	1.686437*** (0.231454)
New Industry Grant	1.240928* (0.154405)	1.073655 (0.11259)
SFADCo Grant	0.575243*** (0.121121)	0.781846 (0.165674)
Wald test (7df)	*42.92****	*28.61****
Log likelihood (psuedo)	*-593.23*	*-392.00037*

Heteroscedasticity-consistent standard errors in parentheses
*, **, *** denote 10%, 5% and 1% significance levels respectively

Table 3.24 shows results from log-normal re-estimations of Model One for both the full 415 plants and the surviving 331 plants, in order to get some idea of the extent of any sample selection bias that might occur. The results in Table 3.24 find that the qualitative results have been unaffected by omission of the dead plants. However, results vary quantitatively and statistical significance is affected. Wald tests comparing the time ratios for each covariate showed that these differences were not statistically significant at five per cent. It can therefore be concluded that sample selection bias is not a serious concern in this instance. Size is therefore included in subsequent models.

Following McCloughan and Stone (1998), Görg and Strobl (2003a), and Girma et al (2007), sectoral growth is now included in the model.[116] Plants in growing sectors can be expected to have better survival probabilities as there is less competitive pressure on them. Cox proportional hazards models can deal with time-varying covariates but, as McCloughan and Stone (1998) point out, time-varying covariates are difficult to incorporate into parametric models. They therefore treat them as fixed covariates by estimating their means instead, which they argue is commonly thought "acceptable." Accordingly, average annual percentage sectoral growth (based on changes in total employment in each NACE two-digit sector for the full population of plants in the FES) is therefore included as a fixed variable instead of using annual changes as in Görg and Strobl (2003a) and Girma et al (2007). The three fastest growing NACE two-digit sectors are office machinery and computers (NACE 30), medical, precision and optical instruments (NACE 33), and manufacture of radio, television and communication equipment (NACE 32). The largest average percentage contractions in employment over the study period were in textiles, clothing, and footwear (NACE 17, 18 and 19). Results for this model are given in Table 3.25.

[116] As already noted, Girma et al (2007) and Görg and Strobl (2003a) stratify their regressions by the NACE two-digit sectors, so sectoral dummies are not included as covariates.

Table 3.25 Model Six Log-Normal Regression for 331 New Grant-Aided Plants

Covariate	Time Ratios
Size	1.211537*** (0.055969)
UK	0.819897* (0.090384)
US	1.0465 (0.158218)
Rest of World	0.381782** (0.1785)
Food, drink and tobacco	1.574462*** (0.249154)
High-tech	1.506802*** (0.229778)
Sector growth	1.014088 (0.019162)
Wald test (7df)	*45.38****
Log likelihood (psuedo)	*-383.451*

Heteroscedasticity-consistent standard errors in parentheses
*, **, *** denote 10%, 5% and 1% significance levels respectively
Note: Employment data was only available for plants surviving until 1972

As expected, sectoral growth had a time ratio greater than one meaning that belonging to a growing sector improved the survival prospects of a plant, although only by a little over one per cent. This result was not statistically significant however having a p-value of 0.459. Furthermore, a likelihood ratio test for equivalence between the two models is not statistically significant, suggesting that Model Five fits as well as Model Six. The inclusion of sectoral growth has not improved the regression. This can be explained by a domestic measure of sectoral growth being inadequate in the context of export-oriented industry. If sectoral dummies are dropped from the model then the effect of sectoral growth increases (the time ratio increases to 1.043784) and becomes statistically significant at one per cent, however a likelihood ratio tests suggests that the larger model is preferred (i.e. Model Six with the sectoral dummies included). Furthermore, the inclusion of the broad sector dummies in the regressions has the advantage of capturing all sector-specific effects including unobserved variables.

As size is a statistically significant covariate, and important in the literature, the effect of plant size on the other covariates is further examined. Model Seven is estimated with interactions between the various covariates in Model Five and size. Görg and Strobl (2003a) interact the foreign-ownership dummy with plant size and sector growth, concluding that foreign-owned plants had poorer survival probabilities, regardless of size, if they were in declining sectors. Girma et al (2007) include interaction terms between foreign ownership and grant receipt and grant amount.[117] The literature review and the descriptive statistics in Section 3.4.1 suggest possible interaction effects between size and the ownership

[117] They also interact grant receipt with two dummies. One dummy is used to measure the effect of a policy change in the 1980s which affected grants, and the other is an election dummy which is again relevant to the payment of grants at the time. Neither of these is relevant here as this study is only looking at grants paid over the period 1955-1972.

and sectoral covariates. Results for Model Seven are shown in Table 3.26. The interaction between size and US-ownership is statistically significant at five per cent suggesting that size is important for the survival of US-owned plants. The other statistically significant covariates in this model are US-ownership which has now fallen well below one, and the interaction term between size and rest-of-world ownership (although this was only significant at 10 per cent). Again a likelihood ratio test suggests Model Five is as good a fit, so including the interactions with size did not improve the model.

Table 3.26 Model Seven (Size Interactions)
Log-Normal Regression for 331 New Grant-Aided Plants

Covariate	Time Ratios
Size	1.093065 (0.077465)
UK	0.578363 (0.279696)
US	0.362266** (0.185166)
Rest of World	0.091888** (0.099125)
Food, drink and tobacco	1.011236 (0.54774)
High-tech	1.3247 (0.652675)
Size*UK	1.090206 (0.121176)
Size*US	1.286729** (0.141074)
Size*Rest of World	1.433739* (0.281705)
Size*Food, drink and tobacco	1.125549 (0.14433)
Size*High-tech	1.046526 (0.112676)
Wald test (11df)	*57.72***
Log likelihood (psuedo)	*-380.533*

Heteroscedasticity-consistent standard errors in parentheses
*, **, *** denote 10%, 5% and 1% significance levels respectively
Note: Employment data was only available for plants surviving until 1972

Given the significant result for the interaction of size with US-ownership and the relationship between these that was suggested by the descriptive statistics earlier, the partial correlations between the various covariates were checked. None of these were particularly large, as can be seen from the correlation matrix in Table 3.27.

Table 3.27 Partial Correlations

	Size	UK	US	Rest of World	Food, drink and tobacco	High-tech
Size	1					
UK	-0.026	1				
US	0.1711	-0.2778	1			
Rest of World	0.0007	-0.0518	-0.0491	1		
Food, drink and tobacco	-0.0807	0.0813	-0.1478	-0.036	1	
High-tech	0.1297	-0.0682	0.1349	0.0285	-0.1947	1

Finally, the effect of indigenous ownership is empirically important, although the univariate analysis showed it not to be statistically significant. The dummy variable for indigenous ownership is therefore included in Model Eight. Also, as the descriptive statistics earlier showed some relationship between indigenous ownership and sector, interactions with the two sectoral dummies are also included. The results in Table 3.28 show that survival rates for indigenous high-tech new grant-aided plants were worse than for foreign-owned high-tech plants and this was significant at five per cent. It should be remembered however, that only seven out of 70 high-tech new grant-aided plants still alive in 1972 were indigenous (i.e. 10 per cent). A likelihood ratio tests shows this model to fit no better than Model Five.

Table 3.28 Model Eight Log-Normal Regression for 331 New Grant-Aided Plants

Covariate	**Time Ratios**
Size	1.209131*** (0.055675)
Indigenous	0.943999 (0.149272)
UK	0.774267** (0.093898)
US	1.012987 (0.158209)
Rest of World	0.369646** (0.181248)
Food, drink and tobacco	1.638021*** (0.303536)
High-tech	1.721115*** (0.249322)
Indigenous*Food, drink and tobacco	0.99642 (0.31735)
Indigenous*High-tech	0.550241** (0.16741)
Wald test (9df)	*50.21****
Log likelihood (psuedo)	*-382.085*

Heteroscedasticity-consistent standard errors in parentheses
*, **, *** denote 10%, 5% and 1% significance levels respectively
Note: Employment data was only available for plants surviving until 1972

Finally, Table 3.29 compares the results for the two preferred models, Model Five and Model Eight. Many of the results are similar. Both models show that larger plants have better survival prospects, increasing survival time by more than 20 per cent, and these results are significant at one per cent. UK and rest-of-world ownership reduces survival. The plants in the food and high-tech sectors have a lower risk of failure, significant at one per cent. Indigenous ownership, included in Model Eight, accelerates time-to-failure for the grant-aided plants but this result is not statistically significant. Furthermore, the interactions between indigenous ownership and sectoral dummies suggest that indigenous ownership had a negative impact on the survival outcomes of new grant-aided plants in high-tech sectors, in particular, with this result being significant at five per cent. Indigenous high-tech plants are different from foreign-owned ones in being substantially smaller. One caveat of this result, however, is that there are only eight indigenous high-tech new grant-aided plants in total,

one of which had exited by 1972 so there are only seven included in any models where size is a covariate.

Table 3.29 Comparison of Models

Covariate	Time Ratios	
	Model Five	**Model Eight**
Size	1.214336***	1.209131***
	-0.055856	-0.055675
Indigenous		0.943999
		-0.149272
UK	0.810630*	0.774267**
	-0.089424	-0.093898
US	1.066304	1.012987
	-0.158752	-0.158209
Rest of World	0.390471**	0.369646**
	-0.183480	-0.181248
Food, drink and tobacco	1.621470***	1.638021***
	-0.247015	-0.303536
High-tech	1.615045***	1.721115***
	-0.214496	-0.249322
Indigenous*Food, drink and tobacco		0.99642
		-0.31735
Indigenous*High-tech		0.550241**
		-0.167410
Wald test (9df)	*45.710****	*50.210****
Log likelihood (psuedo)	*-383.788*	*-382.085*
Nos. of Observations	331	331

Heteroscedasticity-consistent standard errors in parentheses
*, **, *** denote 10%, 5% and 1% significance levels respectively

3.5 CONCLUSIONS

There are a number of novelties in this study which fill gaps in the extant literature. The first is the gathering and analysing of data for the pre-EU entry new grant-aided plants in Ireland. There is no other similar study for Ireland for this period. A second novelty is that this study identifies sectoral effects, whereas extant survival studies on Irish industry merely control for these through stratification of survival models. A third novelty is that foreign ownership is disaggregated by home region whereas most Irish survival studies lump all foreign-ownership together. As is expected empirically, this shows that the home region does matter with US-ownership being associated with improved survival outcomes. A fourth novelty is that this study limits the analysis to new plants, excluding incumbents. This provides a clearer picture of the characteristics and survival outcomes of new grant-aided industry that established in Ireland at the time, marking the beginning of the new era of outward-looking economic policies and FDI-intensity which was to continue in subsequent decades.

The main novelty of this study, and its two key contributions, is in the gathering of data for the pre-EU entry new grant-aided plants in Ireland and in the exploration of the

characteristics and survival outcomes of the new grant-aided establishments which is made possible by the existence of this database. These plants are found to be mostly foreign-owned and larger than the general population of plants in 1972. They were also over-represented in high-tech sectors. New grant-aided indigenous plants were predominantly found in the food-processing and textiles sectors and were relatively smaller. Foreign-owned plants were located in a more diverse range of sectors. European-owned industry predominated in food, textiles, rubber, and plastics. The main non-European country of ownership was the US. As found in the literature review, US-owned plants are larger and more frequently located in high-tech and modern sectors. The most populated sectors for US plants after fabricated metals were the modern and mainly high-tech sectors of chemicals and instrument engineering. US-owned plants arrived later than European-owned plants with the different sectoral mix reflecting shifts in comparative advantage and industrial structure as well as different motivations. The main motivation for US investment in Ireland was market access and relatively low-cost labour. UK owners were attracted by the availability of local raw materials, and German owners by the availability of labour. US-ownership predominated in the SFADCo area, with Shannon itself conferring particular advantages to non-European owners through air-freight and warehousing opportunities.

Survival times were found to be relatively long suggesting that, as expected, grants aid survival. Survival times were somewhat longer for indigenous new grant-aided plants, in particular, although this effect was small and not statistically significant. This can be attributed also to grants being particularly beneficial for indigenous industry which can be expected to have greater financial constraints than foreign-owned plants who were more often part of multi-plant MNCs.[118] The overall hazard function for the new grant-aided plants in this study is found to have an inverse-U shape with the turning points from positive to negative duration dependence occurring at around 12 years, slightly higher than the the turning point for greenfield MNC subsidiaries in UK's Northern Region found by McCloughan and Stone (1998), but substantially higher than the turning points found in other survival studies. Again grant-aid is a likely contributory factor. The type of grant received also differed by nationality of owner, however grant type is not a significant covariate with size and sectoral location being the main statistically significant covariates, capturing some of the grant-type effect. Indeed, size is found to be the over-riding statistically significant covariate in the survival analysis, in common with other studies.

[118] Although, as noted earlier, Girma et al (2007) omitted smaller plants from their study which bias their results as indigenous plants are disproportionately small.

The second novelty of this study is the examination of sectoral differences. These are not identified by Girma et al (2007) or by Görg and Strobl (2003a), for example, who stratify Cox models by NACE two-digit sectors, presumably to overcome the proportional hazards violation. Here we saw that plants in the food, drink and tobacco, and high-tech sectors display better survival prospects, particularly so for high-tech plants, and these results were generally highly statistically significant. When interactions with the indigenous ownership dummy are included, we see that these effects are stronger for foreign-owned plants, with indigenous plants having higher failure rates in high-tech sectors (although, as noted, there were very few indigenous high-tech grant-aided plants). Sectoral differences are important empirically too as industrial agencies often target particular industries.

The third novelty of this study is the disaggregation of foreign ownership into a number of home regions whereas most Irish survival studies lump all foreign-ownership together. As is expected empirically, this shows that the home region does matter with US-ownership being associated with improved survival outcomes. Many studies on plant-survival compare foreign-owned with indigenous establishments without further disaggregation of 'foreign' by home country or region. The results of the survival analysis show that home region does matter and that 'foreign' is too broad a grouping in the Irish context for this era. Godart et al (2012) is one of the few survival studies to do something similar for Ireland but they include the UK under EU. This may make sense for the period covered in their study (2003-2006), but less so for the period in this study. As described earlier, European owners established their plants earlier and had somewhat different motivations than US owners. There are also obvious sectoral differences. Thirty-eight per cent of plants with UK-owners, the single most important home country, were in the textiles, clothing, and leather sectors (NACE 17, 18, and 19), compared to just 15 per cent of US-owned plants, for example. These sectors were especially affected by worldwide structural shifts and the dismantling of tariff protection in Ireland, especially after EU membership.[119] The most statistically significant results for home region were for the rest-of-world and UK-owned establishments, both consistently showing poorer performances. One caveat in the case of the rest-of-world plants is that there are very few observations on which to form conclusions. The poor performance of UK-owned plants can be attributed to their sectoral concentration, especially with the dismantling of tariffs, and to increases in labour costs. US-owned plants showed better performance in terms of survival but these results are not statistically significant. The disaggregation of foreign-owned industry into separate regional blocks is therefore appropriate when modelling in the Irish context and failure to do so weakens the conclusions

[119] Further details of the survival of some of these are also available in Appendix 3.1.

drawn in most studies. Indigenous ownership reduced the survival rates of plants only slightly in general but indigenous ownership of high-tech plants substantially reduced their survival outcomes compared with foreign-owned high-tech plants. However, this does not necessarily compare like with like – the mean size of an indigenous high-tech plant in 1972 was 93.7 employees compared with 175.2 for those under foreign-ownership. There were also very few observations of indigenous high-tech plants on which to base this conclusion.[120]

The final novelty of this study is that it is limited to new grant-aided plants. Other studies on Irish plant survival utilising the FES data include incumbents as well (see for example, Görg and Strobl, 2003a; Girma et al, 2007).[121] The pattern of new manufacturing investment in Ireland over the 1955-1972 period confirms that structural shifts were occurring in both sector and ownership of industry. There was a gradual increase in US ownership particularly in high-tech industries and a decline of the importance of UK investment which was, among the new grant-aided plants, mostly concentrated in traditional sectors of food, textiles, and clothing. These changes cannot be seen as clearly if the new plants are not isolated from incumbents as the latter include many plants that existed in the protectionist era.

On a technical note, the use of the Cox proportional hazards model was found inappropriate for the plants in this study, with the proportional hazards assumption being violated by a number of covariates which may be a further indication of grant-aid obscuring relationships. This model's popularity lies chiefly in its flexibility with respect to the hazard function's distribution and its ease of interpretation. However, the violation of the proportional hazards assumption here, despite initially promising results, suggests it is necessary to compare survival or hazard functions across groups in advance of using such a model in order to ensure that a proportional hazards model is appropriate. Stratification can help alleviate the problem but makes it difficult to identify the effects of important covariates.

From an economic policy perspective the period covered by this study marks the beginning of Ireland's move to outward-looking economic policy and the tentative beginnings of the FDI-intensity of the Irish economy. As Ireland was a late industrialiser, its experience with undertaking such a policy shift is extremely relevant for other economies. The early plants

[120] There were originally eight indigenous high-tech plants, fallen to seven by 1972 and to one by 1992.
[121] Although due to limitations associated with another database used in their study, Girma et al (2007) largely restricted their analysis to plants with 20 or more employees. Because of this, and because of the use of propensity score matching, their paper does not cover all plants in the FES database, unlike Görg and Strobl (2003a). Furthermore, Girma et al (2007) do not use the FES as the basis for selecting plants for most of their analysis.

provided jobs with low skill levels associated with low labour costs which were appropriate for the stage of economic development. High-tech plants arrived later as the IDA began to target more capital-intensive firms. Only later was more emphasis placed on the attraction of higher-order activities such as R&D. The early plants, and indeed the industrial agencies themselves, were ploughing new furrows. The industrial agencies had originally to combat the 'green curtain' view of Ireland but the relative success of these early plants created a demonstration effect for the industry that followed. The poorer survival of some early plants, especially under SFADCo, suggests the need for a more targeted industrial policy rather than the scatter-gun approach adopted in the early years. Kennedy et al (1987) suggest that economic policy was piecemeal at this time.

Irish economic policy at this time was also conservative and minimalist. The aim was basically two-fold: To create employment in order to stem the flow of emigration, and to ease balance-of-payments problems, both to be achieved with minimal social change. O'Malley (1989) suggests that outward-looking policy involved minimum intervention in the market except to the extent that the system of grants and tax concessions was biased in favour of export industries. These can be justified on the basis of overcoming market failure although there has been some debate about the effectiveness of the policy especially with respect to the size of incentives given. The impact on established industry was minimised as new industry essentially did not compete on domestic markets. The policy shift to outward-looking policies required a substantial shift in thinking, politically and socially, as well as economically. The new policies were implemented with a view to minimising the impact of other structural change (such as the flight from the land) and the social effects of emigration and unemployment. Suspicion of foreign capital remained in some quarters. The conservative and minimalist view of development limited the opportunities for women which usually go hand-in-hand with a shift to outward-looking policies. Instead, in the Irish case, there was concern that too many jobs were not just low-skilled but were targeted at females and from 1969 the IDA began to seek more 'male-employing', as well as capital-intensive, industries. This helped reinforce the weaker economic and social position of women prior to EU entry. It may also have exacerbated the secular decline in the clothing and textiles industries, found in this study, which can be attributed to the loss of competitiveness resulting from the removal of tariffs but also to equal pay legislation that was gradually introduced in the 1970s.

Some of the debates of the period are still relevant today. Both Donaldson (1965) and the 1967 *Survey*, for example, pointed out complaints by some foreign industrialists of the risk of over-education from the introduction of more widespread second-level education, and

indeed many of these low-skill jobs did ultimately disappear as the economy developed and the industrial agencies began to target more capital-intensive industries and higher-order functions. This debate is similar to the one today with respect to third-level education and the role of the state in education of the population *vis-à-vis* the demands of industry for staff with specific skills. Another debate which remains relevant is the role of state policy in the development of indigenous industry. These grants were primarily paid to foreign-owned industry and this period saw the take-off of foreign involvement in industry, although as was discussed in Chapter One, there was foreign involvement prior to this. The emphasis on the attraction of foreign investment contributed to what is often described as a 'dualistic' industrial structure. The debate of how to build 'strong self-sustaining indigenous industry' remains.

The existence of this new database opens up new opportunities for further research. One direction is to examine the employment growth for these plants, especially interesting as direct employment was one of the main reasons for the provision of grant-aid. Interestingly, Northcott (1970) and McAleese (1972) note that employment growth in Ireland was achieved at this time largely through the arrival of new plants rather than the growth of existing ones. Another interesting option for future research is to compare these early new grant-aided plants, now that the data are available, with new grant-aided plants that established post-EU entry, utilising the Forfás grant data for that period.

The key contributions of this study are, first, in the gathering of data for the pre-EU entry new grant-aided plants in Ireland and, second, in the exploration of the characteristics and survival outcomes of these establishments.

REFERENCES

Agarwal, R. and D. Audretsch (2001) 'Does Entry Size Matter? The Impact of the Life-cycle and Technology on Firm Survival' *Journal of Industrial Economics*, *49*(1), 21-43

Audretsch, D. (1991) 'New-Firm Survival and the Technological Regime' *Review of Economics and Statistics*, *73*(3), 441-450

Audretsch, D. and T. Mahmood (1995) 'New-Firm Survival: New Results using a Hazard Function' *Review of Economics and Statistics*, *77*(1), 97–103

Bandick, R. (2010) 'Multinationals and Plant Survival' *Review of World Economics 146(4),* 609-634.

Barry, F. and J. Bradley (1997) 'FDI and Trade: The Irish Host-Country Experience' *The Economic Journal*, *107*(445), 1798-1811.

Brock, C. (1968) 'Public Policy and Private Industrial Development' in J. Bristow and A. Tait (eds), *Economic Policy in Ireland*, Dublin

Buckley, P. (1974) 'Some Aspects of Foreign Private Investment in the Manufacturing Sector of the Economy of the Irish Republic' *Economic and Social Review, 5*(3)

Cameron, A. and P. Trivedi (2005) *Microeconometrics: Methods and Applications* Cambridge University Press

Cleves, G., W. Gould and R. Gutierrez (2004) *An Introduction to Survival Analysis Using Stata* Stata Press

Corrente, J., L. Chalita and J.Moreira (2003) 'Choosing between Cox Proportional Hazards and Logistic Models for Interval-Censored Data via Bootstrap' *Journal of Applied Statistics, 30*(1), 37-47

Delios, A. and P. Beamish (2001) 'Survival and Profitability: The Roles of Experience and Intangible Assets in Foreign Subsidiary Performance' *Academy of Management Journal, 44*(5), 1028-1038

Disney, R., J. Haskel and Y. Heden (2003) 'Entry, Exit and Establishment Survival in UK Manufacturing' *Journal of Industrial Economics, 51*(1), 91-112

Donaldson, L. (1965) *Development Planning in Ireland* Praeger, New York

Dunne, T., M. Roberts and L. Samuelson (1989) 'The Growth and Failure of US Manufacturing Plants' *The Quarterly Journal of Economics,* 671-698.

Evans, D. (1987) 'The Relationship between Firm Growth, Size, and Age: Estimates for 100 Manufacturing Industries' *Journal of Industrial Economics, 35*(4), 567-581

Geroski, P. (1995) 'What do we Know about Entry?' *International Journal of Industrial Organization, 13*(4), 421-440

Girma, S., H. Görg and E. Strobl (2007) 'The Effects of Government Grants on Plant Survival: A Micro-Econometric Analysis' *International Journal of Industrial Organization, 25*(4), 701-720

Godart, O., H. Görg, and A. Hanley (2012) 'Surviving the Crisis: Foreign Multinationals versus Domestic Firms' *World Economy 35*(10), 1305-1321

Görg, H. and E. Strobl (2002a) 'Multinational Companies and Indigenous Development: An Empirical Analysis' *European Economic Review, 46*(7), 1305-1322

Görg, H. and E. Strobl (2002b) 'Multinational Companies and Entrant Start-Up Size: Evidence from Quantile Regressions' *Review of Industrial Organization, 20*(1), 15-31

Görg, H. and E. Strobl (2003a) ''Footloose'Multinationals?' *The Manchester School, 71*(1), 1-19

Görg, H. and E. Strobl (2003b) 'Multinational Companies, Technology Spillovers and Plant Survival' *The Scandinavian Journal of Economics, 105*(4), 581-595

Harris, R. and M. Trainor (2007) 'Impact of Government Intervention on Employment Change and Plant Closure in Northern Ireland, 1983–97' *Regional Studies, 41*(1), 51-63

Irish Taxation Institute (2008) *Corporation Tax: Finance Act 2008*, 20th edition

Jovanovic, B. (1982) 'Selection and Evolution of Industry' *Econometrica, 50(*7), 649-670

Kearns, A. and F. Ruane (2001) 'The Tangible Contribution of R&D-Spending Foreign-Owned Plants to a Host Region: A Plant Level Study of the Irish Manufacturing Sector (1980–1996)' *Research Policy, 30*(2), 227-244

Kennedy, K., T. Giblin and D. McHugh (1988) *The Economic Development of Ireland in the 20th Century* Routledge, London

Lawless, M. (2014) 'Age or Size? Contributions to Job Creation' *Small Business Economics*, *42*(4), 815-830

Li, J. (1995) 'Foreign Entry and Survival: Effects of Strategic Choices on Performance in International Markets' *Strategic Management Journal*, *16*(5), 333-351

Mata, J. and J. Machado (1996) 'Firm Start-Up Size: A Conditional Quantile Approach' *European Economic Review, 40*(6), 1305-1323

Mata, J., P. Portugal and R. Guimaraes (1995) 'The Survival of New Plants: Start-Up Conditions and Post-Entry Evolution' *International Journal of Industrial Organization, 13*(4), 459-481

Mata, J. and P. Portugal (2002) 'The Survival of New Domestic and Foreign-Owned Firms' *Strategic Management Journal*, 23(4), 323-343

McAleese, D. (1972) 'Capital Inflows and Direct Foreign Investment in Ireland 1952-1970' *Journal of the Statistical and Social Inquiry Society of Ireland* 22(4), 63-105

McAleese, D. (1977) *A Profile of Grant-Aided Industry in Ireland* IDA Ireland, Dublin

McAleese, D. and M. Counahan (1979) "Stickers' or 'Snatchers'? Employment in Multinational Corporations during the Recession' *Oxford Bulletin of Economics and Statistics 41*(6), 345–358

McCloughan, P. and I. Stone (1998) 'Life Duration of Foreign Multinational Subsidiaries: Evidence from UK Northern Manufacturing Industry 1970–93' *International Journal of Industrial Organization*, *16*(6), 719-747

Meyler, A. and E. Strobl (2000) 'Regional Industrial Policy and Job Generation in Ireland' *Economic and Social Review*, *31*, 111-128

Munro, H. (1967) 'Why Shannon? 3. The Industrial Estate' *The Irish Times,* 31st May

Northcott, J. (1970) 'Symposium on the Buchanan Report' *Journal of the Statistical and Social Inquiry Society of Ireland, 22(2)*, 179-208

O'Farrell, P. (1976) 'An Analysis of Industrial Closures: Irish Experience 1960–1973' *Regional Studies*, *10*(4), 433-448

O'Hearn, D. (1987) 'Estimates of New Foreign Manufacturing Employment in Ireland (1956-1972)' *Economic and Social Review, 18*(3), 173-188

O'Malley, E. (1980) *Industrial Policy and Development: A Survey of the Literature from the Early 1960s*, NESC Report No. 56, Stationery Office, Dublin

O'Malley, E. (1989) *Industry and Economic Development: The Challenge for the Latecomer* Gill and Macmillan, Dublin

Pyle, J. (1990) 'Export-Led Development and the Underemployment of Women: The Impact of Discriminatory Development Policy in the Republic of Ireland" in K. Ward (ed) *Women Workers and Global Restructuring* Cornell University Press: New York

Segarra, A. and M. Callejón (2002) 'New Firms' Survival and Market Turbulence: New Evidence from Spain' *Review of Industrial Organization, 20*(1), 1-14

Strobl, E., P. Walsh and F. Barry (1998) 'Aggregate Job Creation, Job Destruction and Job Turnover in the Irish Manufacturing Sector' *Economic and Social Review*, *29*(1), 55-71

Survey Team (1967) *Survey of Grant-aided Industry* Stationery Office, Dublin

Teeling, J. (1976) 'Four Basic Types of US Companies in Operation' *The Irish Times,* 15th March

Vernon, R. (1966) 'International Trade and International Investment in the Product Life-cycle' *Quarterly Journal of Economics*, *81*(2), 190-207

Viney, M. (1963) 'Jobs at Any Price?' *The Irish Times,* 10th April

Chapter Four

Exploring Financial Foreign Direct Investment: Growth and Internationalisation of Venture Capital in Ireland

"Historically, Irish enterprise has suffered from the lack of a developed venture capital base, and this has hindered the emergence of high potential, high-risk, start-up businesses"
Review of Industrial Policy and Performance (2003)

4.1 CONTEXT

Venture capital (VC) is associated with high-risk, high-return investment in early-stage companies involving the development of new products and processes for new markets. It is widely linked to the development of High Potential Start-Ups (HPSUs) and of innovative dynamic regions. The link with innovative start-ups means that the availability of an adequate supply of VC is usually seen as a necessary precondition for the emergence of innovative and dynamic regions, Silicon Valley being the commonly cited example. In the Irish context, a strong VC sector is seen as a requisite for the development of a self-sustaining export-oriented indigenous industrial sector, a goal which has long eluded policy-makers.

VC developed gradually in the US and in Europe in the post-war period but expanded quite dramatically in the 1990s, reflecting the dot-com bubble. In Ireland both sides of the VC market began to develop from the early 1990s. On the demand-side investment opportunities emerged, primarily in the indigenous computer software sector, the most dynamic indigenous high-tech sector of the 'Celtic Tiger' era (Crone, 2004; Ó Riain, 2004). For such sectors VC represents a particularly appropriate financing vehicle. At the same time, on the supply-side, publicly provided funding and other elements of public policy dramatically enhanced the availability of VC. As we will see later, the Irish VC market is highly internationalised. Cross-border flows of VC have been referred to as 'financial FDI' (FFDI) as these investments have many similar features to 'classical' or 'traditional' FDI.[122] This chapter first examines the development of the VC market in Ireland, documenting the co-evolution of the demand and supply sides of the market and the role of the state. In doing so, it develops a comprehensive set of data to explore VC in Ireland in comparison to other European countries and to the US. The degree of internationalisation of VC in Ireland is also explored, again in comparative perspective. As noted in Chapter One, parts of this

[122] The use of the term 'financial' refers to the financial intermediation role of VC funds.

chapter are published as Barry, F., C. O'Mahony and B. Sax (2012) 'Venture Capital in Ireland in Comparative Perspective.' *Irish Journal of Management, 32*(1) and reproduced as Appendix 4 at the end of this thesis.[123]

The following sub-sections look first at the definition of VC and then, briefly, at the development of VC markets in the US and in Europe.

4.1.1 Definitions of Venture Capital and Private Equity

'Venture Capital' refers to long-term equity capital provided to early-stage companies, covering seed, start-up, early-stage, and expansion funds, where the venture capitalist also typically contributes management support to the enterprise. This type of capital is particularly appropriate to the needs of innovative start-up companies where informational asymmetries and the absence of collateral and reputation preclude access to more conventional forms of financing, and where the provision of equity can relax the time constraints that enterprises would otherwise face. It is considered to be high-risk investment and failure rates are expected to be high with the venture capitalist compensated by high returns from the few successes. 'Private Equity' (PE) is a wider concept which incorporates later-stage equity investment including the financing of management buy-outs (MBOs) and management buy-ins (MBIs).

The main sources of European and US data arise from surveys of equity funds, collected by associations of member companies: the European Private Equity and Venture Capital Association (EVCA) and the National Venture Capital Association (NVCA).[124] In Europe VC and other forms of PE are usually considered together and often loosely referred to as 'venture capital'.[125] Both involve investment by professionally managed funds in companies that find it difficult to access traditional sources of finance and these funds are often raised from the same sources. However, VC and later-stage PE are quite different in their motivations and economic impact. VC is involved with young start-ups in new markets, later-stage PE often with troubled firms in well-established markets. While VC seeks to create or add value to a company this is not always the case for later-stage PE. For

[123] This publication was a collaborative process. This author's main contribution was to completely update earlier data through their collection, analysis, and presentation. The final drafting of the paper was undertaken by this author in collaboration with Professor Frank Barry. This author had a further role as corresponding author.

[124] Most empirical studies use the industry data from the EVCA and/or NVCA which are derived from Thomson Reuters. Some studies also use commercial databases or collect primary data. Aizenman and Kendall (2012) and Gu and Lu (2011) use firm-level data directly from the Thomson Reuters' VentureXpert (now ThomsonONE) database which covers both VC and PE firms in the US, Europe, and Asia. Tykvova and Schertler (2011) use Bureau van Dijk's Zephyr database together with some EVCA data. Because, of the dearth of detailed data in the available databases, some researchers instead collect primary data through surveys (e.g. Hellman and Puri, 2000).

[125] In this vein, it is worth noting that EVCA is not simply a 'venture capital association' like the NVCA but more precisely a 'private equity and venture capital association' although PE does not appear in its acronym.

example, buy-out funds used to finance acquisitions may not add value, in some instances leading to job losses, asset-stripping, or the ultimate winding down of the business. In a leveraged buyout (LBO) debt is used to acquire a company and reduce its equity base (Jeng and Wells, 2000). Aizenman and Kendall (2008:5) consider many forms of PE to be largely "financial engineering" involving only a change in control of the firm without "the creation of real assets and new technologies".

The focus of this chapter is VC because of its link with technologically innovative HPSUs and regions and hence with the development of Irish indigenous export-oriented industry. Although every effort is made to focus solely on VC only, conflation of VC and PE in much of the available European data means that it is not always possible to distinguish VC from aggregate PE. This issue is further discussed in Section 4.3 and also in Section 4.4 wherever it arises. As we will see later, VC is a very large share of PE in the Irish context so this problem is less serious for Ireland than for some other European countries. By contrast, for example, buy-outs constitute by far the largest share of PE in the UK. Given the conflation of VC and PE in the data some authors (see Harding, 2002; Leleux and Surlemont, 2003; Megginson, 2004) describe aggregate PE data as 'venture capital'. This problem is particularly acute in comparisons between Europe and the US as the US data generally cover VC only, but it is also important for pan-European studies as the relative importance of VC within total PE varies across European countries. Sometimes PE is used as a 'wider' interpretation of VC, Wright et al (2005), for example, justify this on the basis that the funds are often managed by the same firms.

There are two ways in which VC financing occurs: Directly from individuals (such as 'angel investors') and corporations, or indirectly from specialised professionally-managed VC funds acting as financial intermediaries between investors (individuals, corporations, pension funds, banks, insurance companies) and the recipient, or portfolio, firms. This latter form is referred to as 'formal' VC and is the type commonly covered by the data. Along with their financial intermediation role, venture capitalists often provide other resources including management assistance, performance monitoring, and reputational capital. Investment is often made in stages, so that venture capitalists can exercise some control to protect their investments. As venture capitalists have a limited time horizon, the availability of exit opportunities, particularly of Initial Public Offerings (IPOs), is an important requisite for the development of a strong VC sector.

4.1.2 The Development of Venture Capital in the US

The VC idea originated in the US where the first VC firm, American Research and Development (ARD), was established in 1946 in Cambridge, Massachusetts by academics from MIT and Harvard together with local business people (for more discussion see Gompers and Lerner, 2001). ARD invested in high-risk companies involved in technologies developed during the Second World War.

Prior to 1980 VC in the US was regarded by many as a 'cottage industry'. Kenney et al (2002:6) have described its development as an "organic trial-and-error process" with some limited government involvement. Significant new legislation adopted in the late 1970s and 1980s furthered its development. This legislation included 'The Revenue Act' of 1978 and 'The Economic Recovery Tax Act' of 1981 which reduced the capital gains tax rate and raised the incentives for long-term investments, and 'The Small Business Investment Incentive Act' of 1980 which defined VC-type funds as firms that stimulated economic growth by encouraging entrepreneurship. Many see the most important legislation, however, to be 'The Employment Retirement Income Stabilisation Act' (ERISA) 1979 (the 'Prudent Man Rule') which changed the investment rules for pension fund managers, allowing them to place funds in high-risk investments, and its clarification (ERISA 1980 known as 'Safe Harbor') which clearly distinguished between investment fund and pension fund managers.[126] These made it possible for pension funds to be accepted as partners in VC funds without the risk of incurring substantial liability.

Bottazzi and Da Rin (2002) attribute much of the substantial growth in VC in the US from the 1980s both to this latter piece of legislation and to the dominance, by then, of limited partnerships over closed-end funds. At this time too, venture capitalists were instrumental in such success stories as Apple Computer, Cisco Systems, Genentech, Microsoft, Netscape, Sun Microsystems, and Starbucks (Gompers, 2007). Growth was particularly dramatic in the 1990s but declined after the dot-com crash at the turn of the millennium, recovering slightly thereafter until the global financial crisis hit in 2007. While Megginson (2004) describes VC as a mainly US financial innovation until the mid-1990s, the success of VC in the US meant that the popularity of this form of finance began to spread to countries in Europe and Asia.

The most often cited example of VC success is Silicon Valley which has been portrayed as an ecosystem consisting of two elements: (i) an economy of established firms, universities,

[126] In response to corruption, the 1973 ERISA had made pension fund managers criminally liable for any losses from high-risk investments, this was interpreted at the time to apply to VC (Kenney et al, 2002).

research laboratories etc., which produces output and innovations, and (ii) an institutional infrastructure, with VC at its core, which enables the creation and growth of new start-up firms (Kenney, 2004). Just as policy changes are seen as important in creating an environment for the development of a strong VC industry however, the role of government money has also been important. Contrary to its popular perception as a region where creative and innovative activity has been able to develop with the support of private venture capitalists unfettered by public sector interference, Silicon Valley owes its origins to government defence spending (Lerner, 2009).

4.1.3 The Development of European Venture Capital

The development of VC in Europe has also been gradual. In Germany for example, the first step was the government support for Small and Medium-Sized Enterprises (SMEs) started in 1947 with the European Recovery Programme which offered low interest loans and other supports for R&D (Jeng and Wells, 2000). However, although providing support to SMEs, this scheme was not specifically VC funding. Subsequently, in the 1950s and 1960s, equity stock companies were established in Germany, owned and funded by banks and state governments. These again did not constitute VC as such, providing equity or near-equity to small firms for expansion rather than for start-ups. Furthermore, regulation meant they were largely risk averse. According to Jeng and Wells (2000), institutional support for start-ups in Germany did not occur until 1970 with the founding of the first VC firm, the Deutsche Gesellschaft für Wagniskapital (WFG).[127] This had 29 members, all financial institutions with the West German government agreeing to cover 75 per cent of losses. From 1979 there was a gradual entry of other VC firms into the German market. In the 1980s WFG's own focus shifted away from start-ups and high-tech firms, the number of partners was reduced and in 1988 the company became a subsidiary of Deutsche Bank. A co-investment scheme was established in Germany in 1989 and subsequently revised in 1995.

As in the US, VC in Europe grew substantially in the 1990s, but this growth and subsequent fall were not as dramatic as in the US. Despite the earlier experiences documented above, it was only in the 1990s that the provision of equity to SMEs became a major policy objective in Germany, for example (Sunley et al, 2005). By 1995 the German VC association had grown to 100 members (Jeng and Wells, 2000). Similarly, most Irish VC firms only established since the mid-1990s (Mulcahy, 2005).

[127] This translates as the 'German Society for Venture Capital'.

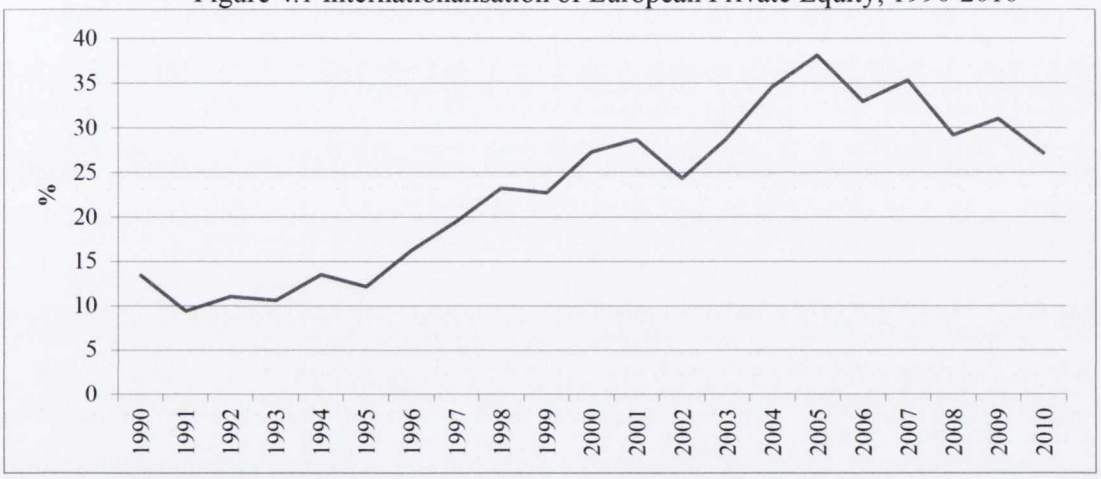
Early developments in the Irish VC market included the setting up of the IDA's Enterprise Development Programme in 1978; the establishment of the National Enterprise Agency in 1981, its replacement by the National Development Corporation in 1986 and its amalgamation with the IDA in 1991; as well as the introduction of the Business Expansion Scheme in 1984 and the commencement of the Seed Capital Scheme in 1993. The Irish Venture Capital Association (IVCA) had been founded in 1985 and had three members by the end of the 1980s. These were (i) Allied Combined Trust, established in 1972 with Allied Irish Investment Bank as a major shareholder; (ii) the Industrial Credit Company, established by the state in the 1930s to encourage investment in industry, and (iii) the Dublin Business Innovation Centre, established in 1987 with private, public, and EU support.

1994 was a crucial year in the development of the Irish VC market, with a number of significant changes introduced that year (Murphy, 2000). One was the establishment in Irish law of the 'Investment Limited Partnership', which had proved a suitable vehicle for VC activities in the US. This provides double taxation relief so that investments that take place via qualifying VC funds are treated as though they are direct investments in the underlying companies.[128] 1994 also saw the publication of government guidelines advocating that pension funds provide finance to support the VC sector (Murphy, 2000). The guidelines had their origins in a report commissioned by the Irish Association of Pension Funds, the Irish Insurance Federation, and the Department of Finance, which found that pension-fund investments in Ireland were negligible in comparison to the US and the UK. The guidelines were issued as an alternative to legislation which would have required pension funds to make certain commitments to VC. From 1994 the state's industrial development agencies also adopted new policies towards VC. One strand of the new approach saw them shift away from grant assistance towards equity participation in companies to which they advanced support. The other strand was to expand the availability of VC by investing state capital, through Enterprise Ireland (EI), in commercial VC funds.[129] The National Software Directorate had been established within the IDA in 1991 but became one of the main drivers of high-tech-oriented VC industry in the latter part of the 1990s (Breznitz, 2012). There was rapid growth of the indigenous software industry from 1995, with the state involved as a regular partner, but this was followed by stagnation in the early 2000s (Breznitz, 2012).

[128] For more detailed information on the advantages of the investment limited partnership as a special vehicle for venture capitalists, see Lyons (2004).
[129] See Sterne (2004: 247-251, 284) on the history of commercial VC firms in Ireland.

The European PE market has always been more internationalised than the US market. Figure 4.1 shows that the foreign share of investment by European PE firms increased strongly from 1990-2005, and although it declined somewhat from its peak of 39.1 per cent in 2005, the share is still substantially higher at 27.1 per cent in 2010 than in 1990 (13.4 per cent). This internationalisation has been on more of a regional than a global basis because the small size of European economies has encouraged firms to seek investment opportunities or finance abroad. This phenomenon has been referred to as 'Europeanisation' as opposed to 'Internationalisation' *per se*. However, since the 1990s US investors have been investing more abroad and Baygan and Freudenberg (2000) show that the US (closely followed by the UK) was the largest source of funds raised by European PE houses in 1999.

Figure 4.1 Internationalisation of European Private Equity, 1990-2010



Source: Own calculations based on EVCA data.
Note: These data are not available for VC separately.

4.1.4 Research Questions

This chapter seeks to answer the following questions:

- How does the development of the VC environment in Ireland compare with the US and elsewhere in Europe?
- What is the nature of state intervention in the Irish VC market?
- What is the degree of internationalisation of VC in Ireland in comparison to other countries?

The chapter proceeds as follows: The literature is reviewed in Section 4.2. Section 4.3 describes the methodology and the data used. Section 4.4 first analyses the Irish VC market in comparison with those in the US and Europe, tracing the co-evolution of the supply and demand sides of the market, before examining the role of the state in the development of the market and then turning to the degree of internationalisation of VC in the Irish context.

Conclusions are drawn in Section 4.5, together with a discussion on the role of state policy and the implications for future economic research in this field.

4.2 LITERATURE REVIEW

4.2.1 Aspects of Venture Capital Financing

Lerner (2009:6-7) describes VC funds as "independently managed, dedicated pools of capital that focus on equity or equity linked investment in privately held, high growth companies". Venture capitalists tend to raise funds at certain times, maybe only every few years, then invest as opportunities arise, often operating on a 3-5 year time span (Bottozzi and Da Rin, 2002; Mulcahy, 2005). Markets tend to be cyclical, although not always because of any direct cyclical effect on the VC industry itself (Baygan and Freudenberg, 2000; Mulcahy, 2005). In a recession venture capitalists need to allocate extra time and effort to assist their portfolio firms rather than evaluating new projects. There are also fewer exit opportunities in a recession causing bottlenecks in portfolios (Mulcahy, 2005). VC can also be quite volatile "rising during periods of enthusiasm and then crashing precipitously" according to Keller and Block (2012:637).

Young start-ups find it difficult to access traditional sources of finance such as bank loans and other debt financing instruments. Reasons include high risk or uncertainty, an unproven product or concept, a high level of intangible assets, lack of collateral, lack of a track record, low turnover with many years of negative cashflow in prospect, and information asymmetries (Baygan and Freudenberg, 2000; Jeng and Wells, 2000; Hogan and Hutson, 2005; Lerner, 2009; Mac an Bhaird and Lucey, 2010). These problems are particularly acute for high-tech firms because their greater information asymmetries and levels of intangibles (such as in the software industry) make them difficult to value (Cumming and MacIntosh, 2001). Cumming and MacIntosh (2001) argue that this leads to longer investment durations in high-tech firms as it takes more time for cashflow to turn positive and exit is difficult due to the problems associated with valuation. Common sources of finance are VC funds or angel investors as well as government backed grant or tax incentive equity schemes (Mac an Bhaird and Lucey, 2010).[130] Jeng and Wells (2000) argue that the financial intermediation role of VC firms is particularly important in countries such as the US which have restrictions on banks holding equity and banks are found to be more commonly involved in VC financing in Europe than in the US. As already noted, VC is

[130] Mac an Bhaird and Lucey (2010) point out that government policy in Ireland is targeted at "nascent firms" with high export and employment growth potential.

associated with high-risk investment. High-returns from successful projects are required because of the very high failure rate of VC-backed projects (Kenney et al, 2002).

Venture capitalists usually provide managerial and organisational expertise to firms and may have industry-specific experience. VC finance thus complements the hard technical skills of the entrepreneur with the soft skills of the venture capitalist (Bottozzi and Da Rin, 2002). Baygan and Freudenberg (2000) suggest that, along with their financial intermediation role, these other resources provided by the venture capitalist aid the survival of firms, at least in the short-run. However, the entrepreneur may be in a better position than the venture capitalist to assess the likely success of the project as a lot of highly-specialised knowledge may be involved in high-tech sectors such as biotechnology (Baygan and Freudenberg, 2000). The venture capitalist's inability to assess the likely success of projects increases risk exposure and many authors refer to the agency problems that can arise. These can be eased by the staging of VC investments as a means of control allowing active monitoring to take place (Gompers, 2007; Popov and Roosenboom, 2009). VC also imposes costs on the investee, arising from the ceding of control and from the time spent dealing with venture capitalists (Hellman and Puri, 2000; Mac an Bhaird and Lucey, 2010). As a result, entrepreneurs who desire to be more independent and retain more control are less likely to use external equity financing such as VC (Mac an Bhaird and Lucey, 2010).

VC is disaggregated by stage generally into seed, start-up, and expansion/later-stage investments, with the first two stages constituting 'early-stage' VC. Seed capital is typically used to fund initial R&D and to assess the commercial viability of the project and is particularly difficult to access as risks are very high (Jeng and Wells, 2000). In Germany, public finance, which has dominated VC, mostly goes to early-stage projects in the form of guarantees, refinancing loans, and direct investment including co-investment (Sunley et al, 2005). Da Rin et al (2006), however, argue that the difficulty for seed funding in Europe has been the poor returns available given the high risk involved. At the start-up stage the firm is gearing up to produce and market the product and negative cashflow is still common at this stage (Jeng and Wells, 2000). Expansion or 'later-stage' VC is required to fund the growth of the firm and any further R&D (Jeng and Wells, 2000) and is usually invested in firms that are already VC-supported. The equity financing cycle is described by Mulcahy (2005) as beginning with the entrepreneur investing his/her own funds at the seed stage, followed by other informal investors such as family and friends. Angel investors might then fill the equity gap between family and friends and professional VC funds. Mulcahy (2005) points out that VC funds only get involved when the firm's plans have become substantial (i.e. investments are greater than €1 million). The seed financing stage is therefore critical

for a firm to grow large enough to attract VC. The level of risk is also high at the seed stage and falls from the early to later stages of financing as the product or concept becomes proven and the firm grows in size. Harding (2002) suggests that the equity gap is actually a 'knowledge gap' measuring the degree of information asymmetry and consequent risk.

Exit is the final stage of the equity financing cycle. Agmon and Messica (2009) argue that the exit process is a direct outcome of two aspects of VC: firstly, the need for change, and secondly, the need for a return on the investment which is the capital gain on exit. The availability of exit opportunities is therefore an important requisite for the development of VC as venture capitalists want to ultimately harvest their investments when the time is suitable (Megginson, 2004). Cumming and MacIntosh (2001) find that the earlier VC is received (and hence the more capitalised is the firm at the early stage) the shorter the duration of the investment and the earlier the exit. Tykvova and Schertler (2011) define successful exits as IPOs, trade sales, secondary sales, and MBOs. IPOs have better returns than other modes of exit and are important for a thriving VC sector as good returns attract funds (Mulcahy, 2005). Development of financial markets is important to allow the possibility of easy exit through liquid means such as the availability of IPOs (Botozzi and Da Rin, 2002; Mulcahy, 2005). Mulcahy (2005) is critical of the poor performance of the Irish Stock Exchange as one reason for the popularity of trade sales over IPOs for Irish VC divestments. She also argues that most Irish start-ups perceive themselves, often incorrectly, as too small to go public and do not plan or prepare for an IPO, instead opting for trade sales. Another factor may be early divestment by Irish entrepreneurs as Jeng and Wells (2000) point out that IPOs are more important for later-stage investments than for exit at an early-stage

Differences between the European and US VC markets are also discussed in the literature. Megginson (2004) describes the main differences as the sources of funds, the development stage of the portfolio firm and hence the stage of investment, the main exit strategies used, and the organisation of funds themselves. In terms of the sources of funds, he finds that there is greater reliance in Europe on financial institutions and less on pension funds. According to Harding (2002) EI was instrumental in Ireland in getting banks involved in VC financing and she also points to the important role of banks in the German VC market. In the US, on the other hand, banks are prohibited from taking an equity stake in a company (Jeng and Wells, 2000). Banks have shorter investment horizons than other investors such as pension funds and insurance companies and this may hinder the development of VC in Europe (OECD, 1996). Another difference is that European VC funds have a more reactive approach to dealing with portfolio firms compared to what Megginson (2004) and Jeng and

Wells (2000) argue is a more pro-active role by US funds. Megginson (2004) attributes this difference to cultural and historical reasons: VC firms in the US and UK are mainly limited partnerships but in France and Germany they tend to be 'captive funds', with more than 80 per cent of funds coming from one source, and they are often subsidiaries of banks. Jeng and Wells (2000) also refer to cultural and institutional aversion to risk-taking in Germany when arguing that VC was still small despite government policy to grow it, although they do acknowledge evidence of the German situation changing. US VC funds also tend to be staffed by technical specialists (Megginson, 2004) whereas European VC firms are generally staffed by people with management consultancy, accounting or banking backgrounds with no entrepreneurial experience (Mulcahy, 2005). Megginson (2004) also notes that in Europe there is less early-stage investment and fewer exits by IPOs. Jeng and Wells (2000) suggest that the existence of IPOs was the strongest driver of VC but only significant for later-stage investments only. The OECD (1996:13) claims that there was a "clear consensus" that the NASDAQ drove the VC market in the US and Megginson (2004) suggests the lack of IPOs is a key factor in Europe's inability to 'duplicate' US success with the development of high-tech industry. However, it should be noted that in much of his analysis Megginson (2004) is not comparing like with like because the EVCA data he uses cover aggregate PE rather than VC only. He states, for example, that €34.9 billion was invested by European VCs in 2000 but an examination of the EVCA data shows that only €19.7 billion of this is VC with buy-outs, totalling €14.4 billion, constituting most of the remainder.[131] Consequently, his sectoral comparison is skewed as buy-outs, included in his European data but not his US data, can be expected to be less heavily concentrated in high-tech industry. The relative size of high-tech VC investment in Europe is therefore understated in his analysis. There is a general consensus that VC has been more successful in the US than in Europe which Megginson (2004) attributes to the above issues. Bottazzi and Da Rin (2002) find that, for European firms, VC was only helpful at start-up and did not seem to influence the growth of the investee which they attribute to the immaturity of the European VC sector.

4.2.2 Government Policy and Venture Capital

All countries have experienced some degree of government involvement in the development of VC (Kenney et al, 2002) although the extent of state involvement varies, being higher in Europe than in the US. Lerner (2009) describes government support as acting as a catalyst

[131] This conflation of VC with aggregate PE is common as much of the EVCA data cover aggregate PE and lack detail by VC itself. This problem is particularly acute if Europe is being compared directly with the US as the US data are mainly for VC. Conclusions in Europe-only studies are also affected however because VC constitutes different shares of PE in different countries as shown later. Leleux and Surlemont (2003), for example, use PE data throughout their study although their discussion is about VC. The 15 countries in their analysis are EU13 (omitting Greece and Luxembourg) plus Norway and Switzerland. In the period covered, 1990-1996, VC constituted 86 per cent of PE investments made by funds managed in Ireland and 76 per cent in Germany, compared to only 31 per cent in the UK.

to the development of firms, sectors, and regions. Market failure, economic growth, and job creation are the main arguments for government intervention in VC markets. As Messica and Agmon (2008) point out, government objectives will differ from those of the venture capitalist and whereas the venture capitalist aims to maximise the direct return from a particular investment, governments are also interested in indirect benefits arising from spillovers. Lerner (2009) argues that the rationale for intervention rests on three pillars: technological innovation spurs economic growth; VC is an appropriate investment vehicle to support innovation; and government can effectively promote VC and entrepreneurship. The last of these he sees as a "shakier" proposition.

The main sources of failure in the VC market are the equity gap, externalities arising from knowledge spillovers and economies of agglomeration, and problems related to the long maturing time in high-tech sectors. The equity gap prevents firms from achieving the critical size required to attract VC finance resulting in the failure of firms despite high-potential. Knowledge spillovers result in the social benefits from R&D outweighing the private benefits (Lerner, 1996). The existence of such spillovers is a valid argument in favour of government intervention in the development of innovative start-ups (Lerner, 2009) as support for the early entrepreneurs in a new industry will create external economies leading to the establishment of more firms. Economies of agglomeration, including the development of pools of skilled labour and sub-suppliers, arise from the clustering of VC-supported industry. Long maturing times can also lead to VC market failure where a maturing time is beyond the lifespan of a VC fund, this is especially likely in the biotechnology or medical devices sectors (Messica and Agmon, 2008). In such cases there can be a role for government intervention although election cycles can also shorten the time span of state support. Additionally, the government can play a role in smoothing out the VC investment cycle and solve the problems associated with volatility (Jeng and Wells, 2000; Messica and Agmon, 2008).

On the demand-side of the VC market suitable investment opportunities need to exist. Indirect measures can be used to enhance the business environment, through the provision of appropriate legal and regulatory environments, and tax policy (Megginson, 2004; Lerner, 2009). A further consideration is that government involvement has a role in certifying firms to venture capitalists, reducing information asymmetries and thereby making firms more attractive to VC funds (Lerner, 1996). Government may also play an advisory role. The state can also play a role in the boosting of linkages with university research, (Gompers and Lerner, 2001; Harding, 2002; Megginson, 2004; Lerner, 2009; Keller and Block, 2012). The Irish software industry has had strong linkages with university research spawning firms

such as Iona, Baltimore, and Trintech (Breznitz, 2007). In more recent years, Breznitz (2007) suggests that many of the outcomes of R&D activities in Irish universities are being patented by US MNCs rather than being developed by Irish firms. If this is the case, then the benefits from the substantial demand-side efforts in supporting R&D are ultimately reaped by foreign-owned companies. Somewhat ironically, efforts to develop strong indigenous industry could lead to even greater development of the foreign-owned sector.

Some governments have adopted a picking winners policy of selecting 'sunrise' industries to support. Megginson (2004) and Lerner (2009) largely argue against such an approach although Lerner (2009) does point to a few successes, which he sees as exceptions to the rule. One such exception is Taiwan where the government saw opportunities in the production of standardised computer components and peripherals arising out of the development of the personal computer.[132] Private firms in this industry were supported in a number of ways, including through research funding and investment in human capital (Lerner, 2009). Irish industrial policy also involves targeting of particular industries, software having been a particular focus of VC policy. Interestingly in both the Taiwanese and Irish cases the industries targeted had only weak barriers to entry which opened up specialised market niches for small innovative firms. Supporting such firms in industries with strong barriers to entry is likely to be less successful especially where there is substantial proprietary knowledge held by incumbents such as in the life-sciences.

Supply-side policies aim to increase the flow of funds into the VC market by improving the attractiveness of the VC market to institutional investors. Baygan and Freudenberg (2000) argue that the level of VC activity, and the trade-off between risk and return, varies because of the legal, institutional, or regulatory barriers to entrepreneurship which discourage risk-taking by imposing a costly compliance burden for example. Indirect interventions include the definition of a legal and fiscal framework to facilitate the development of a VC industry and the regulation of the market and investors to either provide incentives or impediments to VC (Leleux and Surlemont, 2003) with some countries prohibiting investment by pension funds and insurance companies due to the high risk (Baygan and Freudenberg, 2000) while others introduce legislation or guidelines to facilitate these investors to enter the VC market. Establishing a legal and fiscal framework to facilitate VC includes bankruptcy legislation (Leleux and Surlemont, 2003) and the facilitation of exit opportunities by IPOs through the development of a secondary stock market) or loss guarantees (Baygan and Freudenberg,

[132] Barriers to entry were lowered as a result of the development of the personal computer and standardised technology (Lerner, 2009). O'Malley (1989) also discusses this maturation of an industry and the standardisation of technology as an opportunity for latecomers, removing early industrialisers' advantages over low-cost newcomers.

2000; Leleux and Surlemont, 2003; Lerner, 2009). The venture capitalist's expected returns are also influenced by tax policy such as the capital gains tax rate (Baygan and Freudenberg, 2000; Leleux and Surlemont, 2003; Da Rin et al, 2006; Lerner, 2009). Da Rin et al (2006) recommend cutting capital gains tax claiming that the lower expected returns in Europe compared with the US are the real reason for the smaller VC market. Such calls need to be given careful consideration however as a balance needs to be struck between private profit-making and the wider social benefits that the state wishes to achieve.

Direct interventions on the supply-side include the establishment of public venture finance including equity or loans (Leleux and Surlemont, 2003) and the co-investment of projects with private sector venture capitalists. Co-investment arrangements are common. Mason and Harrison (2003) describe a co-investment approach in the UK's government's regional VC policy with 50 per cent of the funding coming from the private sector and some of the public sector's input coming from the European Investment Fund. Co-investment approaches have certification advantages as well as helping to avoid the crowding-out of private VC. However, Lerner (2009) recommends this co-investment policy of a matching funds requirement as the public sector may not be good at assessing a potential project, especially when a lot of specialised knowledge is required. Government support should be seen, according to Lerner (2009), as complementary rather than a substitute for private funding, supporting rather than displacing the private sector. Baygan and Freudenberg (2000) argue that direct financing policies assume an equity gap exists. If there is an equity gap direct supports are more vital in the early-stages and Lerner (2009) sees a role for government at the seed stage when it is very difficult for the entrepreneur to access any finance. In Germany, where public finance has dominated VC, most state funding goes to early-stage projects in the form of guarantees, refinancing loans, and direct investment including co-investment (Sunley et al, 2005). Messica and Agmon (2008) argue that any funding needs to be sector-specific as requirements and maturing times differ across sectors: life sciences having long maturing times compared with IT and software. Lerner (2009) further warns that a scatter-gun approach to funding industries dilutes the impact of the funding. Da Rin et al (2006) however argue that the difficulties with seed funding, as well as for the development of high-tech industry, in Europe is not a lack of VC or suitable investment opportunities but the low expected returns to the venture capitalist. Jeng and Wells (2000) find that government-funded VC has different sensitivities than other VC. High levels of IPOs were generally associated with high levels of VC, for example, but this relationship did not hold for government funded VC suggesting that government funding is used in environments not otherwise favourable to VC.

State support has been used to develop innovation-intensive clusters in an effort to emulate Silicon Valley (see Lerner 2009 for a fuller discussion). However, economies of agglomeration and demonstration effects cause high-tech firms to often cluster in a region without government encouragement. Gompers and Lerner (2001) find that slightly more than one-third of VC investment in the US in 1999 went to firms in California, attributing this to the high concentration of high-tech firms there. Mulcahy (2005) finds around 79 per cent of Irish VC investments taking place in Dublin firms. Despite discussing the importance of developing "interlocking clusters of excellence and expertise" the *Review of Industrial Policy and Performance* (2003:89) was critical of the dominance of Dublin firms in the take up of funds jointly operated by VC firms and EI from 1996- 2000, and efforts were later made to achieve a greater regional spread. As Mulcahy (2005) argues, evidence suggests it may be more efficient for high-tech firms, in particular, to cluster in one area and she argues that this has implications for EI policy.

In the US the 'Small Business Innovation Research' (SBIR) programme funds cutting edge technology and innovation. Lerner (1996) finds that firms receiving funds under this programme had better employment and sales growth than similar firms that did not receive this support. This effect was stronger for high-tech firms and for those in locations where there was a lot of VC activity. Keller and Block (2012) argue that the SBIR has acted as a catalyst in the development of small high-tech firms through interacting with other changes taking place, such as the adoption of open innovation strategies by large firms, and through the correction of 'network failures'. They claim that the SBIR provided critical funding and smoothed the way for the cultural acceptance of engineers and scientists becoming entrepreneurs as well as playing a role in bringing firms and venture capitalists together.

Military expenditure is an important source of state support in many cases, the Israeli experience being a commonly cited example. This has also been a feature of the development of the VC sector in the US with government military contracts also being important in the early development of Silicon Valley (Lerner, 2009; Aizenman and Kendall, 2012). Mainly drawing from the Israeli experience, Avnimelech and Teubal (2008) present an 'Innovation and Technology Policy Cycle' model of the emergence of innovation-intensive clusters in industrialising economies. The early phase identified in the model relates to the emergence of innovation capabilities and the diffusion of R&D across the economy. The background conditions were established in Israel in the wake of the Six Day war of 1967 which saw a sharp increase in military R&D spending, significant investments by foreign multinationals in R&D laboratories and a state-orchestrated process to expand innovation in the business sector. The second phase of the model sees VC emerge,

alongside an acceleration in the growth of high-tech start-ups, and IPO and M&A activity. They describe how VC funding was purposefully developed by government, after a number of false starts, through the enduring Yozma Program of 1993. This government-owned VC fund invested directly in early-stage activities as well as operating as a fund of funds invested through private VC companies.

While Ireland does not have military spending in common with Israel, the two countries do have similarities in being small economies with strong links with the US. Small economies can particularly benefit from state intervention in the VC market as local capital markets are too small to fund high-tech industry (Messica and Agmon, 2008). Harding (2002) argues that the Irish government needed to achieve a shift from the grant dependency of the 1980s to an entrepreneurial culture, echoing the report of the Industrial Policy Review Group (1992) (known as the *Culliton Report)* which criticised the "hand-out" mentality of Irish business. The predominance of state agencies in industrial policy may also be to blame for the Irish VC industry being what Breznitz (2007:178) calls "reliant" on the state for both funds and decision-making. In Ireland EI support has included tax benefits and R&D grants but only firms deemed to be HPSUs qualify for EI support.[133] Although the development of the software industry in Ireland is described by Breznitz (2012:100) as a "grassroots transformation" the state later became a regular partner in funding it. Breznitz (2012) argues that the micro-management of indigenous industry and the lack of resources for EI to vet firms has led to bottlenecks. This is exacerbated by the requirement for firms to have private funding which causes a 'Catch-22' situation where a firm cannot get private sector funding without the credibility of EI support but cannot get EI support without having private funding in place.

The requirement that both demand-side and supply-side deficiencies are addressed is a common theme in the literature. Avnimelech et al (2005) suggest that part of the problem with government intervention in the market has been one of conceptualisation, where the absence of VC is seen as a purely supply-side deficiency. There tends to be a belief among policy makers that supply of VC creates its own demand (Harding, 2002). Avnimelech et al (2004:6) caution that the emergence of a dynamic regional or national VC market requires not just that supply-side shortages of funds be addressed but also that appropriate demand-side conditions prevail, notably "a flow of investment opportunities capable of growing in value quickly enough to provide capital gains justifying the investment risks". An

[133] EI invests in HPSUs both by directly holding equity in an enterprise it supports which is considered a demand-side measure as it directly supports the enterprise, and through EI Seed and VC investments which involve co-investment by EI and private VC funds and as such are considered a supply-side measure.

inappropriate focus solely on the supply side is also one of the grounds on which Mason and Harrison (2003) critique the UK regional VC initiative, pointing out that firms need to be 'investment ready'. Harding (2002) demonstrates that countries that have been particularly successful in developing VC have had demand-side policy interventions too. In this regard, she argues that it is necessary to gradually create a new industrial culture by breaking away from a 'culture of grant dependency' to a 'culture of entrepreneurship' (Harding, 2002).

Like the poor survival rates of VC-backed projects generally, there are more failures than successes in government-backed VC projects, as documented by Lerner (2009). As well as an excessive focus on supply-side measures to the neglect of the demand-side, there are a number of other reasons for government failure. One of these is the failure to understand and listen to the VC market as there needs to be a flow of information between the private and public sector Lerner (2009). Bottazzi and Da Rin (2002) argue that the 'quality' of VC is also important, not just the quantity. Another problem is the long time horizon involved which does not sit easily with election cycles. As Lerner (2009) points out, it takes time to build a self-sustaining VC industry. The birth date of the US VC industry itself has been suggested as 1978 which was twenty years after the 'Small Business Investment Companies Program' (SBIC) (Lerner, 2009). Other issues raised by Lerner (2009) are that the size of support is often wrong, and it lacks the required flexibility (as development and investment take place in stages, it is often necessary to change direction). Lerner (2009) argues that if the government wants short-term 'fixes' than it would be better not to have got involved as quick returns are unlikely. Harding (2002) suggests that although demand-side policies are the most effective they can be more complex, as they involve cultural and institutional change. Government can also fail in the inconsistency of support with Lerner (2009) referring to stop and start support in the development of Silicon Valley. Another common problem that can arise with any state aid is deciding when it should cease. Evidence from the Netherlands suggests that withdrawing government support at a later stage should not have a negative impact on VC (Jeng and Wells, 2000).

The extent of government involvement requires careful consideration. Kenney et al (2002) warn against 'capricious' government action that can harm the development of a self-sustaining VC industry. Public sector involvement can potentially undermine the credibility of private venture capitalists if the impression is that the private sector cannot raise funds successfully (Mulcahy, 2005). Crowding-out is a risk with government supply-side interventions undercutting the private sector and leaving it with only 'lemons' to fund (Leleux and Surlemont, 2003). Breznitz (2012) echoes Mulcahy (2005) in the view that EI supports can hinder rather than benefit the industry. Mulcahy (2005) is also critical of EI

'outsourcing' investor responsibilities such as due diligence, deal structuring and pricing, and portfolio management and oversight. Lerner (2009) points out that policymakers may make decisions based on a 'buzz' and without having complete information. Distortions can also occur in the provision of subsidies due to pressure from interest groups (Lerner, 2009). Furthermore, consideration must be given to the size and nature of government intervention, and to whether the same outcome can actually be achieved without government intervention. Indeed, the link between VC and the development and growth of HPSUs is questioned by Keller and Block (2012). They argue that the volatility of VC is at variance with the steady growth required by HPSUs. The role for government to smooth out funding cycles, 'galvanising' investment during downturns, has been discussed by Jeng and Wells (2000) and Mulcahy (2005). Keller and Block (2012) further argue that much VC investment is not aimed at such firms as it typically is not made at the seed stage and is not always in firms at the cutting edge of new technology, citing the extent of investment in online retail in an attempt to emulate the success of Amazon, as an example.[134] Megginson (2004) cites the EVCA as calling on governments to provide direct financial support only when matched by private funds, concluding that while government can provide support only a "vibrant private sector" can create wealth.

There is a risk of policy capture by the PE industry. Entrepreneurship is seen as synonymous with economic growth and wealth creation but Lerner (2009) alludes to there being two categories of entrepreneurs: those that create wealth and those that extract it. Government involvement can become distorted by lobbying by interest groups and even the politicians themselves to increase their own private profit rather than to social benefits (Lerner. 1996). While arguing against continued state support, as the equity gap was filled and the Irish VC industry had grown substantially, Mulcahy (2005), who writes largely from an industry perspective, does see a role for the state in encouraging angel investment and supporting better exit strategies. It is necessary but can be difficult to strike the right balance of support. Tax (such as cuts in capital gains tax) and legislative changes (such as limited liability legislation) may occur at the behest of the industry, and although they may result in value creation the issue of social benefits vis-à-vis private profit-making must be carefully considered. It is important that such calls are considered carefully by governments as a balance needs to be struck between the social and private objectives.

[134] We saw earlier that VC was important to the development of Starbucks, also not in the high-tech sector.

4.2.3 Internationalisation of Venture Capital

For the most part, VC has tended to be domestic and local. This is partially because it involves deal-making so proximity of the actors is important. US VC in particular was local until the 1990s when an oversupply of funds into US VC firms led them to look for investment opportunities abroad (Aizenman and Kendall, 2012). There have always been more cross-border flows in Europe because economies are smaller, a process noted earlier as 'Europeanisation'. Lerner (2009) claims that the important early investment in the development of the most successful "entrepreneurial hubs" since the 1990s has been overseas rather than domestic investment. Foreign investment often occurs through syndicated deals with a local partner as the presence of a local venture capitalist to lead the deal is often considered essential (Florida and Kenney, 1988). Such cross-border deals have become easier due to lower communication costs. In small economies local capital markets are too small to fund high-tech industry (Messica and Agmon, 2008) and this gap may be filled by foreign capital.

Madhavan and Iriyama (2009) argue that there are two different models of the process driving cross-border VC flows. One is an economic opportunity-driven process where market attractiveness factors such as market size and country-specific characteristics are important. The alternative, which they favour, is the network model. They argue that internationalisation of the activity of US VC firms is associated with 'transnational technological communities' (TTCs) i.e. groups of immigrants active both in home and host countries.[135] Aizenman and Kendall (2012) also see the role of networks, as well as fixed costs associated with entry, as important in the path dependency of VC investment. Furthermore, internationalisation is helped by cultural ties and other links between countries such as the availability of VC experts with local knowledge (Florida and Kenney, 1988; De Backer and Sleuwaegen, 2003; Wright et al, 2005). Classical FDI has a role in developing these links and the destination countries for cross-border VC are commonly major FDI hosts (Madhavan and Iriyama, 2009; Gu and Lu, 2011).

This is important in the Irish context, given the significance of classical FDI in the Irish economy and the economic and cultural ties between Ireland and the US, in particular. For example, a substantial number of former MNC employees are involved in the indigenous software sector and others had worked in the industry overseas (O'Malley and O'Gorman, 2001; Ó Riain, 2004). The *Review of Industrial Policy and Performance* (2003) also claims

[135] They suggest that in the US case, these are composed of former foreign students in US universities subsequently establishing businesses in the US. When they ultimately return home, they feed into these contacts to help fund new businesses in their home countries.

that one-third of software entrepreneurs had worked in a foreign-owned electronics firm immediately prior to establishing their own firm and two-thirds had at some stage in their careers. Such knowledge spillovers are likely to be important in the development of indigenous firms in this sector. Much of this knowledge was attained at home, via classical FDI, as well as abroad as with the TTCs described by Madhavan and Iriyama (2009). According to Ó Riain (2004) spillover effects operating through local networks in such technical communities and the availability of product markets helped develop the sector. A further factor was the high domestic demand for software (O'Malley and O'Gorman, 2001). Ó Riain (2004) argues that government policy played a role in 'scaling up' these local networks, with the state being the major provider of funding (and also education) to the sector until 1996. The success of indigenous software was not matched to the same degree in other high-tech industries such as pharmaceuticals and O'Malley and O'Gorman (2001) suggest that market structure is a contributory factor. They point to the lower entry barriers and consequent lower concentration of the software industry compared to other industries which allowed the establishment of SMEs, often to serve specialised niches. Pointing to the very high inflow of funds as a particular feature of VC market in Ireland, the *Review of Industrial Policy and Performance* (2003) says that despite problems in the ICT sector at that time, the drop in funding was less than in other parts of the EU and the US.

Classical FDI and VC-supported indigenous industry may be seen as substitutes or complements. On the one hand, classical FDI can crowd out indigenous enterprise through competition effects in both product and factor markets (Markusen and Venables, 1999; Görg and Strobl, 2000; De Backer and Sleuwaegen, 2003). In the Irish case this effect can be chiefly expected in factor markets through higher wage rates, for example, as MNCs located in Ireland are chiefly exporters and located in industries where there was little extant industry locally. Barry and Kearney (2006) find little or no 'crowding-out' of employment in Irish indigenous firms by foreign MNCs. On the other hand, the presence of MNCs in the host country can act as a catalyst for the development of domestic entrepreneurship through learning, demonstration, network, and linkage effects (Markusen and Venables, 1999; De Backer and Sleuwaegen, 2003). The development of the networked global business replacing the vertically integrated MNC is also relevant here. Keller and Block (2012) argue that SMEs, rather than large MNCs, are now commonly responsible for innovation, one factor being the adoption of 'open innovation' policies by large corporations rather than undertaking R&D in house as in the past. Evidence for this according to Keller and Block (2012) is found in the jobs available for PhD level scientists and engineers in the US which are predominantly in SMEs rather than in large firms. This gives a role to small indigenous firms to develop alongside the subsidiaries of large foreign MNCs. Görg and Strobl (2000)

find a positive effect on the entry of indigenous manufacturing firms in Ireland. De Backer and Sleuwaegen (2003) also find a mainly complementary relationship between classical FDI and entry of new indigenous manufacturing firms in Belgium, although crowding out can occur initially. This complementarity, they stress, is not a natural process but requires specific policies to ensure that adequate linkages are developed (De Backer and Sleuwaegen, 2003).

Agmon (2006) and Agmon and Messica (2009) describe international flows of VC and PE as a new form of FFDI. Internationalised VC involves the export of high-risk sector-specific capital to small and emerging economies and the process and rationale are similar to classical FDI with capital flows augmented by management involvement (Agmon and Messica, 2009). Gu and Lu (2011) argue that it is this involvement in the investee that distinguishes cross-border VC as FDI rather than Foreign Portfolio Investment (FPI). Ownership of funds is oligopolistic with most of the high-risk capital globally held by a few large financial institutions in the US and Western Europe (Agmon, 2006) somewhat analogous to the dominance of classical FDI by large MNCs. Gu and Lu (2011:269) liken the close involvement of the venture capitalist in the investee to that of a parent "actively involved in the strategic and operational decisions of its subsidiaries" in classical FDI. Furthermore, they see syndication of overseas VC deals as similar to MNC parents engaging in joint ventures. In addition, Aizenman and Kendall (2012) find that VC firms involved in cross-border deals tended to be larger than those engaged solely in local domestic deals. Common drivers of international VC flows and other forms of FDI include the distance between home and host countries, and language and colonial ties.[136] Aizenman and Kendall (2012) further find that VC tends to flow to countries with more 'high-end' human capital, better business environments, and deeper financial markets. The latter facilitate exit through IPOs. Guler and Guillén (2010) argue that policy stability is important for both classical FDI and for VC. Agmon and Messica (2009) find that the growth in this form of FDI has not only earned a return for the investor but has been important in reducing trade costs for the investees, therefore enhancing their ability to compete internationally.[137]

However, Guler and Guillén (2010) argue that the financial intermediation role often played by VC funds, where the VC firm acts as an intermediary between the ultimate investor and the investee, is a commonality between internationalised VC and Foreign Portfolio Investment (FPI) as the ultimate investor's goal is purely the financial return rather than an interest in the good or service being provided and the ultimate investor is not involved in

[136] These may act as proxies for networks and also of institutional similarity (Aizenman and Kendall, 2008).
[137] An important caveat is that they are referring to PE in its entirety rather than VC itself.

any way with the management of the firm although the VC fund may be (Agmon, 2006). Two further commonalities between VC and FPI are the importance of the legal protection of ownership rights and the key role of equity markets (Guler and Guillén, 2010). Furthermore, cross-border VC has some features which are not shared with either FDI or FPI. One feature specific to the VC industry for example is the over-supply of VC funds in the US in the late 1990s leading to a search for VC investment opportunities abroad (Aizenman and Kendall, 2012). Another feature is the heavy concentration of VC in high-tech sectors making a host country's technological and scientific knowledge stocks and ICT infrastructure more important to the venture capitalist than to either the direct or portfolio investor (Guler and Guillén, 2010; Aizenman and Kendall, 2012). This distinction is largely irrelevant in the Irish context however as high-tech sectors are also targeted by the IDA as classical FDI. Despite the qualifications, it is evident that international VC has more features in common with classical FDI than with FPI.

4.2.4 Summary and Discussion

Two gaps in VC research are of particular relevance in the Irish context. First, most extant studies focus on the VC industry itself rather than on its role within the economy (Lerner, 2009; Popov and Roosenboom, 2009). Features of the VC market identified in much of the literature reviewed above are the size, development, and growth of the VC market, the relative importance of VC, the relative importance of the early and late stage investments, the relative importance of various modes of exit especially the role of IPOs, the sources of funds, and the sectoral distribution, in particular the extent of VC in high-tech sectors and projects. These features will be explored for the Irish VC market to meet this chapter's first objective of documenting the development of VC in Ireland at the macro-level in comparison with other European countries and the US. Furthermore, as VC is important to the development of innovative start-ups and relevant to Irish industrial policy to develop strong self-sustaining indigenous industry, the role of VC in the economy in terms of investment into portfolio firms themselves will be explored. This is of greater interest economically but lacks research partially due to the shortage of suitable data. This motivates the first research question comparing the development of the VC environment in Ireland with those in the US and elsewhere in Europe.

Related to the discussion of the features of the VC market is the degree and type of government intervention, also widely discussed in the literature. The state has played a role in most VC markets but to a greater degree in Europe than in the US. The second aim of this chapter is to examine the nature of state intervention in the Irish VC market. The

literature review identified the various issues in respect of state intervention as the amount and types of support and the balance between supply-side and demand-side measures, the equity gap and the role of the state in seed financing, the role of government with respect to supporting R&D and innovation, and the risk of policy capture. This leads to the second research question on the nature of state intervention in the Irish VC market.

The other gap in VC research that has been identified by Gompers and Lerner (2001), Gompers (2007), Wright et al (2005), and others, is the dearth of studies on the increasing internationalisation of VC. The third objective of this chapter is to examine the degree of internationalisation of VC in Ireland. The limited literature in this area finds that although VC has become more internationalised, the extent of internationalisation varies across countries. The size, growth, and nature of cross-border flows of funds and investment in Ireland will therefore be compared to other countries from both an industry and economy point of view. This motivates the final research question of how the degree of internationalisation of VC in Ireland compares with other countries.

4.3 DATA AND METHODOLOGY

The research approach is necessarily descriptive. The data have been compiled and presented to enable comparisons to be made, particularly from the perspective of economic development rather than the development of the VC market itself. One of the problems for economic research into VC is that much of the data takes a VC industry-centric approach.[138] Most of the data used in the analysis in Section 4.4 are from the EVCA and the NVCA. Care needs to be taken when using these data as they have a number of pitfalls:

Firstly, definitions vary. As the EVCA data cover all PE investments and the NVCA data are limited to VC only, they are not directly comparable. It is not always possible to disentangle VC and PE in the EVCA data. For example, funds raised were not disaggregated by stage prior to 2007, although investments were. Similarly, sectoral and geographical detail is available for VC investments only from 2007. In contrast, most of the NVCA data cover VC itself although it does also produce some data on wider PE.

Secondly, the comparability of the data at the disaggregated level suffers from funds raised and funds invested having different breakdowns with the former being usually disaggregated by type of investor (corporations, government etc.) and the latter by stage of investment (seed, early etc.) or by industrial sector (Baygan and Freudenberg, 2000).

[138] Much of the wider literature available is industry-centric too, some of it written by practitioners rather than academics.

Thirdly, there is also a problem comparing the different data sources on a sectoral basis. The EVCA and NVCA use their own sectoral breakdowns although the EVCA does provide a key which enables recoding to the NACE industrial classification system.

Fourthly, data are mostly presented on a 'country of management' basis so they focus on the VC or PE houses themselves rather than on the portfolio firms that actually receive the investment. This makes economic evaluation of the role of VC difficult as the VC sector is not equivalent to the VC received by portfolio firms. The EVCA and NVCA only produce a small amount of data on 'country of origin' and 'country of destination' bases.[139] For some countries with highly internationalised VC markets, such as Ireland, the distinction between the 'country of management' approach and the latter two approaches is particularly important. The 'country of management' approach means, for example, that investment in Irish indigenous firms by foreign venture capitalists is not conceptually the same as 'foreign investment' as these funds may have been raised locally, from Irish residents, and are only 'managed' by foreign residents. A 'country of origin' and 'country of destination' approach is more suited to economic research as it gives a clearer picture of the actual capital flows taking place and the role of foreign investment. This issue is increasingly important with the increased internationalisation of VC markets. Firm-level data, with the focus on the portfolio firm rather than on the venture capitalist, would be preferable from a policy viewpoint (Baygan and Freudenberg, 2000). As already noted, in some EVCA data it is not possible to disentangle what proportion of investment is VC as opposed to later-stage PE. The calculation of the inward and outward flows of PE received from and invested abroad is a case in point: The inflow of PE into Irish portfolio firms, for example, equals the value of total PE investment received by Irish portfolio firms ('country of destination' data only available for 1999 onwards) minus domestic PE investment made by Irish PE houses; the outflow of PE from Ireland equals the value of total PE investment made by Irish PE houses less domestic investment made by Irish PE firms. Although the total investment made by domestic PE houses and received by domestic portfolio firms is available separately for VC from 1999, the geographical distribution of investments data needed to measure the domestic elements was not available for VC separately until 2007. Therefore conclusions about the internationalisation of VC can only be drawn for the period 2007-2010 and for a longer time-series (going back to 1999) it is only possible to examine the internationalisation of aggregate PE.

[139] Country of origin and country of destination data were first made available by the EVCA in 2000 so the EVCA data only covers years from 1999, on a mostly aggregate basis. A greater level of disaggregation of these data is available from 2007.

Fifthly, in the EVCA data, 'Europe' only refers to member countries and not any other common regional definition, it does not always cover all EU countries for example. The country coverage of the EVCA data is also inconsistent across time as membership changes over time. Furthermore, according to Baygan and Freudenberg (2000) the EVCA data were gathered and analysed in different years by different companies using different methodologies.

Lastly, the extent of investment is likely to be underestimated, especially in the EVCA data. EVCA members tend to be PE companies with funds often sourced from banks and institutional investors. Informal investment, such as the entrepreneur's own resources, family and friends, and angel investors, is omitted although this form of financing is commonly thought to be much larger than other forms of PE (OECD, 1996; Baygan and Freudenberg, 2000).[140] Furthermore, Popov and Roosenboom (2009) point out that US PE investment into a European country is only counted if it passes through the European office of the US investor. This includes shares in syndicated deals where each share is allocated to the country of the investor. Where the US investor has no European office then these investments do not appear in the EVCA data and in this sense the EVCA data are incomplete, although most US VC investors do have European offices (Popov and Roosenboom, 2009). Since 2007 some data are also available from the EVCA for flows from non-European PE houses into European firms. The NVCA data only cover domestic investments (Baygan and Freudenberg, 2000).

The time period covered in the chapter is 1990-2010 as the 1990s saw dramatic growth of VC in Europe and the US and the take-off of VC in Ireland. This was followed by the collapse of the dot-com bubble at the turn of the millennium and later the global financial crisis which both impacted on VC. At the time of undertaking this research, 2010 is the most recent year for which data are available.

4.4 ANALYSIS AND RESULTS

This section first examines the development of the VC market in Ireland in a comparative perspective. The role of government in the development of VC is examined in an Irish context in the following sub-section. Lastly, the internationalisation of the Irish VC

[140] Data on the size of informal investment are scarce. According to Fitzsimmons and O'Gorman (2011), for the period June 2008- June 2011, 3.2 per cent of the adult population in Ireland reported making such investments with an average of €26,000 invested. Both figures are somewhat lower than the EU15 average. These data only cover domestic investors however and ignore investment from overseas. OECD (1996) reports estimates for the UK suggesting that angel investment may be two to four times greater than institutional investment.

environment, particularly significant when compared to other countries, is explored in the final sub-section.

4.4.1 Comparison of Venture Capital Markets

The first step is to examine features of the Irish VC market in comparison with the US and European markets. These are identified from the literature review as the size, development, and growth of the VC market, the relative importance of VC, the relative importance of the early and late stage investments, the relative importance of various modes of exit especially the role of IPOs, the sources of funds, and the sectoral distribution, in particular the extent of VC in high-tech sectors and projects. Growth in the US market was particularly dramatic in the 1990s but this was followed by the dot-com crash in 2001 and later by the global financial crisis. While the US VC market reached a maximum of only $5.5 billion in the 1980s, the number of VC funds increased from 43 to 629 between 1991 and 2000, by which time capital commitments had risen to well over $100 billion. Table 4.1 shows this increase in both funds raised and invested in the 1990s and the sharp fall that followed after 2000. Following some recovery, the global financial crisis had a further impact and by 2010 the US market had not returned to the levels prevailing at the end of the 1990s. It should be remembered, however, that funds raised and invested in any year or time period are not two sides of the same coin as venture capitalists tend to raise funds at certain times, maybe only every few years, and then invest as opportunities arise.

Table 4.1 The US Venture Capital Market (€billion), Annual Averages

	1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
Funds Raised	6.4	63.9	23.6	21.7	15.4
Funds Invested	4.8	57.3	26.8	18.8	17.6

Source: NVCA.
Note: Data converted to euros (ECUs prior to 1999) using Eurostat period average exchange rates.

Equivalent data for selected European economies, available only for VC investments prior to 2007, are shown in Table 4.2.[141] The European VC market also expanded over the 1990s but the bubble, and subsequent downturn, was far less dramatic than in the US. The global financial crisis had a bigger impact than the dot-com crash and by 2010 European VC investments were substantially lower than the levels of the late 1990s despite another peak occurring in 2006. Ireland conforms to the general European pattern.

[141] Both the US and European data generally follow the 'country of management' approach, meaning that they refer to the activities of locally managed funds only. These are the data examined in this section. Some insights to be gleaned from alternative approaches are discussed later.

Table 4.2 Venture Capital Funds Invested (€billion), Annual Averages

	1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
Europe	2.8	12.1	10.1	13.4	5.2
UK	0.7	3.4	2.6	6.1	1.3
Germany	0.5	2.6	1.6	1.1	0.8
France	0.5	1.8	1.3	1.6	1.0
Ireland	0.03	0.11	0.10	0.09	0.05

Source: Own calculations based on EVCA data.
Note: Data are investments made by VC funds located in these countries as opposed to investment in the country itself. Figures for Ireland for example refer to investments made by VC funds managed in Ireland which may be invested in portfolio firms in Ireland and overseas.

A comparison of funds raised and invested for European countries over 1990-2010 is only possible for the aggregate PE market because EVCA data on funds raised are not available by stage prior to 2007.

Table 4.3 Private Equity Funds Raised and Invested (€billion), Annual averages

	1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
FUNDS RAISED					
Europe	6.9	31.3	31.5	70.5	49.4
UK	3.4	12.2	16.6	43.6	26.7
Germany	0.7	3.9	2.2	2.6	2.4
France	1.0	5.2	4.1	8.2	5.5
Ireland	0.05	0.23	0.16	0.05	0.17
FUNDS INVESTED					
Europe	5.6	24.9	27.0	51.7	48.3
UK	2.4	10.6	10.3	27.9	21.3
Germany	0.7	3.3	3.1	3.3	5.6
France	1.0	3.3	4.5	7.5	7.5
Ireland	0.03	0.13	0.17	0.09	0.13

Source: Own calculations based on data from EVCA
Note: Converted where necessary to euros (ECUs prior to 1999) using Eurostat period average exchange rates.

Table 4.3 reveals that a turn-of-the-millennium bubble is much less in evidence in the European PE market. PE funds raised and invested generally continued to grow until the onset of the global financial crisis, though Ireland stood somewhat apart from the general European trend, with both funds raised and invested increasing in the 2007-2010 period.

More recent EVCA data contain greater detail on funds raised by stage thereby allowing VC to be examined separately from 2007. Table 4.4 shows that VC transactions generally fell over the 2007-2010 period. Investments made by the Irish VC industry were consistently lower than funds raised over the four years in contrast to the general situation for the large economies shown and for Europe overall. This gap was relatively larger for VC than for aggregate PE. This suggests a lack of investment opportunities over the period although four years is too short a time scale to draw solid conclusions especially as funds are raised and invested at different times.

Table 4.4 Venture Capital Funds Raised and Invested (€billion), 2007-2010

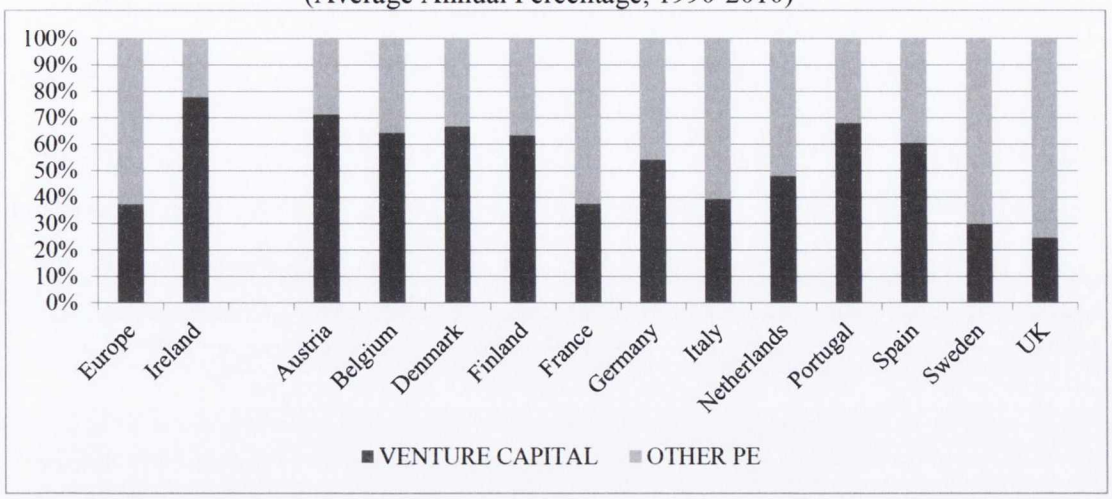
	2007	2008	2009	2010	Average 2007-2010
FUNDS RAISED					
Europe	8.4	6.2	3.5	3.3	5.4
UK	1.6	1	0.6	0.6	1.0
Germany	1.4	1.3	0.3	0.6	0.9
France	0.8	1	0.4	0.8	0.8
Ireland	0.19	0.08	0.12	0.09	0.12
FUNDS INVESTED					
Europe	6.2	6.8	4.1	3.8	5.2
UK	1.6	1.9	0.9	0.8	1.3
Germany	0.8	1	0.7	0.7	0.8
France	0.9	1.2	0.9	0.8	1.0
Ireland	0.07	0.05	0.05	0.03	0.05

Source: Own calculations based on EVCA data.

One notable difference between the Irish and general European PE environments is that in Ireland VC is relatively more important than later-stage PE. Over the period 1990-2010, VC accounted for an annual average of 78 per cent of investments made by Irish PE firms substantially higher than the European average of 37 per cent. In comparison, the VC shares of investments made by local PE houses in the UK, Germany, and France were on average 25 per cent, 54 per cent, and 37 per cent, respectively. The equivalent data on the funds raised side are only available from 2007. On average over the years 2007-2010 VC accounted for 77 per cent of all funds raised by Irish PE houses per annum compared to a European average of just 14 per cent.[142] Average shares for UK, Germany, and France were 6 per cent, 38 per cent, and 16 per cent, respectively, over these years. A large part of the overall European PE industry constitutes buy-out transactions particularly in the UK where they accounted for more than three-quarters of the value of transactions by UK PE firms over 2007-2010, for example.[143] This greater importance of VC compared to later-stage PE in Ireland may be an indication of the previous poor development of Irish indigenous industry, leaving few opportunities to invest in more established firms. Figure 4.2 shows that Irish PE houses stand out among European PE houses for having a very high share of VC in their investments. Other economies where VC investment accounted for more than half of all PE investment are generally either small or peripheral: Austria, Portugal, Denmark, Belgium, Finland, and Spain. At 54 per cent, Germany is the only large core economy where the value of VC investments is larger than the value of other PE investments made by local-managed funds.

[142] As already noted, separate VC data are only available from 2007 for funds raised.
[143] See, for example, the discussion of UK merchant capital in Sunley et al. (2005).

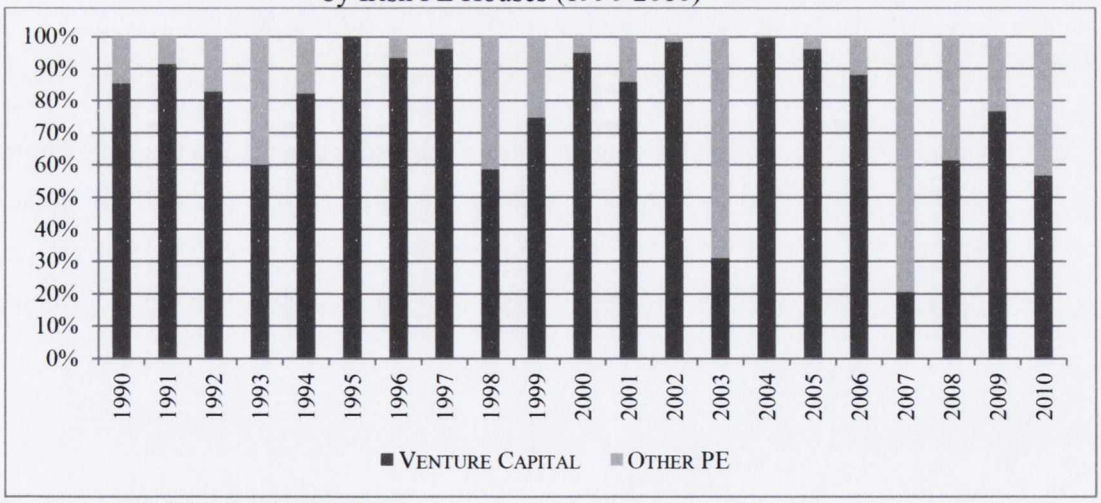
Figure 4.2 Venture Capital Investments as a Share of all Private Equity Investments (Average Annual Percentage, 1990-2010)



Source: Own calculations based on EVCA data
Note: Country of Management data applies to location of the PE house.

Looking in more detail at the annual data for Irish PE firms in Figure 4.3, VC accounted for large shares of PE investments in all years other than in 2003 and 2007. These two years also represented the highest volumes of funds ever invested by Irish PE houses, with the vast bulk of the investments being made domestically in Ireland. Of the €255 million invested in 2003, for example, only €13 million went overseas. The remainder included seven buy-out transactions totalling €176 million or 69 per cent of all PE investments.[144]

Figure 4.3 Venture Capital Investments as a Share of all Private Equity Investments by Irish PE Houses (1990-2010)

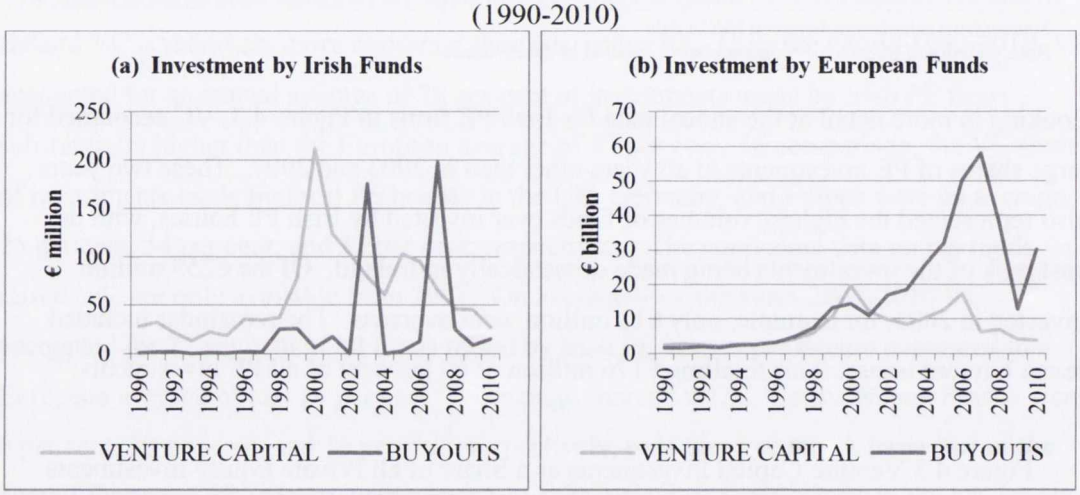


Source: Own calculations based on EVCA data

[144] 2003 also saw an unprecedented increase in the activity of other European PE funds who invested some €293 million in Irish companies, bringing the total invested in Ireland by domestic and other European PE funds to more than €535 million as shown later in Figure 4.15. Similar data on funds invested in Irish enterprises by non-European VC funds were unavailable (see Baygan and Freudenberg, 2000). These may be of some importance as Irish software companies in particular are known to seek financing from US Venture Capitalists.

Buy-outs also constituted more than 60 per cent of PE investments 2007.[145] By contrast, buy-out transactions constituted a very small part of all PE transactions by the Irish PE industry in most years, averaging just 14 per cent of PE investments per annum over the whole period compared with a European average of 54 per cent over the same period. Figure 4.4 shows these differences in the relative importance of VC and buy-outs between Ireland and Europe in general. Buy-outs are low in Ireland except for the peaks in 2003 and 2007. In Europe generally, buy-outs have become a much more important form of PE from the turn of the millennium, also experiencing a peak in 2007 and levels much lower thereafter during the global financial crisis.

Figure 4.4 Venture Capital and Buy-out Investments by Irish and European PE Houses (1990-2010)

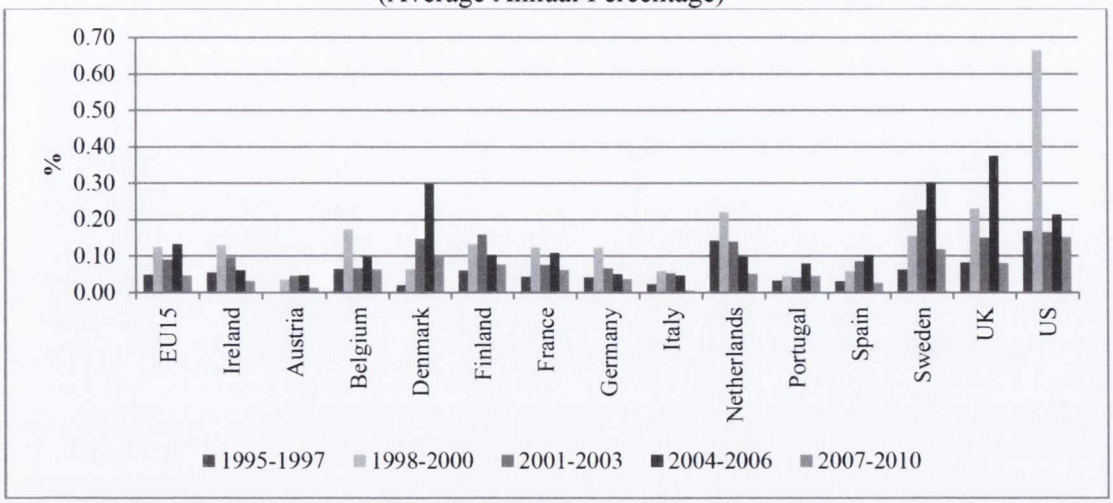


Source: Own calculations based on EVCA data
Note: The Irish market is shown in €million but the European market in €billion due to its greater size.

Relative to the size of the economy, for most countries in Europe and for the US, VC was most significant in the late 1990s. Figure 4.5 shows VC investments as a share of national income. Despite the rapid growth in VC, amounts are still relatively small. Even for the US at the height of the dot-com bubble, investments per annum came to less than one per cent of GDP. Except for the years 2004-2006, Ireland recorded values close to the EU15 average.

[145] As Ireland is a small economy, a small number of mega-deals will have a profound effect on the total value of PE in any year. MBOs of Eircom, Smurfit, and Green Property in 2003 were all described as "deals of significance on a European scale" (Brian O'Kelly, The Irish Times, 16th February 2004); PE deals in 2007 included the buy-out of Bupa, the acquisition of TodayFM, and a number of large hotel deals (including the sale of the Jury's Inn chain and the Burlington hotel). Some of these deals while lucrative for the sellers involved substantial job losses (Arther Beesley, The Irish Times, 28th December 2007).

Figure 4.5 Venture Capital Investments as Share of National Income
(Average Annual Percentage)

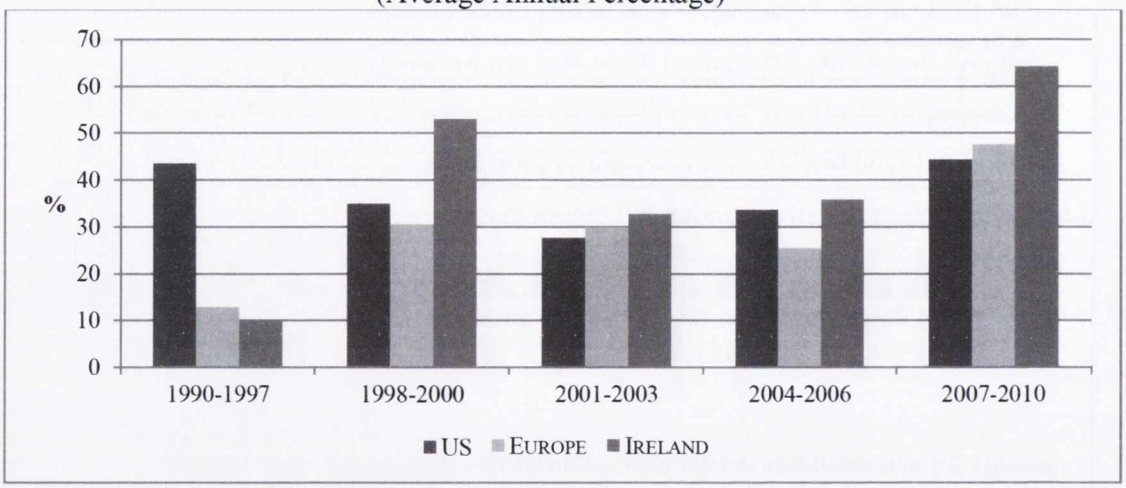


Source: Own calculations based on EVCA and NVCA data.
Note: GNP for Ireland, except where included as part of EU15, GDP for all other countries. VC data for Luxembourg are only included in EU15 from 2007.

Figure 4.6 provides data on the breakdown of VC finance by stage to compare funds committed to the early seed and start-up phases versus the expansion phases of enterprise development. Early-stage financing is seen as particularly important for the development of new firms with late-stage VC involved in the growth of firms that are usually already VC-supported. The share of early-stage financing by Irish managed funds changed substantially over the years, with expansion phase projects predominant prior to 1998. Since then, the Irish market has been above both the European average and the US in terms of the proportion of VC finance going to early-stage investments. However, only a small amount of this is at the seed stage. On average over the years 1990-2010 the seed stage accounted for 5.6 per cent of early-stage investment by Irish-managed funds slightly less than the European average of 9.7 per cent. By contrast, seed funding in the US over these years constituted 26.3 per cent of all early-stage VC on average.[146] As noted earlier the data only take account of the formal VC sector and this only tends to get involved once firms have reached a critical size, this may account for the low level of seed financing. Breznitz (2007:178) blames the "ultraconservatism" of the Irish VC industry for its unwillingness to invest at the seed stage. It was noted earlier that seed funding is the most serious equity gap facing young firms and the lack of such finance is a concern as it can lead to the failure of high-potential firms.

[146] The NVCA data uses three stages: seed, early-stage, and later-stage. The 'early-stage' in the NVCA data is taken to be approximately equivalent to the 'start-up' stage in the EVCA data. Therefore the term 'early-stage' refers to seed plus start-up finance for European data and seed plus early-stage finance for the US data. The other stage categories in the EVCA data are 'expansion' and 'later-stage' venture finance which are considered together to be equivalent to 'later-stage' finance in the NVCA data.

Figure 4.6 Early-Stage (Seed and Start-Up) Investments as Share of Total VC Investments (Average Annual Percentage)



Source: Own calculations on the basis of EVCA and NVCA data.
Note: In the NVCA data 'early-stage' funding is the equivalent of 'start up' funding in the EVCA data. Here 'early-stage' for the US represents the aggregate of seed plus 'early-stage'.

Turning now to look at modes of exit, Table 4.5 shows there is less difference between Ireland and the rest of Europe in terms of mode of exit for aggregate PE.[147] As discussed in the literature, trade sales have been predominant in both cases although representing a somewhat higher share for Ireland than for Europe generally. Write-offs were also higher for Ireland. In comparison, the US data on mode of exit distinguish only between acquisitions and VC-backed IPOs, with the ratio of the former to the latter running at around three-to-one. EVCA divestment data for VC only are available from 2007. These are not fully comparable to the aggregate PE data displayed in Table 4.5 because they are by 'country of destination' referring to divestment in the country where the portfolio firm is located rather than where the VC fund is located. Patterns are similar in both cases.

Table 4.5 Mode of Exit for Private Equity (Average Annual Percentage)

	Ireland		Europe	
	1998-2003	**2004-2010**	**1998-2003**	**2004-2010**
Trade Sales	46	42	35	26
Divestment by public offering	7	4	15	11
• Divestment on flotation (IPO)	1	0	6	5
• Sale of quoted equity	7	4	8	6
Write-offs	18	26	14	12
Repayment of principal loans	11	4	13	13
Sale to another private equity house	5	8	8	22
Sale to a financial institution	0	1	5	4
Other modes	12	14	10	13

Source: EVCA.
Note: This level of disaggregation is not available prior to 1998. These data are not available for VC funds separately prior to 2007.

[147] The EVCA divestment data are not disaggregated by type of fund so the figures given here apply to all PE. The level of detail shown here was not available for years prior to 1998.

Table 4.6 shows that the most popular exit mode in Ireland and Europe was again trade sales, more popular in Ireland than in Europe as a whole. Write-offs were also more common, and IPOs less common, in Ireland than in Europe overall.

Table 4.6 Mode of Exit for VC in Portfolio Firms (Average Annual Percentage)

	Ireland	Europe
	2007-2010	2007-2010
Trade Sales	45	35
Divestment by public offering	2	15
• Divestment on flotation (IPO)	2	3
• Sale of quoted equity	0	11
Write-offs	25	15
Repayment of principal loans	2	5
Sale to another private equity house	15	12
Sale to a financial institution	5	3
Other modes	6	16

Source: EVCA.
Note: These data are only available for VC investments separately from 2007. Data are by country of portfolio firm.

Sources of funds also differ between Europe and the US. Table 4.7 compares the sources of funds in these markets with the Irish market. The analysis is limited because of the different breakdowns available in the data between the EVCA and the NVCA. Fundraising data are only available for aggregate PE for Europe but for VC for the US so Table 4.7 does not quite compare like with like. Given this caveat, it can be seen that institutional investors have been much more important as sources of funds in Europe than in the US. The data show a similar pattern to that found in the literature with financial institutions, mostly banks, dominating PE funds in Europe, which has been suggested as a sign of the immaturity of the European market compared to the US.

Table 4.7 Sources of PE New Funds (Europe and Ireland); Sources of VC New Funds (US) (Average Annual Percentage by Type of Investor)

		1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
Corporations	Europe	8	11	6	5	3
	Ireland	5	5	2	0	1
	US	6	5	6	5	2
Financial Institutions	Europe	51	40	36	29	19
	Ireland	46	28	18	22	16
	US	11	11	9	8	5

Source: Own calculations based on EVCA and NVCA data, exchange rates from Eurostat.
Note: Figures do not sum to 100 because some categories of investor (particularly private investors and pension funds) are excluded.

The sectoral breakdown of investments has changed over time. Sectorally disaggregated EVCA data are available only for aggregate PE investments made by locally-managed funds for the whole 1990-2010 period. The sectoral breakdown of investments by Irish managed PE funds is shown in Table 4.8.

Table 4.8 Sectoral Distribution of PE Investments by Irish PE Houses
(Average Annual Percentage, 1990-2010)

Sector	1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
Communications	7.8	15.9	14.3	16.2	21.9
Computer and consumer electronics	13.3	51.4	72.5	49.8	20.9
Life sciences	4.4	3.4	6.5	18.0	20.6
Energy and environment	0.6	0.2	0.4	0	4.2
Consumer goods and retail	36.5	3.4	1.0	10.5	4.4
Consumer services	na	na	na	na	3.7
Business and industrial products	15.5	15.4	3.0	2.2	4.4
Business and industrial services	5.4	5.5	1.9	0.7	1.3
Chemicals and materials	3.0	0.3	0.1	2.3	0.3
Transportation	4.8	0	0.2	0	7.8
Financial services	0.4	0	0.1	0	0.1
Real estate	na	na	na	na	0.0
Agriculture	1.3	1.1	0.0	0.0	0.2
Construction	5.2	1.6	0.0	0.0	3.0
Unknown	0.2	1.7	0.1	0.2	7.1

Source: Own calculations based on EVCA data.
Note: EVCA sectoral classifications changed in 2007, prior to this 'Consumer Services' and 'Real Estate' did not exist as separate categories.

While at the beginning of the 1990s Irish PE investment activity was directed towards more traditional consumer related and other manufacturing sectors, towards the late 1990s it began to focus on 'new technology' (i.e. on communications, and computer and consumer electronics) with life sciences becoming important over the new millennium. The later years suggest a greater diversification. This may be a sign of greater maturity, and more long-term stability in the sector, as diversification may balance out lower but more stable returns in some sectors with higher but more volatile returns in other sectors (Mulcahy, 2005).

Table 4.9 Sectoral Distribution of VC Investments into Irish Industry
(Annual Percentage 2007-2010)

Sector	2007	2008	2009	2010	Average 2007-2010
Communications	31.0	11.8	32.9	36.6	28.1
Computer and consumer electronics	50.2	29.2	28.8	34.6	35.7
Life Sciences	12.6	4.0	29.6	24.8	17.7
Energy and environment	1.3	0.4	0	1.8	0.9
Consumer goods and retail	1.2	0.1	0	0	0
Consumer services (other)	0.1	0.8	6.7	1.2	2.2
Business and industrial products	0.0	1.0	0.8	0.3	0.5
Business and industrial services	3.5	10.8	0.7	0.3	3.8
Chemicals and materials	0.1	0.2	0.5	0.4	0.3
Transportation	0	0.5	0	0	0
Financial services	0	41.0	0	0	10.3
Real estate	0	0	0	0	0
Agriculture	0.1	0.3	0	0	0.1
Construction	0	0	0	0	0
Unknown	0	0	0	0	0
Subtotal high-tech	81.9	28.7	81.8	80.6	68.3

Source: EVCA

Table 4.9 shows VC in Irish industry for 2007-2010 is concentrated mainly in the communications, computer and consumer electronics, and life sciences sectors in line with

the findings for the aggregate PE investments by Irish-managed funds shown in Table 4.8 above.

On average over the 2007-2010 the shares of VC received by firms in the communications, and computer and consumer electronics sectors are larger than the shares of investments made by Irish-managed PE funds in these sectors. In contrast, firms in the life sciences sector received a smaller share of VC investment. There are two possible explanations for these discrepancies. Cross-border investment is one possibility with inflows of funds into the communications and computer and consumer electronics sectors and outflows in the life sciences sector. However, comparison of the aggregate PE data for investments made by Irish-managed PE funds and the aggregate PE invested in Irish enterprises over 2007-2010 shows that firms in each of these sectors received investment far exceeding the value of investments made by Irish managed funds in each of these years suggesting very substantial inflows of overseas investment in all the three sectors.[148] An alternative explanation is the differential between VC and aggregate PE which is chiefly composed of buy-outs. To get a further insight into this, Table 4.10 shows that on average over the 2007-2010 period VC accounted for just over 60 per cent of total PE received by Irish firms in the communications and computer and consumer electronics sectors compared with only 22 per cent by the life sciences sector which includes pharmaceuticals, medical devices, and biotechnology.

Table 4.10 VC Shares of PE Investment into Irish Industry (Annual Percentage)
(Selected Sectors 2007-2010)

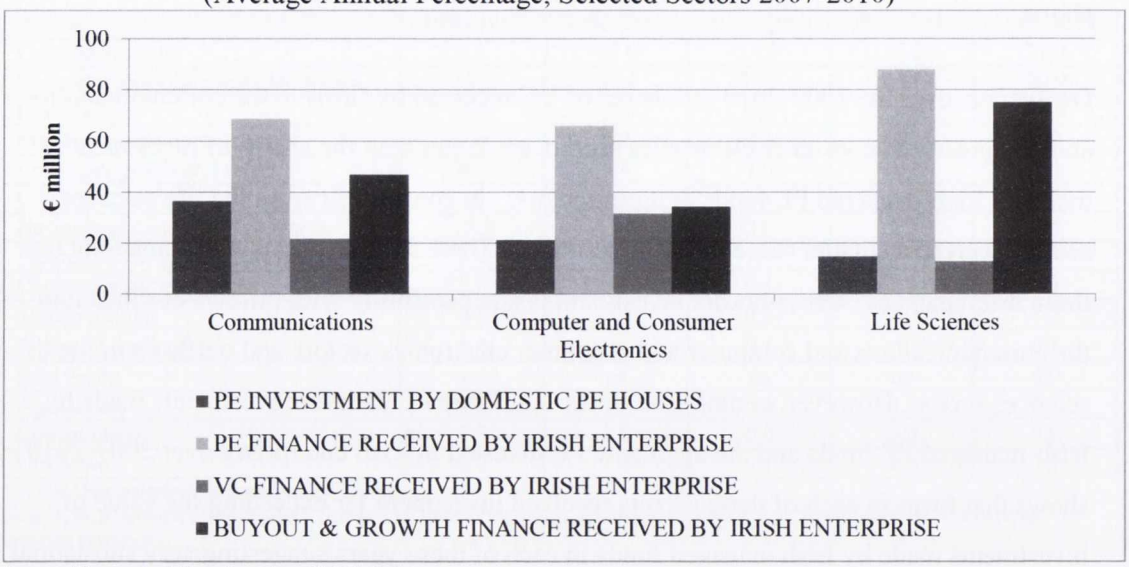
Sector	2007	2008	2009	2010	Average 2007-2010
Communications	**13.5**	**91.3**	**87.5**	**54.2**	**61.6**
Computer and consumer electronics	**38.1**	**96.7**	**97.7**	**18.7**	**62.8**
Life sciences	**8.3**	**26.1**	**46.1**	**7.4**	**22.0**
Consumer goods and retail	2.3	100	0	0	25.6
Consumer services (other)	0.7	14.9	4.7	100	30.1
Business and industrial products	0	12.9	100	100	53.2
Business and industrial services	100	28.8	3.8	100	58.2

Source: Own calculations based on EVCA data
Note: The sectors highlighted in bold are those that received the largest shares of VC investment in Irish portfolio firms.

An examination of the EVCA sectoral data for buy-out and growth financing shows that this was particularly substantial in the life sciences sector. Figure 4.7 shows that aggregate PE financing received by Irish firms is many multiples of that invested by domestic PE houses in all three sectors.

[148] In 2010, for example, the values of PE investment into firms in the communications sector was three times that made by Irish PE houses (€30m compared to €10m) compared to multiples of 9 times in the computer and consumer electronics sector (€81m to €9m) and more than 11 times in the life sciences sector (€146m compared to €13m). The explanation for the discrepancy in the life sciences sector therefore does not appear to be outward investment.

Figure 4.7 Comparison of Investment by Domestic PE Houses and into Irish Industry (Average Annual Percentage, Selected Sectors 2007-2010)



Source: Own calculations based on EVCA data.
Note: The EVCA data group buyouts and growth finance together in the sectoral breakdowns.

In the computer and consumer electronics sector VC investment exceeds aggregate PE investment by Irish-managed funds indicating an inflow of VC in this sector over the four years. However, the other sectors show substantial buy-out financing. The volatility of buy-out finance may be a factor here. Buy-out and growth finance were very substantial for portfolio firms in the communications sector in 2007 and in life sciences sector in both 2007 and 2010 with amounts much lower in other years.[149] Even so, on average VC investment in the life sciences was at a similar level to PE investments made by domestically-managed funds.

Overall in Europe, on the other hand, although there was some shift towards communications over the new millennium, more traditional sectors (such as consumer goods and retail, and business and industrial products) remained relatively strong throughout the period of analysis, as seen in Table 4.11.

[149] 2007 and 2010 also saw higher levels of buy-outs in the computer and consumer electronics sector compared to the intervening years, although these were not spectacular.

Table 4.11 Sectoral Distribution of PE Investments by European PE Houses
(Average Annual Percentage, 1990-2010)

Sector	1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
Communications	3.3	11.3	13.3	14.2	12.4
Computer and consumer electronics	9.5	14.1	10.2	7.7	7.2
Life sciences	6.1	8.2	9.9	9.8	12.4
Energy and environment	1.5	1.0	1.7	2.0	5.9
Consumer goods and retail	21.2	17.4	18.9	22.0	14.8
Consumer services	na	na	na	na	8.2
Business and industrial products	24.3	19.0	18.7	15.6	12.1
Business and industrial services	10.6	7.9	8.0	11.5	9.3
Chemicals and materials	3.6	3.6	4.0	2.5	3.5
Transportation	5.4	5.5	3.4	2.5	3.8
Financial services	4.3	2.2	2.9	3.6	6.0
Real estate	na	na	na	na	0.3
Agriculture	1.5	0.9	0.5	0.3	0.6
Construction	4.1	2.2	3.8	2.5	2.9
Unknown	4.4	6.7	4.8	5.8	0.6

Source: Own calculations based on EVCA data
Note: EVCA sectoral classifications changed in 2007, prior to this 'consumer services' and 'real estate' did not exist as separate categories. High-tech sub-total is only available from 2007 so has not been included here.

Again, the sectoral breakdown for VC investments in European firms is available for 2007-2010 and these figures are shown in Table 4.12. This shows a different picture with the life sciences sector the largest recipient of VC in Europe overall, ahead of the communications and computer and consumer electronics that are so important in the Irish context. The energy and environment sector also received a high level of VC in Europe with a 12.3 per cent share on average over the four years compared to less than one per cent in Ireland. These four sectors accounted for greater shares of VC investment into European industry than of aggregate PE invested by European-managed funds. This shows a greater concentration of VC in these sectors.

Table 4.12 Sectoral Distribution of VC Investments into European Industry
(Annual Percentage, 2007-2010)

Sector	2007	2008	2009	2010	Average 2007-2010
Communications	14.8	16.4	17.3	15.0	15.9
Computer and consumer electronics	21.0	17.7	18.4	20.3	19.4
Life sciences	25.0	21.1	28.1	30.0	26.0
Energy and environment	9.7	16.8	12.0	10.7	12.3
Consumer goods and retail	4.9	6.0	5.3	4.1	5.1
Consumer services: other	4.2	3.0	3.1	2.7	3.2
Business and industrial products	7.0	5.9	7.3	7.3	6.9
Business and industrial services	2.9	4.5	2.8	3.5	3.4
Chemicals and materials	1.6	1.4	1.9	2.5	1.9
Transportation	1.3	1.1	0.6	1.1	1.0
Financial services	2.5	2.9	0.9	1.1	1.9
Real estate	1.2	0.7	0.2	0.3	0.6
Agriculture	0.5	0.7	0.5	0.4	0.5
Construction	0.8	1.0	0.3	0.7	0.7
Unknown	2.7	0.7	1.3	0.1	1.2
Subtotal high-tech	42.1	35.8	44.5	47.2	42.4

Source: Own calculations based on EVCA data

In Table 4.13 we can see that across the Atlantic, VC investments also focus on new technology sectors, although they are more evenly distributed across these sectors. The biotechnology and medical devices and equipment sectors combined are equivalent to life sciences in the EVCA data. Software, an important industry in the context of Irish VC, is also very important for VC in the US, accounting for about one-fifth of VC investment. As in Europe, energy is an important sector in the US which is not the case for Ireland.

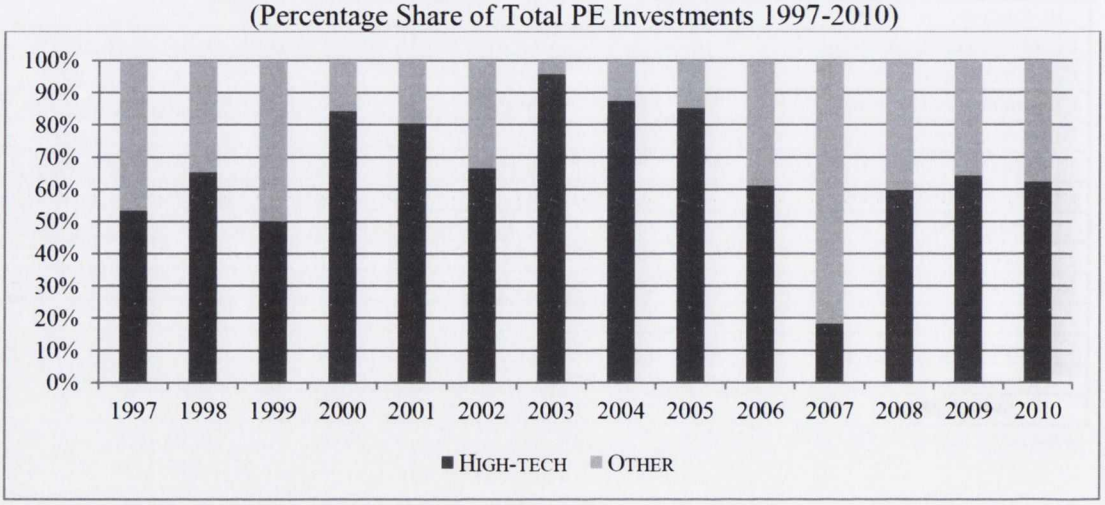
Table 4.13 Sectoral Distribution of VC Investments in the US
(Average Annual Percentage 1990-2010)

Sector	1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
Biotechnology	12.2	5.1	14.4	17.6	17.4
Business products and services	2.3	4.4	2.7	1.7	1.7
Computers and peripherals	5.2	1.7	1.9	2.3	2.0
Consumer products and services	4.8	3.6	1.1	1.4	1.8
Electronics/Instrumentation	2.0	0.8	1.1	2.0	1.9
Financial services	2.6	3.9	2.3	2.6	2.1
Healthcare services	4.7	2.7	1.4	1.6	0.9
Industrial/Energy	6.7	4.3	3.3	4.9	13.9
IT services	2.4	7.2	4.8	4.5	6.7
Media and entertainment	6.7	10.5	4.5	5.2	6.5
Medical devices and equipment	10.1	3.5	7.1	9.5	12.2
Networking and equipment	7.2	9.1	11.9	6.1	3.9
Semiconductors	3.7	3.0	7.5	8.7	5.2
Software	18.4	21.6	24.8	21.6	18.2
Telecommunications	8.2	14.7	10.5	9.2	4.7
Undisclosed/Other	0.3	0.2	0.0	0.1	0.0
Total	100.0	100.0	100.0	100.0	100.0

Source: Own calculations based on NVCA data

Although investments in high-tech sectors frequently involve investments in high-tech projects, there is no necessary overlap between the two categories. Account must be taken of the quality and type of the specific investments involved. The EVCA began to record investments in high-tech projects from 1997 and Figure 4.8 presents data on Irish PE investments in such projects for the period 1997-2010.

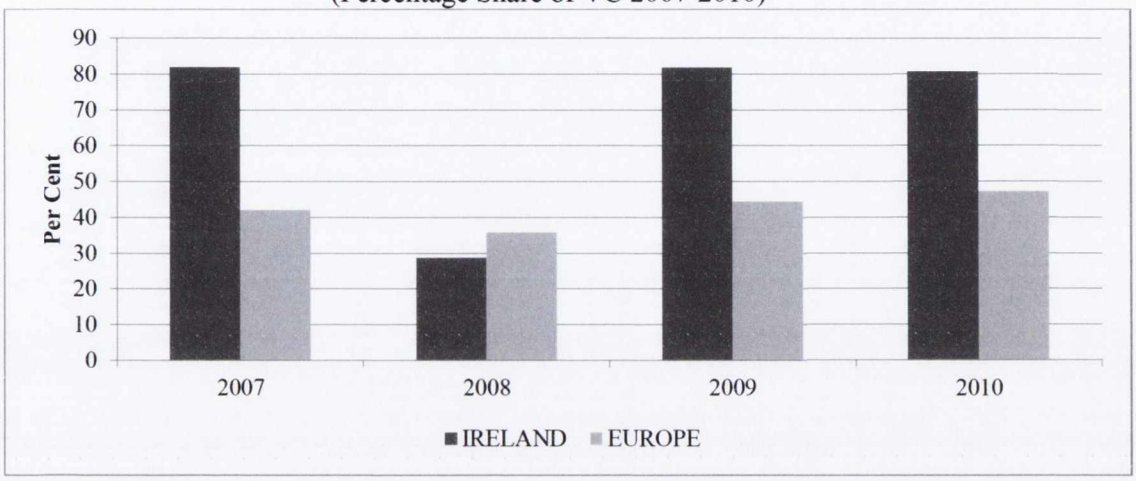
Figure 4.8 PE Investments in High-Tech Projects in Ireland
(Percentage Share of Total PE Investments 1997-2010)



Source: EVCA data

Similar data are available for VC separately from 2007 and Figure 4.9 compares these between Ireland and Europe. The share of VC investment in high-tech projects in Ireland is approximately 80 per cent and substantially larger than the share for Europe as a whole in three of these years, 2008 being the exception.

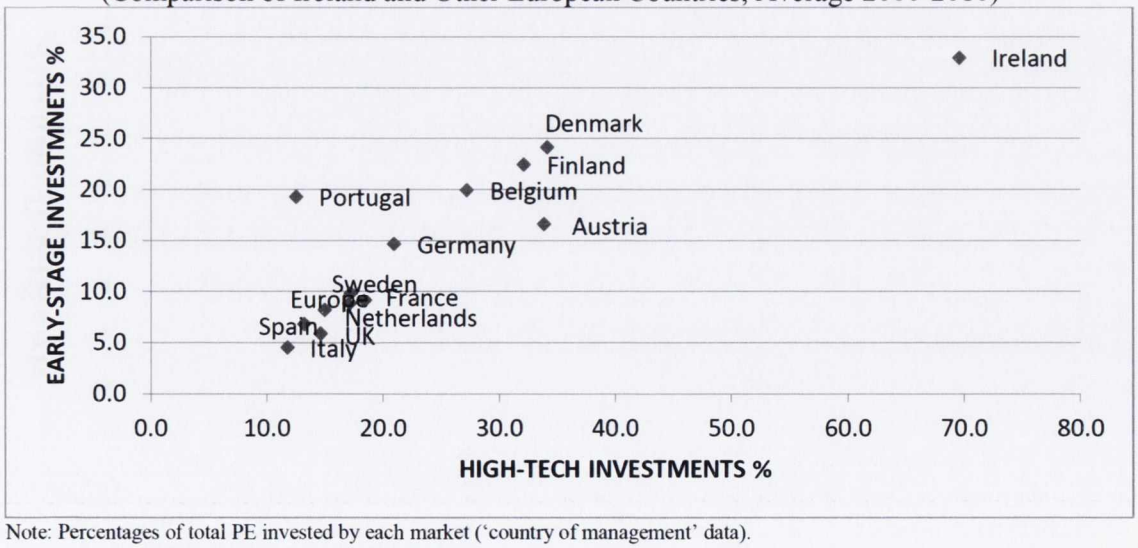
Figure 4.9 VC Investments in High-Tech Projects in Ireland and Europe
(Percentage Share of VC 2007-2010)



Source: EVCA data

Figure 4.10 charts various national PE markets in terms of the shares of PE investments by locally managed funds in early-stage and in high-tech projects. Of the European countries for which data are available, Ireland appears to be something of an outlier, with high proportions of both early-stage investments and high-tech investments in the total.

Figure 4.10 Early-Stage and High-Tech Private Equity Investments
(Comparison of Ireland and Other European Countries, Average 2000-2010)

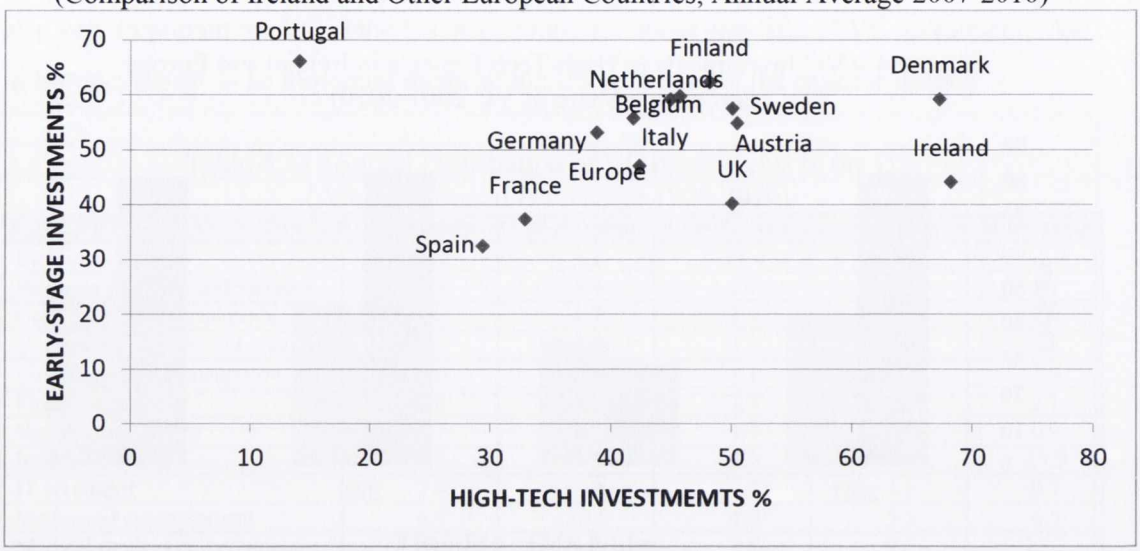


Note: Percentages of total PE invested by each market ('country of management' data).
Source: Own calculations on the basis of EVCA data.

Ireland's outlier status in Figure 4.10 is largely due to the high share of VC in PE investments made by Irish managed funds. A similar comparison for VC investment is

possible only for the period 2007-2010 and on a 'country of destination' basis showing investments received by portfolio firms within the country.

Figure 4.11 Early-Stage and High-Tech VC Investments
(Comparison of Ireland and Other European Countries, Annual Average 2007-2010)



Note: Percentages of total amounts invested by each market ('country of destination' data).
Source: Own calculations on the basis of EVCA data

Figure 4.11 shows that many countries have high shares of VC in high-tech sectors and in early-stage investments. Ireland and Denmark stand out as having the highest shares of high-tech VC investment activity.

4.4.2 Government Policy and Venture Capital in Ireland

Since 1990 government provision of VC funds grew in Europe as a whole, although it has typically contributed a smaller share than in Ireland since the initiatives of the mid-1990s, and the contrast has grown dramatically in recent years as shown in Table 4.14. Unfortunately the EVCA only produce these data for aggregate PE managed by local PE houses so only give some indication of the relative importance of the various sources of funding for VC itself. In the US the government plays no direct role in the provision of VC, as the Small Business Investment Companies (SBICs) are not considered to be VC (Bottazzi and da Rin, 2002).

Table 4.14 Government as Source of PE New Funds: Europe and Ireland
(Average Annual Percentage)

	1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
Europe	5	5	8	8	6
Ireland	9	9	18	10	34

Source: Own calculations based on EVCA data.

Table 4.15 shows that of the European countries for which data are available, PE funds located in Portugal, Finland, and Ireland record the highest shares for government as a source of new PE funds over the full 1990-2010 period, well above the European average.

Table 4.15 Sources of PE New Funds for European Economies
(Average Annual Percentage by Type of Investor, 1990-2010)

	Corporations	Private Individuals	Financial Institutions	Pension Funds	Government Agencies
Austria	6	4	44	2	14
Belgium	9	9	39	5	13
Denmark	6	7	27	28	8
Finland	26	1	37	21	16
France	8	7	51	10	3
Germany	8	8	52	5	10
Ireland	3	16	30	14	15
Italy	8	9	51	6	5
Netherlands	5	5	56	15	2
Portugal	8	1	54	3	27
Spain	10	6	42	8	14
Sweden	9	3	22	21	9
UK	5	4	30	34	4
Europe	7	6	38	22	6

Source: Own calculations based on EVCA data
Note: Country figures do not sum to 100 because some categories of investor are omitted

This differential may be partially attributed to the greater share of VC in aggregate PE in each of these countries (over 60 per cent in the case of Portugal and Finland and almost 80 per cent in Ireland), given that governments are more likely to be supporting VC than other forms of PE. The VC sector is much smaller in the Portuguese economy compared with Ireland or Finland as we saw in Figure 4.5.

It is noteworthy that for all the economies where government agencies provided at least 10 per cent of the PE funds raised by local PE houses, VC constituted more than 50 per cent of the total PE invested by local PE houses, in other words VC is important in these economies compared with later-stage PE (see Figure 4.2). The only exception is Denmark. As discussed in the literature review, indirect supply-side measures include issuing guidelines and legislation to facilitate certain categories of investors. Table 4.15 also shows that the relative importance of pension funds as investors in PE funds varies across countries. This was very low in Ireland prior to 1994 when the government intervened to boost this source by publishing guidelines for the pensions industry, as discussed earlier. Although Mulcahy (2005:11) argues that by 2001 pension funds had "essentially ceased investing in the Irish venture capital industry", the proportion of new funds accounted for by the pensions sector in Ireland is found here to have fluctuated around the European average level, with 15.2 per

cent of funds raised by the Irish PE industry coming from pension funds, compared with a European average of 12.1 per cent in 2010.

Looking now in more detail at state involvement in the Irish VC market, the industrial development agencies adopted new policies towards VC from 1994. One strand of the new approach, on the supply-side, was expanding the availability of VC by investing state capital, through EI, in commercial VC funds. The 'Indigenous Industry Operational Programme for Industrial Development', a sub-section of the *National Development Plan 1994-99*, had identified as important the difficulties that SMEs faced in raising equity capital. This led to the establishment by EI of the 'Seed and Venture Capital Measure 1994-1999', which had the objectives of (i) making seed and equity capital available to SMEs, primarily in the knowledge economy; (ii) developing the seed and VC market in Ireland; (iii) encouraging private sector participation; and (iv) developing seed and VC management skills. EU and national funding of this measure amounted to a total of €40 million and this was matched at the beginning by a further €40 million in private investments. The VC funds established were run on a purely commercial basis, with investment decisions taken solely by private-sector VC fund managers. Returns were to be fed back into the funds and a 10-year lifecycle was envisaged, with a five year investment period and five years in which to exit and realise returns. In 2000 EI identified potentially high-growth sectors (informatics, digital media, eBusiness, and health sciences) for the development of indigenous industry, and set sales, employment, and export targets up to 2007. In 2001, the 'Seed and Venture Capital Fund Scheme' was recommenced under the *National Development Plan 2001-2006* with a commitment of national and EU funds amounting to €95 million. The objective of the programme was to leverage €400 million in private funding. This had already been achieved by 2002 and by 2004 the 15 funds established under the programme (with about €500 million in capital raised) had made investments in 75 firms totalling €133 million (Enterprise Ireland, 2005). By 2005 the state commitment to 30 VC funds had totalled €164 million (€66 million in total in the first programme and €98 million in the second), and about €30 million in returns had been received. The 2000-2006 programme was followed by a further 'Seed and Venture Capital Programme' from 2007 to 2012, with an EI commitment of €175 million.[150]

On the demand-side of the VC market, another strand of the new approach of Irish policy from 1994 saw state agencies shift away from grant assistance towards equity participation in companies to which they advanced support. This had been advocated in the report of the Industrial Policy Review Group (1992:6), known as the *Culliton Report,* "to meet gaps in

[150] Subsequently, the 'Seed and Venture Capital Scheme 2013-2018' was established.

financial markets for venture capital and seed capital". The *Culliton Report* identified seed funding in particular as being in short supply. The Industrial Development Authority (IDA), it was suggested, should become more of an 'aggressive venture capitalist' and should be prepared to take stakes of up to 50-60 per cent in the companies it supported. To fulfil these tasks adequately, the report advised that the IDA should be restructured into separate bodies, which eventually emerged as Forfás, with responsibility for research and policy, IDA Ireland with responsibility for FDI, and Enterprise Ireland with responsibility for indigenous industry. Supports to the demand side are a multiple of the supports to the supply side of the VC market discussed heretofore. The Irish state offers direct 'hands-on support' to the types of firms for which VC is an appropriate financing vehicle. Another form of such direct support is equity participation. Following the recommendation of the *Culliton Report*, equity participation – in the form of both ordinary shareholdings and preference shares – on the part of what would become Enterprise Ireland increased from five per cent of total financial supports in 1989 to 28 per cent in 1998 (Forfás, 2000, Table 5.2).[151] Table 4.16 shows that EI direct equity participation in the companies it supports exceeds the sum total of funds provided by EI to private-sector VC managers to support companies of their own choosing.[152] This reflects the fact that EI, as a development agency, has different motives from those of the VC funds which seek only to maximise direct returns. The priority for the state agencies has been to develop knowledge-based industries in Ireland because of possible spill-over benefits and other market imperfections rather than to achieve the best direct return on their investments.

Table 4.16 Enterprise Ireland Investments: Direct versus Seed and Venture Capital (€million)
(Four-Year Totals, 1999-2010)

	1999-2002	2003-2006	2007-2010
Direct EI investments	83.90	95.00	172.84
EI Seed and Venture Capital Investments	91.62	46.68	51.65

Source: Enterprise Ireland Financial Statements 2000-2010

Most EI support is targeted towards the very small number of indigenous companies identified as HPSUs. Of the hundreds of thousands of new business start- ups over the period 1989 to 2006, only 637 were selected by EI as HPSUs. Loosely, these were export-oriented firms with innovative products in dynamic market segments, deemed capable of meeting rigorous growth targets.[153] To be deemed eligible for support (though with no

[151]Preference shares with a low coupon rate are used to provide a form of long term finance at low cost to SMEs that are unable to raise development finance from the market on similar terms.

[152] The EI Seed and Venture Capital Investments reported in the table amount to €131.17 for the period 2000-2006. This exceeds the €98 million reported by the *2006 Seed and Venture Capital Programme Report* as EI funds committed for the period. The latter appears to refer to new funds earmarked from the EI budget while the former includes profits, possibly from previous programmes, ploughed back into the current programme.

[153]Companies in software and ICT comprised almost half of these HPSUs, particularly since 1994, while in more recent years there has been a growth in the share represented by the pharmaceuticals and medical devices sectors (O'Brien, 2008).

automatic entitlement), projects must first successfully pass a formal cost-benefit analysis, while qualitative and other factors that are difficult to quantify are then taken into account in a Quality Ranking Matrix.[154] EI has in fact worked with the majority of these HPSUs from embryonic concept stage to the point where they were formally recognised as HPSUs. Supports available from the embryonic stage are dependent on agreement with the agency on an integrated development plan and the agency then customises a support package that can include helping companies to monitor markets and exploit new market opportunities, encouraging process and operations improvement and the development of better products through access to appropriate research, and promoting increased management and employee training levels. EI works intensively with the HPSUs to ensure access to the best external management advice; it helps them to attract expertise to their boards (through appointment of experienced non-executive directors, for example) and to build an appropriate management team; it provides support for in-company training and for product and process development through direct support for in-company R&D and through establishing technology innovation networks; and it helps them develop contacts with private-sector financiers. It may also, where necessary, offer direct financial support (Forfás, 2000). Ó Riain (2004) suggests that the mentoring programmes that pair small companies with experienced industry figures and the 'Enterprise Development Programme' that provides one-on-one support and advice in terms of business plan development have been of particular importance to indigenous software firms and indeed, according to Walsh (1985), the latter had been instituted in 1978 partly in response to the lack of VC finance available at that time. The state has also extensively subsidised the R&D expenditures of indigenous software companies.

The Irish experience corresponds in broad detail to that of Israel. Table 4.17 shows that Irish gross expenditures on R&D have risen as a share of both the EU and the OECD over the period under discussion, suggestive of the spread of innovation capabilities representing Phase 1 of the Avnimelech and Teubal model, discussed earlier.

Table 4.17 Gross Domestic Expenditure on R&D in Ireland
(Share of EU27 and OECD, 1995-2009)

	1995-1997	1998-2000	2001-2003	2004-2006	2007-2009
Ireland as share of EU27	0.63	0.68	0.71	0.87	0.97
Ireland as share of OECD	0.19	0.20	0.22	0.26	0.29

Source: OECD, Main Science and Technology Indicators database

[154]The focus of the development agencies on export development has been criticised in some quarters as overly mercantilist. It has been pointed out in defence however that non-traded-sector firms are likely to be competing largely with each other, which would put the state in a vulnerable position were it to support some and not others. In the case of software, the strong focus of the relevant agency has always been on software-product firms, which tend to be much more export-oriented than software services. (Ó Riain 2004)

In Ireland, as in Israel, there was substantial government support of business sector R&D and innovative start-up companies. Table 4.18 provides a measure of the Irish state's increased participation in the funding of R&D. While the share of R&D financed by government has declined in both the EU and the OECD over the period depicted, it increased in Ireland.

Table 4.18 Percentage of Gross Domestic Expenditure on R&D Financed by Government (Ireland, EU27 and OECD)

	1995	2003	2004	2005	2006
Ireland	22.5	29.8	31.1	32	30.1
EU27	39.5	35.8	35.6	34.8	34.1
OECD	33.9	30.1	30.2	29.4	28.6

Source: OECD, Main Science and Technology Indicators database
Note: missing observations confine our analysis to the years shown.

Although state support has helped the indigenous software industry develop, this did not commence until after a few firms had already been successful (Breznitz, 2012). This was similar to the Israeli experience. Avnimelech and Teubal (2006) argue that the background conditions in Israel would have been unlikely to trigger the necessary supply of VC without government involvement because of market or system failures. This proposition would seem to apply in the Irish case also. In contrast, governments elsewhere have tried to develop a VC *ab initio*, with varying degrees of success (for further discussion see Lerner, 2009). The National Software Directorate had been established within the IDA in 1991 but became one of the main drivers of high-tech-oriented VC industry in the latter part of the 1990s (Breznitz, 2012). There was rapid growth of indigenous software from 1995, with the state involved as a regular partner, but this was followed by stagnation in early 2000s following the dot-com collapse (Breznitz, 2012).

Irish government policy aims to build a self-sustaining VC sector, this task is clearly not straightforward. The weaker the standards of public-sector governance, the greater the fear of 'government failures' should outweigh the desire to correct market failures. An excessive focus on supply-side supports has been criticised (Mason and Harrison, 2003; Avnimelech et al, 2005) while others have argued that demand-side policies are the most effective (Harrison, 2002). The availability of VC finance does little to create the investment opportunities but develops and grows them, although seed funding is critical. However, supply-side measures are more straightforward than demand-side measures to implement. Demand-side policies, in particular innovation policy and the development of an entrepreneurial culture, are more 'slow-burning'. There is also the risk of policy being affected by election cycles and therefore it is more ideally designed and implemented at arm's-length from government in a separate agency such as EI. The requirement that both

demand-side and supply-side deficiencies are addressed is a common theme in the literature. This research finds that, in Ireland, state support to the demand-side has been a multiple of state support to the supply side of the market. The next sub-section demonstrates that Ireland is a substantial net recipient of foreign PE investment (data limitations prevent an analysis of VC itself). Internationalisation of VC reduces the relative importance of the domestic supply-side and increases the relative importance of the demand-side in terms of "creativity, innovation, risk-taking and entrepreneurship" (Baygan and Freudenberg, 2000:7). Foreign capital is thus providing the supply of funds with EI able to devote its attention and finance to the demand-side of the VC market i.e. dealing with the recipient firms themselves. Another factor may be a bias towards demand-side measures resulting from a long tradition of Irish state agencies providing direct support to industry. Breznitz (2007:177) argues that EI sees VC as "a missing pool of finance and not as a separate industry with specific capabilities to be developed". Breznitz (2007) also claims that the Irish state chose policies that specifically limited its direct intervention in the market resulting, in some cases, in EI staff being involved in the funding selection process while also sitting on boards both of the candidate firms and of the VC funds at the same time.

However, as shown earlier, there remains a low level of seed funding and the state can play a key role in filling this particular equity gap which is so crucial for young high-tech firms. Breznitz (2007) is highly critical of the failure of both EI and the VC to seed fund new technology firms. He also hints at the risk of industry capture suggesting that the way EI finance packages were organised had more to do with lowering the risk to VC funds than helping the investees receive more capital (Breznitz, 2007).

Although Mulcahy (2005), writing from an industry perspective, suggests that there is no longer any rationale for government intervention, it appears too early to be able to say in the Irish case that the authorities can begin to take a back seat in the VC process.[155] However, the risk of capture by the VC industry needs to be carefully considered when making policy decision as its objectives differ to that of the state. An extensive review undertaken for the state agency Forfás in 2006 suggested not only that most Irish VC funds were below what would be regarded as a commercially viable size (of at least €40-€50 million) but also that the VC market in Ireland had not yet reached a point where it could be considered sustainable in its own right. Three reasons were offered for this assessment. Firstly, it is difficult to assess performance in such a relatively young market. Secondly, the downturn in

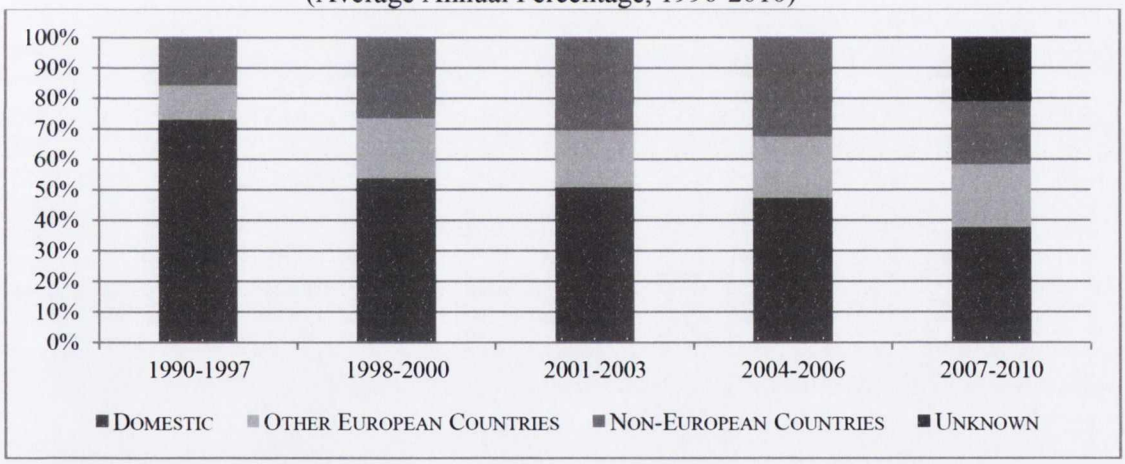
[155] Nor are the internal rates of return (IRR) data unambiguous. For the period 1994-2005 the EVCA has reported the average European IRR as 9.4 per cent, while the only available evidence for Ireland suggests an Irish IRR of 15.7 per cent (http://goliath.ecnext.com/coms2/gi_0199-6804294/Venture-capital-wanted-despite-the.html). It transpires however that this figure is based on the performance of only three particular funds and cannot be taken as representative.

the technology sector represented a serious obstacle. Thirdly, it was thought that state withdrawal of funds at this time would send a negative signal both to local institutional investors and to overseas investors, who tend to look to the local market for evidence of support for VC. This is in spite of the fact that Ireland had ranked second only to the UK in an evaluation by EVCA (2003) in terms of the favourability of the legal and tax aspects of the environment to VC investors and entrepreneurs.

4.4.3 Internationalisation of Venture Capital

As noted earlier, data are generally classified according to the 'country of management' approach i.e. they refer to locally managed funds only. PE funds which are managed in a particular country can be raised from both domestic and non-domestic investors however. Funding sources in both Europe and Ireland have become increasingly internationalised over the period of analysis. Due to data limitations discussed earlier, this analysis is only possible for aggregate PE and not VC itself.

Figure 4.12 Geographical Sources of Funds Raised by the European PE Industry (Average Annual Percentage, 1990-2010)

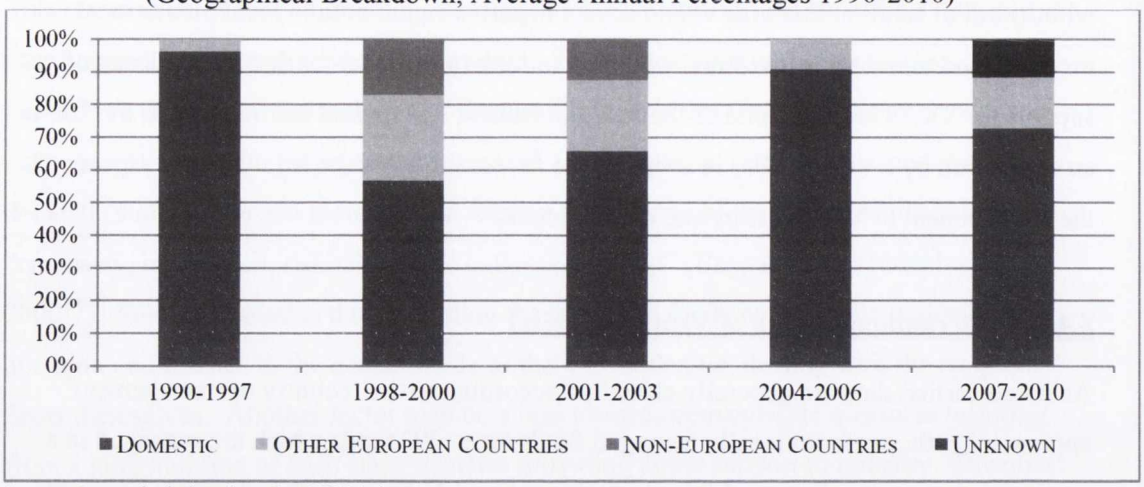


Source: Own calculations based on EVCA data

Figure 4.12 shows that for European countries on average, PE funds raised from non-domestic sources grew from less than one-third of the total in the early 1990s to over one-half of the total in more recent years.

It can be seen in Figure 4.13 that PE funds managed in Ireland displayed a much weaker degree of internationalisation, although the year 2002 stood out as exceptional, with more than 90 per cent of the capital raised that year coming from outside Ireland. These data suggest that Irish PE houses raise most funds in Ireland but as they are on a 'country of management' basis they give no information on the total funds raised in Ireland (i.e. including amounts raised by funds managed overseas).

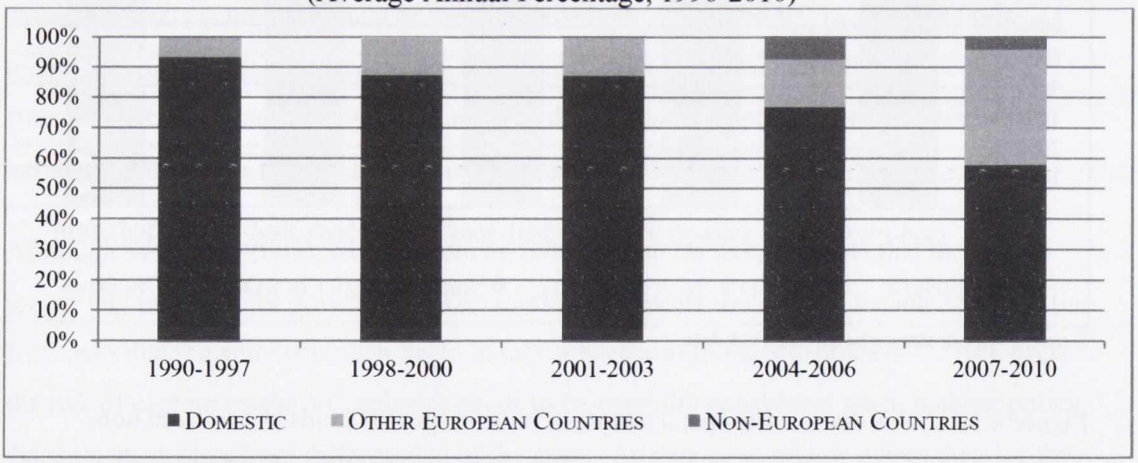
Figure 4.13 Geographical Sources of Funds Raised by the Irish PE Industry
(Geographical Breakdown, Average Annual Percentages 1990-2010)



Source: Own calculations based on EVCA data.

Figure 4.14 displays the propensity of European-managed funds to invest overseas. A substantial part is invested at home but overseas investment has been increasing over time, most of it to other European countries. As said earlier, this is 'Europeanisation' as opposed to 'internationalisation' *per se*. However, no link can be made from these data with the source of the funds being invested (i.e. they may have originated overseas).

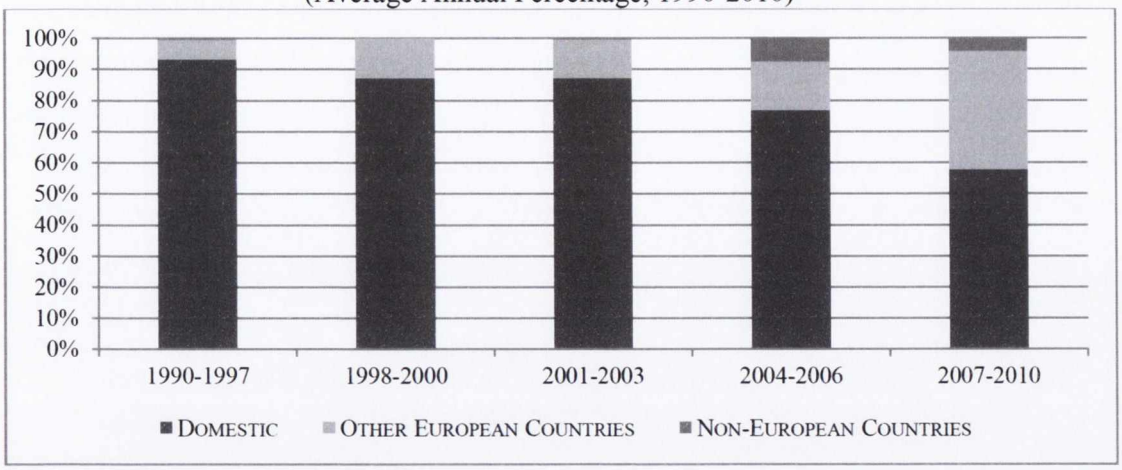
Figure 4.14 Geographical Destinations of Funds Invested by the European PE Industry
(Average Annual Percentage, 1990-2010)



Source: Own calculations based on EVCA data

Irish-managed PE funds have come to match this propensity to invest overseas over recent years, again investing mainly in other European countries, as can be seen in Figure 4.15.

Figure 4.15 Geographical Destinations of Funds Invested by the Irish PE Industry (Average Annual Percentage, 1990-2010)



Source: Own calculations based on EVCA data

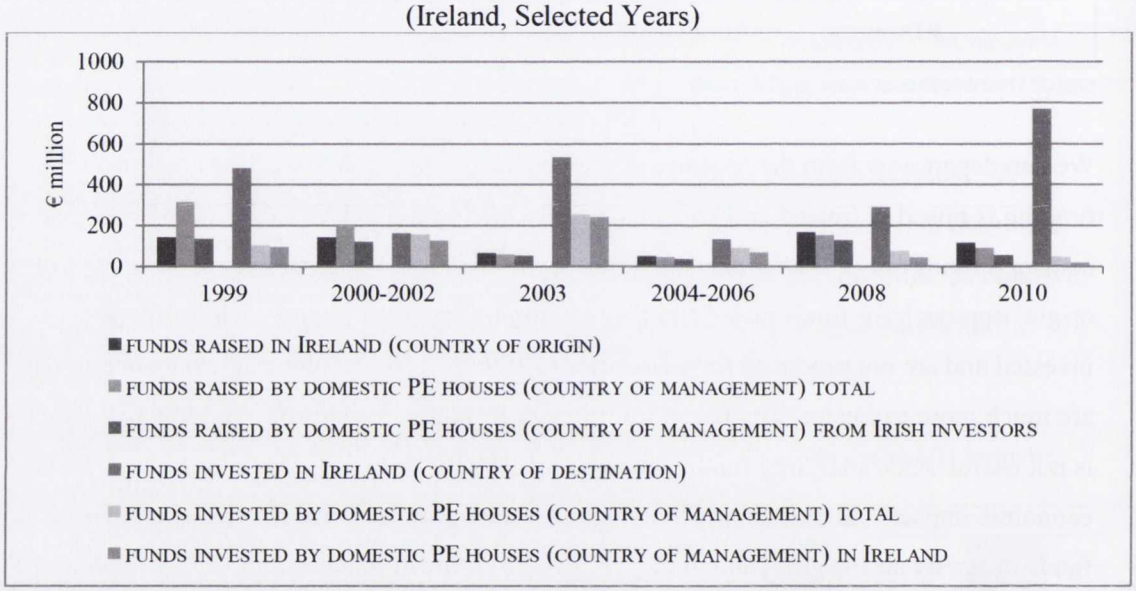
We can depart now from the 'country of management' approach to explore how much funding is raised in Ireland and how much is invested in Ireland (in each case by European-managed funds only). These data are described in the EVCA statistics as the 'country of origin' approach for funds raised and the 'country of destination' approach for funds invested and are not produced for years prior to 1999.[156] The 'country of management' data are much more extensive but present information from the PE industry's perspective which is not useful when analysing fundraising and investment from the viewpoint of their wider economic impact. As an example to explain the difference between the two approaches: funds raised by an Irish PE fund in the UK will be recorded under Ireland in the 'country of management' approach and under the UK in the 'country of origin' approach. Similarly, for funds invested, an Irish based PE fund invested in Germany will be recorded under Ireland by the 'country of management' approach but under Germany by the 'country of destination' approach. As most of these data are not disaggregated by funding stage in the EVCA data, this analysis is necessarily largely limited to looking at PE in its entirety. Data on funds raised are very limited while greater detail is available for investments. The EVCA provides some more detail on VC investments from 2007 and this is analysed later. Of course, as shown earlier in Figure 4.3, in most years the PE market in Ireland leans heavily towards VC so the limitations of this analysis should not be too serious in the Irish case.

Figure 4.16 presents data on all PE funds raised and invested in Ireland for the period 1999-2010, comparing 'country of management' and 'country of origin' for funds raised, and 'country of management' and 'country of destination' for investments. The major

[156]These statistics do not record funds raised or invested by VC funds managed outside Europe. They are only available from 1999 onwards.

asymmetries on the 'PE funds raised' side arise in 1999 and 2002.[157] In both of these years the amounts raised from foreign investors were larger than those raised from domestic investors. This indicates substantial net flows of PE funds raised. A similar situation can be observed on the investment side. In 1999, 2003, 2009, and 2010, much greater investments were made in domestic industry than came from domestically-managed PE funds. The greatest asymmetry arose in 2010, when investments in Ireland ('country of destination') were €770 million, while funds invested by Irish-managed funds were only €48 million.

Figure 4.16 Private Equity:
Country of Management, Country of Origin and Country of Destination Comparison
(Ireland, Selected Years)



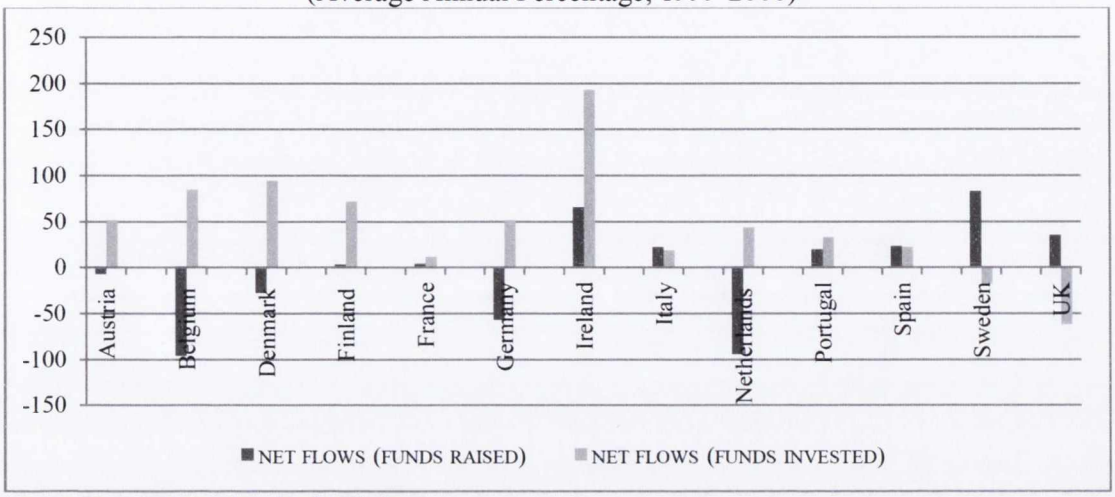
Note: Average annual values where years have been aggregated; Some of the data for 2007 and 2009 are unavailable.
Source: Own calculations based on EVCA data

A comparison with other countries reveals how internationalised or, more precisely, Europeanised the Irish PE market is compared to other European countries.[158] For the period 1999-2006, Ireland exhibited the greatest average net inflows for all European countries for funds invested and the second highest, after Sweden, for funds raised as can be seen in Figure 4.17. On average over the period, net inflows of PE investment into Ireland (i.e. the excess of foreign PE fund investments in Ireland over Irish PE fund investments overseas) came to almost 200 per cent of domestic investments by domestic PE funds.[159] In terms of the countries charted, all were net recipients of investment other than Sweden and the UK. For Ireland, net inflows of funds from abroad (i.e. the excess of overseas funds coming to domestic PE houses over funds raised in Ireland by foreign funds) represented, on average, 66 per cent of funds raised in Ireland by Irish PE houses. Net recipients of funds in

[157] Not all years are shown separately in the figure.
[158] As the data for comparing the 'country of management', 'country of origin' and 'country of destination' approaches are limited in regard to non-European countries, only flows to and from European countries can be taken into consideration in the analysis.
[159] Baygan and Freudenberg (2000) caution that VC flows, both funds raised and investments, are highly volatile, however.

this sense included Ireland, Italy, Portugal, Spain, Sweden, the UK, and to a lesser extent, France and Finland, whereas Belgium, Denmark, Germany, the Netherlands and, to a lesser extent, Austria, were net sources of funds.

Figure 4.17 Flows in PE Funds Raised and Invested, Ireland and Other European Countries (Average Annual Percentage, 1999-2006)



Source: Own calculations based on EVCA data
Note: Data for 2007 and 2009 unavailable.

The equivalent data for 2010 are as shown in Table 4.19. The percentage figure for net inflows of funds invested for Ireland is so large because funds invested from abroad came to €751 million, funds invested abroad by Irish investors came to €27 million, and domestic investment by domestic PE houses was only €19 million (in rounded figures). This illustrates that Ireland is a very substantial net recipient of PE from abroad.

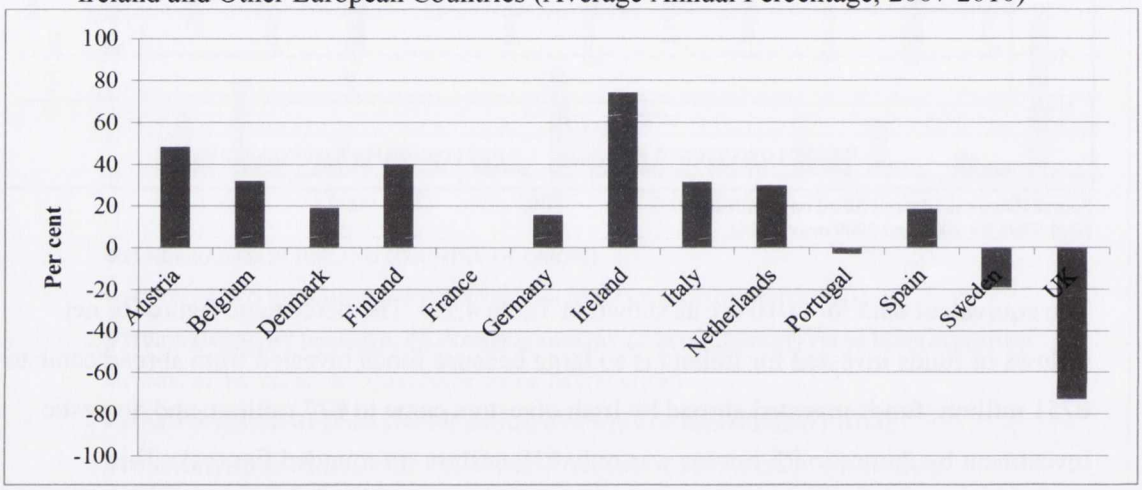
Table 4.19 Net PE Flows (Percentage) Raised and Invested (Ireland and Other European Countries, 2010)

	Net Flows (PE Funds Invested)	Net Flows (PE Funds Raised)
Austria	700	-8
Belgium	192	-6
Denmark	-1	-4
Finland	55	-44
France	14	18
Germany	1	-20
Ireland	3740	-44
Italy	53	-47
Netherlands	67	100
Portugal	-1	56
Spain	19	2
Sweden	-17	68
UK	-37	46
Europe	4	0

Source: Own calculations based on EVCA data

The above analysis refers to the PE industry as such and does not provide direct information for investments actually received by industry in the economy. Since 2007 the EVCA has provided more direct information on the geographic distribution of investments which facilitates the calculation of the investment received by portfolio firms both from domestic PE houses and from overseas. This is also only available for aggregate PE and gives both the amounts of investment overseas made by domestic PE houses and of inward investment from foreign PE houses. To obtain a picture of the importance of such flows, Figure 4.18 shows the net inflow of PE from abroad as a share of total PE invested in portfolio firms in the economy.

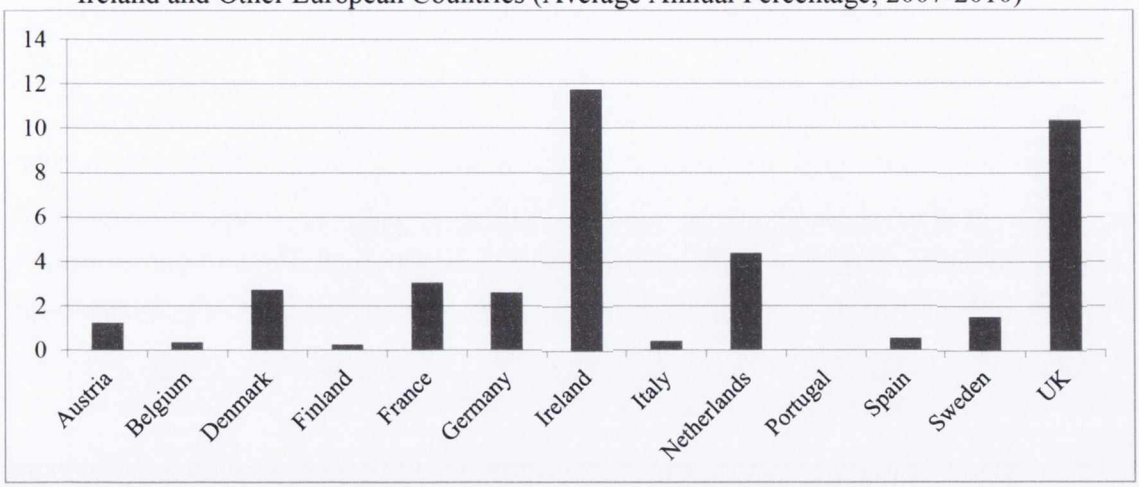
Figure 4.18 Net Inflow of PE as Share of Total PE Investment in Portfolio Firms, Ireland and Other European Countries (Average Annual Percentage, 2007-2010)



Source: Own calculations based on EVCA data.
Note: Net inflow = inflow of PE from foreign PE houses-outflow of PE invested abroad by domestic PE houses.

For the PE calculations above the amount of investment from overseas was calculated as total PE investment in domestic portfolio firms less domestic investment by domestic PE houses. Although 'country of destination' investment data are available separately for VC from 2007, the geographical destination of investments made by domestically-managed VC funds is not, so the same calculations are not possible for VC. Therefore, while there is information on the amount of VC received by Irish-based portfolio firms and the amounts received from VC funds outside Europe, there is less detail on the source of these investments so that the degree of internationalisation of VC itself cannot be accurately assessed. However the EVCA does provide data on VC investments received by European portfolio firms from non-European funds from 2007 so it is possible to glean some information on the wider internationalisation of European VC. Figure 4.19 shows that, on average over 2007-2010, Ireland had the greatest share of VC investment received from outside Europe, followed by the UK. This fits with the anecdotal evidence that much of the foreign VC invested in Irish industry originates in the US.

Figure 4.19 Share of Non-European VC Investments in VC Received by Portfolio Firms, Ireland and Other European Countries (Average Annual Percentage, 2007-2010)



Source: Own calculations based on EVCA data

Given the internationalisation of Irish VC, the question arises as to why it is perceived as important for the state, acting through EI, to create a local VC market, since there appears to be many more investment opportunities in Ireland than Irish investors are able or willing to finance, and Irish indigenous firms themselves are not biased against foreign investors.[160] The answer is found in the literature review where it is found that many international deals are syndicated and involve local venture capitalists. Practitioners in the sector also point out that foreign venture capitalists usually invest in the Irish market by co-investing (or syndication) with Irish venture capitalists.[161] If they invest directly, in turn, it tends to be in firms with some track record, financing later-stage transactions (post-first or even post-second round financing) and frequently only when domestic VC is already in place (Berkery, 2001).

4.5 CONCLUSIONS

The aims of this study are three-fold: To document the development of VC in Ireland from a comparative perspective, to examine the role of government policy within this and, lastly, to explore the degree of internationalisation of VC in Ireland. The role of VC in the economy is an area relatively neglected by economists but of major policy concern as it is associated with the development of innovative start-ups. In Ireland this is linked to the development of self-sustaining export-oriented indigenous industry. Extant studies generally focus on the VC market rather than on the firms that are the recipients of VC investment, the results presented here do both.

[160] Indeed foreign investors are often considered to bring added value due to their established extensive networks and international presence (FitzGerald, 2002).
[161] See for example FitzGerald (2002) and Berkery (2001).

This study finds that, in common with European VC markets generally, the Irish market is smaller, relative to the size of the economy, than the US VC market. It also has relatively lower levels of seed funding and of IPOs than the US. Ireland is found to differ from other European countries in two main ways. Firstly, PE in Ireland leans heavily towards VC compared to other European countries and VC investment itself leans heavily towards early-stage investment (i.e. seed plus start-up investments). Secondly, VC in the Irish economy is highly internationalised with Ireland found to be a large net beneficiary of PE investment from overseas. These results paint a picture of the Irish VC environment in an international context.

The importance of VC in Ireland, and the relatively high levels of early-stage VC, compared to later-stage PE such as buyouts, is an indication of the later development of Irish indigenous industry resulting in a lack of later-stage investment opportunities. Additionally, it may result from the Irish government's policy focus on building a self-sustaining VC sector. However, the low levels of later-stage VC and the high level of trade sales indicate the selling of ownership stakes in preference to engaging in expansion. This suggests either a lack of access to later-stage finance for expansion or a reluctance, or inability, on the part of venture capitalists or entrepreneurs to further grow these firms. Mulcahy (2005) argues that most Irish start-ups perceive themselves as too small to go public and opt instead for trade sales.

Despite the overall relatively high level of early-stage VC, the level of seed funding in Ireland is found to be substantially lower than in the US. Seed funding is the most serious equity gap faced by young high-tech firms but the VC industry is reluctant to invest at this stage due to the very high risks involved. Furthermore, despite the very substantial internationalisation of investments into Irish firms, the syndication of deals with local partners means that the "ultraconservatism" of the Irish VC industry described by Breznitz (2007:178) remains relevant. Foreign venture capitalists also experience higher risk levels due to distance. A further concern is the claim by Breznitz (2007) that spin-offs from Irish university research are patented by US MNCs rather than being developed by indigenous start-ups.

A number of factors contribute to the high degree of internationalisation of VC in Ireland. As a small open economy, Ireland has a big rest of the world and small local financial market and this provides opportunities for the involvement of foreign capital. It was found earlier that European countries with high net inflows of PE investment are all small

economies. In addition, the literature shows that Israel, another small economy, benefitted to a large extent from US VC finance. Another contributory factor is the high level of classical FDI in the Irish economy, particularly from US MNCs, which boosts local industry via linkages, and network, spillover, and demonstration effects, as well as by the provision of output markets. In Ireland VC and classical FDI are largely complementary.

In the Irish context, the rationale for building a strong VC sector is the development of a self-sustaining export-oriented indigenous industrial sector, a goal which has long eluded policy-makers. However, the results presented here show that the achievement of this objective is difficult. First, the low-level of later-stage VC and high rate of trade sales suggests that ownership stakes are being sold by Irish entrepreneurs, often to foreign firms, in preference to expansion. This leads to the irony of state policies aimed at developing indigenous industry leading ultimately to the growth of foreign-owned industry instead. If the state really wants to develop self-sustaining indigenous industry it needs to consider ways to support and maintain Irish ownership. Although it cannot be recommended that the state attempts to seriously distort market forces to the point of creating inefficiencies, agencies should consider if there is a role in supporting firms at the later-stage to grow and reach IPO stage. Alternatively, a change of culture may be required to build confidence among Irish entrepreneurs and enable them envisage heading a larger company rather than selling. Another factor is access to product markets which can often be provided through foreign ownership. A policy objective of developing a self-sustaining indigenous industrial sector will clearly not be met if large numbers of Irish SMEs are bought by foreign MNCs. Of course, in light of the shifts in international business and in the configuration of firms, the question may be more one of how to create Irish-owned MNCs rather than focussing solely on the development of indigenous SMEs. This requires a greater focus on expansion of successful SMEs by their Irish owners. Second, the lack of seed funding is the most serious equity gap, severely limiting the development of young Irish firms. Evidently there is a role for EI in correcting this market failure whether directly, on the demand-side, through the provision of finance to firms or, on the supply-side, through VC funding or through risk-reduction policies such as loss guarantees or certification. Third, the rationale for building a self-sustaining export-oriented indigenous sector is based on the risks associated with the footloose nature of foreign investment and the stronger linkages to the wider economy thought to be provided by indigenous industry. Given that the immediate investors in VC-supported industry in Ireland are likely to be large and foreign, indigenous industry in Ireland remains heavily reliant on foreign capital.[162]

[162] The reader is reminded that this conclusion is based on the PE data as VC data are unavailable, however it has been shown that PE in the Irish context is very substantially VC.

This chapter opened with a quote from *Review of Industrial Policy and Performance* (2003) attributing the lack of HPSUs to the lack of a developed VC sector. Although the literature is critical of an over-reliance on supply-side policies it is found here that Irish policy has largely been on the demand-side. Internationalisation reduces the need for supply-side measures but there is a lack of seed funding in Ireland and there may also be a lack of later-stage VC for expansion. As well as the provision of finance, supply-side measures offer the opportunity to benefit from the expertise that private venture capitalists can provide. Although EI has had, often conflicting, roles on both the supply-side and demand-side of the VC market, overall there has been a policy bias towards the demand-side, whether as a result of tradition or of suspicion of the VC industry. The role of the industry is central to VC development and there is consequently a risk of capture. The industry is often seen to be involved in making policy recommendations and there is a danger of policy changes occurring at the behest of the industry, to its benefit rather than to the benefit of the investees and the wider economy. This problem is exacerbated by the blurring of the line between VC and wider PE and by the data being collected from members of VC associations themselves. Government involvement in VC socialises the risk but the state needs to also share in, or socialise, the rewards. Policy needs to be finely balanced to achieve the government's objectives while also making it profitable for private venture capitalists to be involved. Wider policy implications are suggested also by the complementarity of classical FDI and VC. The synergies between classical FDI and indigenous start-ups should be considered in FDI policy design, and the competitive advantages of indigenous start-ups particularly in terms of resources and market access should be taken into account.

Importantly, most of the VC literature, and indeed the data presentation, focus on the VC market itself rather than on the role of VC in the economy. These are very different things. There is a shortage of data to facilitate the examination of VC from the wider perspective of industrial policy and real economic activity. Partially as a result, this area is poorly researched by economists with most studies on foreign participation in industrial development looking at classical FDI as undertaken by MNCs.[163] Three aspects of this are particularly important: First, the conflation of PE and VC and the lack of detailed data for VC itself make it difficult to examine VC particularly in terms of sources and origins of funds, although the level of disaggregation is improving. The poor quality of the available data makes it impossible to confirm the extent of the inflow of VC into Ireland, for example,

[163] Another reason may be the small relative size of VC. In 2010, for example, a year when inward VC was quite large at €750m, this only amounted to 3.8 per cent of total inward FDI flows (€19880m).

as the appropriate data are available only for aggregate PE. Furthermore, some results in the VC literature are biased because the authors use aggregate PE instead of VC. This is a particular problem for comparisons between Europe and the US where authors use PE data from the EVCA which include buy-outs and NVCA figures for the US which are for VC only. It is also important for pan-European studies, however, as the relative importance of VC varies across countries. Second, data are mainly collected by the industry from members of the industry's associations and are available on a 'country of management' basis only so they are very VC industry-centric without reference to the portfolio firms which are the main focus of economic policy. Third, the geographical detail in the data is weak making it difficult to ascertain the sources of funds and investments. For example, that the US is the main source of overseas PE into Irish firms is an assumption that can be reasonably made but cannot be confirmed. When syndication occurs between a US-based fund and a European-based fund, the EVCA data report the US share only if the US fund has a European office.

Economic research on VC suffers from these data limitations; however the quality of data has begun to improve. The EVCA data are available for the 'country of destination' and 'country of origin' approaches since 1999 and there has been a greater disaggregation of data since 2007. Hopefully, improvements will continue. In particular, it would be useful to have more disaggregation of VC itself to confirm the level of internationalisation, for example. The reasons for the high level of internationalisation of VC and what happens after divestment is a topic requiring further study. From a policy perspective it is important to know to what extent VC-supported enterprise remains indigenous and the reasons for decisions on exit modes and the future expansion of enterprises. Further research in the Irish context can shed light on these issues. As VC is a relatively new form of FDI on Ireland's development path, the Irish experience is of wider applicability, particularly for small and emerging economies. Another avenue is a comparative study of the role of VC in Ireland with other small European economies. Finland, for example, was ranked the second highest European per capita exporter of computer and information services in 2010, after Ireland.[164] The results in this study show that Finnish firms are also substantial net recipients of PE investment from overseas and that VC constitutes a large share of PE in Finland. Furthermore, firms in high-tech sectors in Finland are shown to have received high shares of VC. A comparative study of the role of VC in the computer and information

[164] Based on author's own calculations on data from the OECD (2013) *Statistics on International Trade in Services: Volume 2013/1*and the OECD's *Population and Vital Statistics* Database. Ireland's exports were valued at $8118 million per million of the population, compared to $1207 million for Finland. The third highest per capita exporter was Sweden, which has also been shown to have a highly internationalised PE sector albeit on the funds raised side ($768 million per million of the population).

services sector in Ireland and Finland is therefore feasible, VC having been very important to the development of the indigenous software sector in Ireland.

The key contributions of this chapter are in documenting the evolution of the VC environment in Ireland, by drawing together this comprehensive set of data on the Irish VC environment in comparative prospective, and in pointing to its substantial internationalisation. The objective of building a self-sustaining export-oriented indigenous industrial sector is found to be difficult to achieve, in particular due to the substantial involvement of foreign capital and trade sales.

REFERENCES

Agmon, T. (2006) 'Bringing Financial Economics into International Business Research: Taking Advantage of a Paradigm Change' *Journal of International Business Studies, 37*, 575-577

Agmon, T. and A. Messica (2009) 'Financial Foreign Direct Investment: The role of Private Equity Investments in the Globalization of Firms from Emerging Markets' *Management International Review*, *49*(1), 11-26

Aizenman, J. and J. Kendall (2012) 'The Internationalization of Venture Capital' *Journal of Economic Studies*, *39*(5), 488-511 an earlier version is available as Aizenman, J. and J. Kendall (2008) 'The Internationalization of Venture Capital and Private Equity ' *NBER WP14344*

Avnimelech, G., M. Kenney and M. Teubal (2004) 'Building Venture Capital Industries: Understanding the US and Israeli Experiences *Berkeley Roundtable on the International Economy UC Berkeley USA, Working Paper* 160

Avnimelech, G., M. Kenney and M. Teubal (2005): 'The Life Cycle Model for the Creation of National Venture Capital Industries: The US and Israeli Experiences' in E. Giuliani, R. Rabellotti and M. van Dijk (eds.): *Clusters Facing Competition: The Importance of External Linkages* Ashgate, Aldershot

Avnimelech, G. and M. Teubal (2006) 'Creating Venture Capital Industries that Co-Evolve with High-Tech: Insight from an Extended Industry Life Cycle Perspective on the Israeli Experience' *Research Policy*, 35, 1477-1498

Avnimelech, G., and M. Teubal (2008) 'From Direct Support of Business Sector R&D/Innovation to Targeting Venture Capital/Private Equity: A Catching-Up Innovation and Technology Policy Life Cycle Perspective' *Economics of Innovation and New Technology*, *17*(1), 153-172

Barry, F. and C. Kearney (2006) 'MNEs and Industrial Structure in Host Countries: A Portfolio Analysis of Irish Manufacturing' *Journal of International Business Studies, 37*(3), 392-406

Baygan, G. and M. Freudenberg (2000) *The Internationalisation of Venture Capital Activity in OECD Countries: Implications for Measurement and Policy.* OECD Science, Technology and Industry Working Papers DSTI/DOC (2000)7, OECD Publishing

Beesley, A. (2007) 'The Winners and Losers of 2007' *The Irish Times,* 28th December

Berkery, D. (2001) *Technology in Ireland* Delta Partners, Dublin

Bottazzi, L. and M. Da Rin (2002) 'Venture Capital in Europe and the Financing of Innovative Companies' *Economic Policy, 17*(34), 229-270

Breznitz, D. (2007) *Innovation and the State: Political Choice and Strategies for Growth in Israel, Taiwan, and Ireland*, Yale University Press, New Haven

Breznitz, D. (2012) 'Ideas, Structure, State Action and Economic Growth: Rethinking the Irish Miracle' *Review of International Political Economy, 19*(1), 87-113

Cherif, M. and K. Gazdar (2011) 'What Drives Venture Capital Investments in Europe? New Results from a Panel Data Analysis' *Journal of Applied Business and Economics*, *12*(3), 122-139

Crone, M. (2004) 'Celtic Tiger Cubs: Ireland's VC-Funded Software Start-ups', paper presented at *Institute of Small Business Affairs National Entrepreneurship and SME Development Conference,* Newcastle-Gateshead, November

Cumming, D. and J. MacIntosh (2001) 'Venture Capital Investment Duration in Canada and the United States' *Journal of Multinational Financial Management, 11*(4), 445-463

Da Rin, M., G. Nicodano and A. Sembenelli (2006) 'Public Policy and the Creation of Active Venture Capital Markets' *Journal of Public Economics, 90*(8), 1699-1723

De Backer, K. and L. Sleuwaegen (2003) 'Does Foreign Direct Investment Crowd Out Domestic Entrepreneurship?' *Review of Industrial Organization, 22*(1), 67-84

Department of Enterprise, Trade and Employment (2003) *Review of Industrial Policy and Performance* Stationary Office, Dublin

Enterprise Ireland (2005) *Seed and Venture Capital Programme 2000-2006*

EVCA (2003) *Benchmarking European Tax & Legal Environments. Indicators of Tax & Legal Environment Favouring the Development of Private Equity and Venture Capital in European Union Member States*

FitzGerald, E. (2002) *Venture Capital Opportunities in the Irish Market*, A&L Goodbody, Dublin

Fitzsimons, P. and C. O'Gorman (2011) *The Global Entrepreneurship Monitor (GEM) 2011: The Irish Report* Dublin: Enterprise Ireland, Forfás and InterTradeIreland

Florida, R. and M. Kenney (1988) 'Venture Capital, High Technology and Regional Development' *Regional Studies*, *22*(1), 33-48

Forfás (2000) *Enterprise 2010: New Strategy for the Promotion of Enterprise in Ireland in the 21st Century* Forfás, Dublin

Gompers, P. and J. Lerner (2001) 'The Venture Capital Revolution' *Journal of Economic Perspectives*, *15*(2), 145-168

Gompers, P. (2007) 'Venture Capital', Chapter 9 in B.E. Eckbo (ed.) *Handbook of Corporate Finance: Empirical Corporate Finance*, Volume 1, Elsevier, North-Holland

Görg, H. and E. Strobl (2002) 'Multinational Companies and Indigenous Development: An Empirical Analysis' *European Economic Review, 46* (7), 1305-132

Gu, Q. and J. Lu (2011) 'Effects of Inward Investment on Outward Investment: The Venture Capital Industry Worldwide 1985–2007' *Journal of International Business Studies, 42*(2), 263-284

Guler, I. and M. Guillén (2010) 'Institutions and the Internationalization of US Venture Capital Firms' *Journal of International Business Studies, 41*(2), 185-205

Harding, R. (2002) 'Plugging the Knowledge Gap: An International Comparison of the Role for Policy in the Venture Capital Market' *Venture Capital: An International Journal of Entrepreneurial Finance*, *4*(1), 59-76

Hellman, T. and M. Puri (2000) 'The Interaction between Product Market and Financing Strategy: The Role of Venture Capital' *Review of Financial Studies, 13*(4), 959-984

Hogan, T. and E. Hutson (2005) 'Capital Structure in New Technology-Based Firms: Evidence from the Irish Software Sector' *Global Finance Journal*, *15*(3), 369-387

Industrial Policy Review Group (1992) *A Time for Change: Industrial Policy for the 1990s*, Stationery Office, Dublin. This is widely known as the "Culliton Report"

Jeng, L. and P. Wells (2000) 'The Determinants of Venture Capital Funding: Evidence across Countries' *Journal of Corporate Finance*, 6, 241-289

Keller, M. and F. Block (2012) 'Explaining the Transformation in the US Innovation System: the Impact of a Small Government Program' *Socio-Economic Review 11*, 629–656

Kenney, M., K. Han, and S. Tanaka (2002) 'Scattering Geese: the Venture Capital Industries of East Asia: a Report to the World Bank' *Berkeley Roundtable on the International Economy,* UC Berkeley

Leleux, B. and B. Surlemont (2003) 'Public versus Private Venture Capital: Seeding or Crowding Out? A Pan-European Analysis' *Journal of Business Venturing, 18*(1), 81-104

Lerner, J. (1996) 'The Government as Venture Capitalist: The Long-Run Effects of the SBIR Program' *National Bureau of Economic Research* WP5753

Lerner, J. (2009) *Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed--and What to Do About It*, Princeton University Press

Lyons, S. (2004) *Limited Partnership: Restriction on Size of Partnerships Now Relaxed*, LK Shield Solicitors

Mac an Bhaird, C. and B. Lucey (2010) 'Determinants of Capital Structure in Irish SMEs' *Small Business Economics*, *35*(3), 357-375

Madhavan, R. and A. Iriyama (2009) 'Understanding Global Flows of Venture Capital: Human Networks as the "Carrier Wave" of Globalization' *Journal of International Business Studies*, *40*(8), 1241-1259

Markusen, J. and A. Venables (1999) 'Foreign Direct Investment as a Catalyst for Industrial Development' *European Economic Review, 43*(2), 335-356

Mason, C. and R. Harrison (2003) 'Closing the Regional Equity Gap? A Critique of the Department of Trade and Industry's Regional Venture Capital Funds Initiative' *Regional Studies*, 37, 855-868

Megginson, W. (2004) 'Toward a Global Model of Venture Capital?' *Journal of Applied Corporate Finance*, *16*(1), 89-10

Messica, A. and T. Agmon (2008) 'Venture Capital Dynamics, the Public Sector and the High Technology Industry' *International Journal of Entrepreneurship and Innovation Management, 10*(3), 227-242

Mulcahy, D. (2005) 'Angels and IPOs: Policies for Sustainable Equity Financing of Irish Small Businesses' *Studies in Public Policy, 16,* 1-123

Murphy, M. (2000) 'Ireland: Venturing Far and Near' *European Venture Capital Journal, 46* (September)

O'Brien, G. (2008) *Irish Policy for Selecting and Supporting High Potential Start-Up Companies*, M.Sc. in Economic Policy Studies dissertation, Trinity College Dublin

O'Kelly, B. (2004) 'Reaching endgame; Look behind the Prices and the Headlines for the Reasons for MBOs' *The Irish Times,* 16th February

O'Malley, E. and C. O'Gorman (2001) 'Competitive Advantage in the Irish Indigenous Software Industry and the Role of Inward Foreign Direct Investment' *European Planning Studies*, *9*(3), 303-321

Ó Riain, S. (2004) *The Politics of High-Tech Growth: Developmental Network States in the Global Economy*, Cambridge University Press

OECD (1996) *Venture Capital and Innovation* OECD, Paris

Popov, A. and P. Roosenboom (2009) *On the Real Effects of Private Equity Investment: Evidence from New Business Creation* Working Paper No. 1078, European Central Bank.

Sterne, J. (2004) *Adventures in Code: the Story of the Irish Software Industry*, Liffey Press, Dublin

Sunley, P., B. Klagge, C. Berndt and R. Martin (2005) 'Venture Capital Programmes in the UK and Germany: In What Sense Regional Policies?' *Regional Studies, 39*(2), 255-273

Tykvová, T. and A. Schertler (2011) 'Cross-Border Venture Capital Flows and Local Ties: Evidence from Developed Countries' *Quarterly Review of Economics and Finance*, *51*(1), 36-48

UNCTAD (2012) *World Investment Report: Towards a New Generation of Investment Policies*, New York and Geneva

Walsh, M. (1985) 'Venture Capital in Ireland' *Irish Journal of Irish Business and Administrative Research*, 7(1), 33-45

Wright, M., S. Pruthi and A. Lockett (2005) 'International Venture Capital Research: From Cross-Country Comparisons to Crossing Borders' *International Journal of Management Reviews*, *7*(3), 135-165

Chapter Five

Conclusions

5.1 CONCLUDING REMARKS

This thesis consists of three empirical studies that explore issues in the measurement and analysis of FDI. FDI has evolved from its 'classical' form (greenfield, direct one-to-one, investment from multinational parent to affiliate, in manufacturing) to encompass other types of foreign investment. This affects the measurement and understanding of the role of FDI. The first study examines and quantifies the pitfalls arising in the measurement of FDI, while the other two studies explore two forms of FDI at points along its evolutionary path.

Chapter Two: 'Pitfalls in the Use of Foreign Direct Investment Statistics', the first empirical study, investigates the balance-of-payments measurement of FDI, demonstrating and quantifying the incompatibilities of the data. This study finds that countries use different interpretations of the international standards and therefore the FDI data are not directly comparable across countries. Also, as countries changed their measurement of FDI over time, the data are not directly comparable across time. IMF and OECD data and, more recently, Eurostat data, are found to be superior to the UNCTAD data, being closer to the original sources of the data. The results also highlight the growing significance of financial services FDI, Special Purpose Entities (SPEs), and pass-through investment, increasing the decoupling of FDI capital flows from MNC activity and further affecting both the international and intertemporal comparability of the FDI data.

Chapter Three: 'New Grant-Aided Industry in Ireland Prior to EU Entry: An Establishment-Level Analysis' examines the characteristics and survival performance of new grant-aided exporting manufacturing industry that established in Ireland prior to EU entry. This industry was very substantially foreign-owned and an example of a 'classical' form of FDI at a time when FDI capital flows and MNC activity were more closely connected. FDI was mainly undertaken by highly centralised MNCs and foreign subsidiaries were involved in basic processing with higher-order activities, even in high-tech sectors, remaining in the home country. These new grant-aided plants are found to have been larger than the general population of plants in 1972. New grant-aided indigenous plants were predominantly found in the food-processing and textiles sectors and were relatively smaller than foreign-owned plants. The foreign-owned new grant-aided plants were sectorally more diverse. The main non-European country of ownership was the US and US-owned plants were larger and more

frequently found in high-tech and modern sectors. US-ownership predominated in the SFADCo area. Survival times found for the new grant-aided plants are relatively long suggesting that grants aid survival. In common with the literature, size is the over-riding statistically significant covariate in the survival analysis. Plants in the food, drink and tobacco, and high-tech sectors are found to have better survival outcomes. US-ownership also aided survival, although this result was not significant, whereas UK and rest-of-world owned plants had consistently poor survival outcomes.

Chapter Four: 'Exploring Financial Foreign Direct Investment: Growth and Internationalisation of Venture Capital in Ireland' documents the development of VC in Ireland from a comparative perspective, examining the role of government policy and highlighting the degree of internationalisation. The results of this study paint a picture of the Irish VC environment in an international context. It finds that, in common with European VC markets generally, the Irish market is smaller and has lower levels of seed funding and IPOs than the US VC market. Importantly, Ireland differs from other European countries through the substantial concentration of PE in VC and the very substantial internationalisation of VC. As VC in Ireland is highly internationalised it constitutes a newer form of FDI, complementary to classical FDI. The involvement of government agencies in VC is aimed at the development of indigenous HPSUs but the study finds that there is very substantial foreign involvement in VC-supported industry and divestment is commonly through trade sales. These findings suggest that foreign ownership stakes are important for many of these firms and that the objective of building a self-sustaining export-oriented indigenous industrial sector is difficult to achieve.

5.2 FUTURE RESEARCH DIRECTIONS

A number of future research directions are suggested by this thesis:

Chapter Two shows that the role played by SPEs is worthy of further exploration. As briefly discussed in Appendix 2.2, Mintz and Weichenrieder (2010) use the Deutsche Bundesbank's *MiDi* database to study the role of conduit entities in German FDI. Alternative sources of firm-level data are the Bureau van Dijk's (BvD) *AMADEUS* and *FAME* databases which contains an extensive range of financial and ownership information for Europe, and for the UK and Ireland, respectively.[165] Mintz and Weichenrieder (2010)

[165] The use of BvD's European-wide *AMADEUS* database is restrictive if the study is to include Ireland as it does not contain any holding companies for Ireland and many, although not all, holding companies are SPEs (ECB/Eurostat 2004). Mintz and Weichenrieder (2010) also find that conduit entities are not always holding companies. However *AMADEUS* can be utilised to follow up shareholders and subsidiaries outside Ireland.

identify 'stepping-stone companies' within ownership chains. A similar tracing of ownership chains would be possible using the data on shareholders and subsidiaries contained in the databases produced by BvD. Unique identification numbers allow the matching of firms across these databases. An alternative research approach involves the identification of SPEs. This is difficult as there is no commonly accepted international definition of an SPE and most countries do not collect data on these entities. However, as discussed in Appendix 2.2, a number of reports have tried to improve on this and these can be utilised in this regard. These reports include ECB/Eurostat (2004), Eurostat (2009), UNECE (2011), and OECD (2012).

The existence of the new database assembled for Chapter Three opens up new research opportunities on early new grant-aided industry in Ireland. One interesting direction is to compare the characteristics and performance of these plants, now that the data are available, with the new grant-aided post-EU entry plants. Data for the latter are contained in the Forfás grants database which covers the period from 1972. The proposed research would study only industry establishing for the first time under grant-aid in order to obtain a clearer picture of survival. This adds to Görg and Strobl (2003) and Girma et al (2007) who include plants that established before or during the protectionist era which can be expected to have poorer survival outcomes with the advent of trade liberalisation, thus biasing their results. The inclusion of incumbents means also that some of the 'non-grant-aided' plants in Girma et al (2007) may have actually received early grants, for which they would not have had the data.[166] Another research opportunity presented by the existence of the new database in Chapter Three, is to examine the employment growth of the early new grant-aided plants. This is especially pertinent as the creation of direct employment was one of the main policy aims of grant provision but it has been suggested by Northcott (1970) and McAleese (1972), for example, that plants did not tend to grow beyond their target size and increased employment at this time was mainly achieved through the attraction of more and more firms. This proposed research would add to the employment analysis undertaken by Görg and Strobl (2003).

The reasons for the high level of internationalisation of VC and what happens after divestment is a topic that requires further research. From a policy perspective it is important to know to what extent VC-supported enterprise remains indigenous and the reasons for decisions on exit modes and the future expansion of enterprises. A wider policy question is the relevance of indigenous ownership in a highly integrated global economy. Further

[166]They report that plants were on average nine years old when they first appear in their sample, and that plants will often receive grants when first established. Although they can trace grants back to 1972, they do not have grant data prior to this.

research in the Irish context can shed light on these issues. As VC is a relatively new form of FDI on Ireland's development path, the Irish experience is of wider applicability, particularly for small and emerging economies. Lastly, a comparative study of the role of VC in small European countries is feasible. Firms in Finland, for example, have also been found to be substantial net recipients of PE investment from overseas. Although detailed data of this nature are not available for VC itself, it is also shown that in Finland, VC constitutes a large share of PE. Furthermore, firms in high-tech sectors in Finland are found to have received high shares of VC. One research direction is a comparative study of the role of VC in the computer and information services sector in Ireland and Finland. VC was shown to be very important to the development of the indigenous software sector in Ireland while, in 2010, for example, Finland was ranked the second highest European per capita exporter of computer and information services, after Ireland. [167]

5.3 KEY CONTRIBUTIONS

This thesis makes a number of key empirical contributions. First, it quantifies the extent of the incompatibilities in the balance-of-payments FDI data. The FDI data are used not just in the empirical literature on international capital flows and MNC activity, but also in measures of globalisation. Second, it provides a unique database for the pre-EU entry new grant-aided plants in Ireland. Third, it explores the characteristics and survival outcomes of these establishments. Fourth, it documents the evolution of the VC environment in Ireland, in comparative perspective, by drawing together a comprehensive set of data. Lastly, it points to the substantial internationalisation of VC in the Ireland.

REFERENCES

ECB/Eurostat (2004) *Foreign Direct Investment Task Force Report* March 2004

Eurostat (2009) *Task Force on the Recording of Certain Activities of Multinationals in National Accounts: Final Report* (17th Meeting of the GNI Committee 7-8 July 2009, Luxembourg). Available at http://www.unece.org/fileadmin/DAM/stats/groups/wggna/Report_TF_recording_activities_multinationals_national_accounts.pdf)

Girma, S., H. Görg and E. Strobl (2007) 'The Effects of Government Grants on Plant Survival: A Micro-Econometric Analysis' *International Journal of Industrial Organization*, *25*(4), 701-720

[167] Based on author's own calculations on data from the OECD (2013) *Statistics on International Trade in Services: Volume 2013/1*and the OECD's *Population and Vital Statistics* Database. Ireland's exports were valued at $8118 million per million of the population, compared to $1207 million for Finland. The third highest per capita exporter was Sweden, which has also been shown to have a highly internationalised PE sector albeit on the funds raised side ($768 million per million of the population).

Görg, H. and E. Strobl (2003) ''Footloose'Multinationals?' *The Manchester School*, *71*(1), 1-19

Mata, J. and P. Portugal (2002) 'The Survival of New Domestic and Foreign-Owned Firms' *Strategic Management Journal*, 23(4), 323-343

McAleese, D. (1972) 'Capital Inflows and Direct Foreign Investment in Ireland 1952-1970' *Journal of the Statistical and Social Inquiry Society of Ireland* 22(4), 63-105

Mintz, J. and A.Weichenrieder (2010) *The Indirect Side of Direct Investment* CESifo Book Series, MIT, Cambridge

Northcott, J. (1970) 'Symposium on the Buchanan Report' *Journal of the Statistical and Social Inquiry Society of Ireland, 22(2)*, 179-208

OECD (2012) 'Holdings, Head Offices and SPEs: Issues and Way Forward' Working Party on International Trade in Goods and Trade in Services Statistics, note by M. Chavoix-Mannato and S.Hagino. Available at http://search.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=STD/TBS/WPTGS%282012%2919&docLanguage=En

O'Malley, E. (1989) *Industry and Economic Development: The Challenge for the Latecomer* Gill and Macmillan, Dublin

UNECE (2011) *The Impact of Globalization on National Accounts* United Nations, New York and Geneva. Available at http://www.unece.org/fileadmin/DAM/stats/publications/Guide_on_Impact_of_globalization_on_national_accounts__web_.pdf

Appendix 2.1

A Note on the International Standards

At the time of writing, the current international standard used for FDI is from the IMF's *Balance of Payments Manual* 5th edition published in 1993 (henceforth referred to as BPM5), but EU countries are in the process of switching over to the new international standard for the recording and presentation of the Balance of Payments (ECB/Eurostat, 2011).[168] This new standard is contained in the IMF's *Balance of Payments and International Direct Investment Position Manual* 6th Edition (known as BPM6) and the corresponding 2008 OECD's *Benchmark Definition of Foreign Direct Investment*, Fourth Edition.

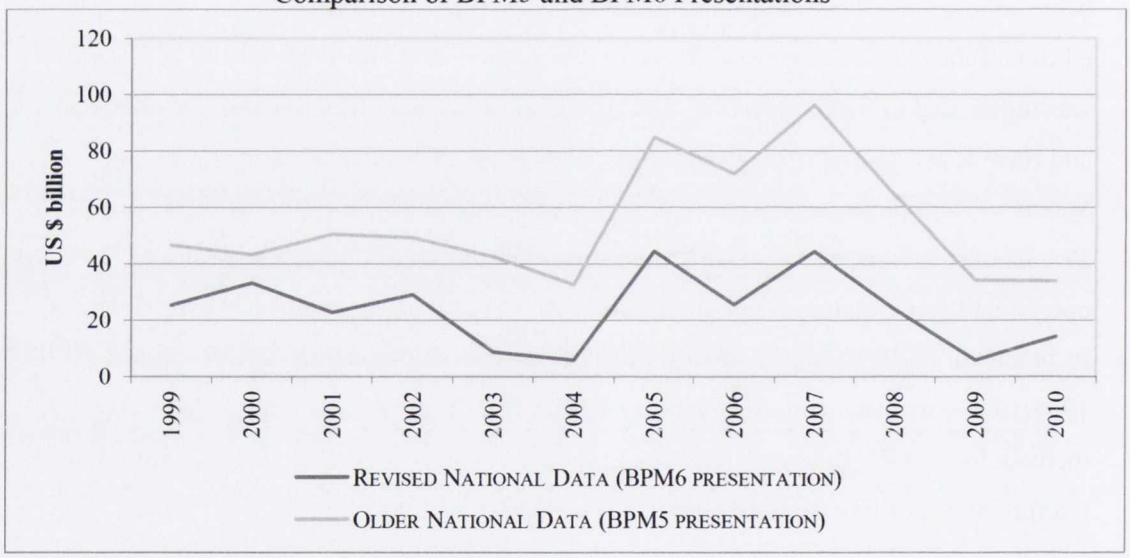
Changes in the international standards occur with the publication of new OECD *Benchmark Definitions* and new IMF *Balance of Payments Manuals*, with some updates also occurring between manuals. The first IMF *Balance of Payments Manual* dates back to 1948. The 4th edition of the IMF's *Balance of Payments Manual* (BPM4) was published in 1977. BPM5 was introduced in September 1993 to take account of developments in international trade and finance and to improve harmonisation between the Balance of Payments and the 1993 *System of National Accounts* (1993 *SNA*). It was endorsed by the OECD (1996) in its *Benchmark Definition of Foreign Direct Investment* 3rd edition which provides a detailed operational guide on the compilation of FDI data. For the data in Chapter Two, BPM5 and its precursor (BPM4) apply. Most European countries implemented BPM5 around 1998/1999 with some countries backdating earlier data, most commonly to 1996. The methodology of EU member states also reflects European Central Bank (ECB) and Eurostat interpretations of this standard.

In BPM6, direct investment (DI) is classified as: DI by the direct investor in the direct investment enterprise (DIE); reverse investment; and DI between fellow enterprises. The last of these categories is new. Fellow enterprises are defined as ones under the control of the same immediate or indirect investor but who are not in a DI relationship with each other. Furthermore, as the standard presentation is changed to the assets/liabilities approach, reverse investment should be more visible, being no longer netted out from DI received from the parent.

[168] Although EU countries were not due to implement the new standard until 2014 (ECB/Eurostat, 2011) the relatively new (since 2010) Coordinated Direct Investment Survey published annually by the OECD since 2010 and covering DI from 2009 follows BPM6.

Inclusion of the new category for DI between fellow enterprises effectively extends the directional principle to loans between fellow/sister affiliates (UNCTAD, 2013). It has been argued, on the one hand, that the extended directional principle will reduce the measured size of 'genuine' investment (DNB, 2008) and distort geographical allocation of investment. However, it can also be argued that not extending the directional principle in this way also distorts the geographical allocations of investment. Some countries already extend this principle (for Ireland, see Connolly (2005) and CSO (2013) for example). It is also hoped that improved Balance of Payments FDI statistics will align better with MNC activity data (DNB, 2008) thereby improving FDI's usefulness as a proxy measurement. During the transition period, the Banque de France has produced FDI data with both BPM5 and BPM6 presentations (for further discussion see Terrien, 2009). This allows a comparison between both presentations for French inward flows for 1999-2010 as shown in Figure A.2.1 below.

Figure A.2.1 France Inward Flows 1999-2010
Comparison of BPM5 and BPM6 Presentations



Sources: Banque de France Balance of Payments Database
Note: € converted to US$ using Eurostat period average exchange rates.

Deflating the two series shown in A.2.1 and comparing annual averages over the period, the revised data is found to be, on average, less than half the magnitude of the older series ($23.99 billion compared to $54.49 billion, in 2005 terms). The correlation between the two series is 0.83. This points to a potential new structural break that is likely to affect the FDI balance-of-payments data over the next few years, as backdating of the change may well differ across countries, as was the case with BPM5.

Falling short of issuing standards in this respect, BPM6 suggests that countries with substantial amounts of pass-through or round-tripping of funds, or where there are a large number of conduit entities such as SPEs, might consider producing separate supplementary

data (IMF, 2009). It has also been suggested that countries with large numbers of resident SPEs assist others to look through these entities via an 'origin and destination matrix' (DNB, 2008). Furthermore, disaggregated data produced by the OECD will no longer include SPE transactions (OECD, 2008).

REFERENCES

Connolly, M (2004) Comments on Barry, F. and C. O'Mahony (2005) 'Making Sense of the Data on Irish Inward FDI' *Journal of the Statistical and Social Inquiry Society of Ireland 34,* 28-57

CSO (2013) *Foreign Direct Investment 2012*

CSO (2014) *BPM6 Implementation* available at http://www.cso.ie/en/media/csoie/surveysandmethodologies/surveys/bop/documents/pdfs/BPM6.pdf

De Nederlandsche Bank (DNB) (2008) *Statistical Bulletin* December 2008

ECB/Eurostat (2011) 'Coordinated Implementation in the European Union of BPM6' at the *Twenty-Fourth Meeting of the IMF Committee on Balance of Payments Statistics* October 2011 available at http://www.imf.org/external/pubs/ft/bop/2011/11-05.pdf

IMF (2009) *Balance of Payments and International Direct Investment Position Manual* 6th Edition

OECD (2008) *Benchmark Definition of Foreign Direct Investment* 4th Edition

Terrien, B (2009) 'A New Standard for Compiling and Disseminating Foreign Direct Investment Statistics' *Quarterly Selection of Articles No. 16* Winter 2009-10 Banque de France. Available at http://www.banque-france.fr/gb/publications/telechar/bulletin/qsa/qsda16/quarterly-selection-of-articles-winter-2009-2010-16-etude_6.pdf.)

UNCTAD (2013) *World Investment Report: Global Value Chains: Investment and Trade for Development* New York, Geneva

Appendix 2.2

A Note on Special Purpose Entities and Pass-Through Investment

There is a lack of data on SPEs as most countries do not collect these specifically. There have been some attempts to establish criteria for the identification of such companies. The Eurostat task force on the recording of certain activities of multinationals in national accounts (2009) reproduced a decision tree used by the Dutch central bank (De Nederlandsche Bank) to help identify SPEs. This identifies SPEs as entities without a physical presence, incorporated in the host economy, and majority foreign controlled.[169] Also, more recently, OECD (2012:12) lists the criteria for identification of an SPE:

- It is a legal entity
- It is directly or indirectly ultimately owned by a non-resident parent
- It has no or few employees, little or no production in the host economy and little or no physical presence
- Almost all its assets and liabilities represent investments to or from abroad
- Its core business is group financing or holding activities i.e. channelling funds between non-residents. Managing and directing local operations is minor.

The main categories of SPEs also have been listed by UNECE (2011) as financing and holding companies, royalty and licence companies, entities invoicing the sales of the worldwide company on behalf of the (non-resident) parent, leasing companies, and Dutch Special Purpose Vehicles (SPVs) created to securitise bank assets.

SPEs do not fall neatly within any one activity in the NACE classification as they can belong in a number of activity classes, and tend to be classified as SPEs according to their structure rather than their main activity. The ECB/Eurostat (2004) task force report on FDI attempts to identify potentially 'SPE hosting' sectors. This analysis is rather limited as there is no information about the level of SPE-intensity of any of these sectors. These sectors were identified either according to the company structure (holding companies and regional headquarters) or by the purpose of the activity (such as various financial activities). Eurostat (2009) also drew up a table of the sectors based on national case studies. These were more extensive than the sectors suggested in ECB/Eurostat (2004) including financial leasing and renting and leasing of machinery for example. These case studies showed that a common characteristic of SPEs was the high value of stocks compared with their employment and their physical structure (Eurostat 2009). OECD (2012) looks at the difficulties arising from attempts to sectorally classify head offices, holding companies, and

[169] The main indicator of physical presence is a sufficient level of employment compared to balance sheet value and/or transaction values. If employment exists in the SPE, typical ratios can be derived by type of activity for the country.

SPEs in line with the 2008 *System of National Accounts* and the 2010 *European System of Accounts*.

As SPEs may be used for pass-through investments (investment from country X to Y via country Z) and round-tripping of investment (domestic investment by country X in X but passing-through another country as a 'stepping stone'), their increased use is likely to inflate the FDI statistics. Their use will overstate the amount of 'real' investment in economies and distort the geographical and sectoral sources and destinations of FDI. 'Immediate' sources and destinations of investments are generally recorded in the FDI statistics rather than the 'ultimate' sources and destinations. Funds can come from a number of countries and companies into an SPE and out again. As UNECE (2011:45) point out: "an MNE may create many SPEs in different countries and channel funds through a succession of them to a non-SPE counterpart". According to ECB/Eurostat (2004) the concept of 'few or no local operations' is the one that tallies best with national definitions in member states including Denmark, the Netherlands, and to a lesser extent, Ireland.[170]

In their study on German FDI, Mintz and Weichenreider (2010) argue that the parallel increase over time in inward and outward FDI for some small host countries can be attributed to the increased use of conduit entities. They point out that FDI often involves complex ownership chains commonly containing holding companies. Three type of holding operations are distinguished: A 'country holding' where operations in a foreign country are held under one 'umbrella' in that country, or an entity set up in the home country specifically to control a foreign operation, or a 'conduit entity' which are holding companies located in third countries (Mintz and Weichenreider, 2010). In a similar analysis, Mintz (2004) compares total inflows and outflows for 'major countries' as a percentage of GDP, averaged for 1997-2001, and finds that the five top countries were Belgium-Luxembourg, Hong Kong, the Netherlands, Sweden, and Ireland. [171] Largely because of their tax regimes, Mintz (2004) argues that these, with the possible exception of Sweden, can be considered conduit countries. As the macro FDI data give no information about what ownership chains look like in practice and about the importance of indirect financing structures compared to direct financing structures, Mintz and Weichenreider (2010) use micro data from the Deutsche Bundesbank's *MiDi* database in their analysis.[172]

[170] A tax amendment in 2001 reduced the share of pass-through investment in Danish FDI (Carlsen and Jensen, 2008).
[171] For this period, Belgium and Luxembourg had a common Balance of Payments.
[172] For a discussion on the *MiDi* database see Lipponer, Alexander (2003) 'A 'New' Micro Database for German FDI' in Hermann, Heinz and Robert Lipsey (eds) *Foreign Direct Investment in the Real and Financial Sector of Industrial Countries* Springer

Mintz and Weichenreider (2010) find that 'typical tax havens' were not important locations for conduit entities for German outward FDI and conclude that this is due to the lack of double tax treaties between these and Germany.[173] The most important conduit countries for outward FDI are found to be the Netherlands, Switzerland, Austria, the US, the UK, and France (in that order).[174] For inward FDI into Germany, Mintz and Weichenreider (2010) find that conduit entities became more important not simply on head count, as was the case for outward FDI, but also in value terms. Again the Netherlands was the main conduit country in head count, although second to Luxembourg (acting as a conduit for investments from the UK) in value terms. Holding companies in offshore tax haven countries are found again to be relatively unimportant, with the exception of the Cayman Islands (Mintz and Weichenreider, 2010).

In Ireland, it is thought that many conduit entities are established under International Financial Services Centre (IFSC) legislation. The IFSC was originally established under specific legislation in 1987 (Grimes, 2006; Fitzpatrick, 2008) and firms were originally eligible for a special corporation tax rate of 10 per cent. To qualify, companies had to be approved and certified. This rate ended at the end of 2002, removing the tax distinction between IFSC companies and non-IFSC companies. The low rate, however, continued to be applied until 2005 for companies that had been established prior to 1998. Originally, companies were required to be based geographically in the specific IFSC area but this changed from the beginning of 2000 when new international financial service projects were able to locate anywhere in Ireland (CSO, 2012). Accordingly, the Irish Central Statistics Office (CSO) counts the activities of all international financial service enterprises as 'IFSC' regardless of their actual location in Ireland.

REFERENCES

Carlsen, M and A. Jensen (2008) 'Globalisastion and Danish Direct Investments' *Monetary Review 2nd Quarter*, Danmarks Nationalbank, 31-66

Central Statistics Office, CSO (2012) *Balance of Payments Quarter 4 and Year 2011* March

ECB/Eurostat (2004) *Foreign Direct Investment Task Force Report*

Eurostat (2009) *Task Force on the Recording of Certain Activities of Multinationals in National Accounts: Final Report* (17th Meeting of the GNI Committee 7-8 July 2009, Luxembourg). Available at

[173] They cite Bermuda, Barbados, the Cayman Islands, and the Bahamas as examples.
[174] They found that Switzerland was the leading host for conduit entities for German outward investment in the beginning of the 1990s but was overtaken by the Netherlands towards the end of the 1990s.

http://www.unece.org/fileadmin/DAM/stats/groups/wggna/Report_TF_recording_activities_multinationals_national_accounts.pdf)

Fitzpatrick, J (2008) 'Dealing with Complex and Changing Company Structures and Trading Practices in Compiling Foreign Direct Investment and Balance Of Payments Related Statistics in Ireland' in *Economic and Globalisation: A Challenge for Official Statistics Proceedings of the 2007 Joint EFTA/UNECE/SSCU Seminar 2007*, United Nations Economic Commission For Europe (UNECE), New York and Geneva
Available at
http://www.unece.org/fileadmin/DAM/stats/publications/Economic%20globalization.pdf

Grimes, S (2006) 'Ireland's Emergence as a Centre for Internationally Traded Services' *Regional Studies, 40* (9), 1041-1054

Mintz, J. (2004) 'Conduit Entities: Implications of Indirect Tax-Efficient Financing Structures for Real Investment' *International Tax and Public Finance 11*, 419-434.

Mintz, J. and A.Weichenrieder (2010) *The Indirect Side of Direct Investment* CESifo Book Series, MIT

OECD (2012) 'Holdings, Head Offices and SPEs: Issues and Way Forward' Working Party on International Trade in Goods and Trade in Services Statistics, note written by M. Chavoix-Mannato and S.Hagino. Available at
http://search.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=STD/TBS/WPTGS%282012%2919&docLanguage=En

UNECE (2011) *The Impact of Globalization on National Accounts* United Nations, New York and Geneva. Available at
http://www.unece.org/fileadmin/DAM/stats/publications/Guide_on_Impact_of_globalization_on_national_accounts__web_.pdf

Appendix 2.3

Pitfalls in the Use of FDI Data to Proxy for MNC Activity Data

FDI data are often used to proxy for MNC activity data because the latter are much less widely available and their measurement has lacked standardisation. In contrast, balance-of-payments data are widely reported and there are international standards for their compilation so they are more common in empirical work. Although Clegg (1992) describes the balance-of-payments FDI data and MNC activity data as 'two sides of the same coin', there are a number of reasons why balance-of-payments FDI data cannot serve as a good proxy for the activities of MNCs:

First, FDI measures the flows and stocks of investment into firms which are (generally) at least 10 per cent foreign owned whereas activity data usually pertain to firms that are majority foreign-owned. The difference in coverage may be small, however, as in many cases FDI holdings are majority owned (Lane and Milesi-Ferretti, 2007) - often 100 per cent owned. This 10 per cent rule is what usually distinguishes FDI from portfolio investment, although there is also an expectation of a lasting interest and sometimes also involvement in management. It is not necessary therefore that this investment be undertaken by a large MNC, as is usually assumed to be the case. Many cross-border venture capital deals, for example, qualify as FDI (OECD, 2000).

Secondly, activity data are typically based on the nationality of ultimate ownership of firms while balance-of-payments data are based on the immediate source and destination of investment funds. These are often not the same, at least partially because of the widespread use of conduit entities in third countries. This leads to a particular difficulty with using geographically and sectorally disaggregated data. This is further complicated by the increased role of intangible assets (such as copyright or patents) which can enable the manipulation of the value and location of production for tax and legal reasons (Lipsey 2010).

Thirdly, the balance-of-payments FDI data may bear little relationship to the actual size of investments because of how they are constructed. FDI flows are measured as the sum of three elements: equity from the parent company, intra-company loans and reinvested earnings (RIE). The behaviour of each of these individual elements reflects complex firm-specific and country-specific factors. Furthermore, investments funded through equity or debt issues in the host-economy or on international capital markets, or through equity contributed by local partners in non-wholly owned foreign affiliates, are not included as

FDI. The elements included within each of these components can vary. The difficulties in recording RIE, in particular, have led to their omission or approximation in many instances. While Dunning and Lundan (2008) suggest that FDI should be considered the lower bound of MNC investment, the size of RIE can be inflated if transfer pricing overvalues goods and services (Bellak and Leibrecht, 2009) and the FDI data can also overstate the size of investments when it is simply passing through conduit entities. FDI data have been described by Devereux and Griffith (2002:86) as "at best a noisy measure of multinational activity". They argue that FDI is not the same as foreign 'real investment' for other reasons too. Investment that finances Mergers and Acquisitions (M&A), for example, may not add to the productive capacity of the host economy. Bisciari and Piette (2007) also point out that the FDI data (in common with activity data) do not distinguish between M&A and greenfield investment. On the other hand, 'domestic' real investment may be financed by Foreign Portfolio Investment (FPI).

Furthermore, the operation of taxation systems can influence the composition of FDI, affecting the extent of reverse investment and RIE, for example. This leads to inaccurate cross-country comparisons and also affects aggregate results obtained from a panel or cross-section dataset which pools a number of countries, particularly mixing countries at different stages of development and history of FDI. Studies across time are also affected as methodologies and the importance of the various issues vary over time. Because of the variability of these effects, Beugelsdijk et al (2010) argue that FDI is not just an inaccurate measure of MNC activity, but also a biased measure.

REFERENCES

Bellak, C. and M. Leibrecht (2009) 'Do Low Corporate Income Tax Rates Attract FDI?–Evidence from Central-and East European Countries' *Applied Economics*, *41*(21), 2691-2703

Beugelsdijk, S., J. Hennart, A. Slangen and R. Smeets (2010) 'Why and How FDI Stocks are a Biased Measure of MNE Affiliate Activity' *Journal of International Business Studies*, *41*(9), 1444-1459

Bisciari, P. and C.H. Piette (2007) 'Direct investment and Belgium's attractiveness' in *Economic Review*, National Bank of Belgium, June

Clegg, J. (1992) 'Explaining Foreign Direct Investment Flows' in Buckley, P and M Casson (eds) *Multinational Enterprises in the World Economy* Edward Elgar, Cheltenham

Devereux, M. and R. Griffith (2002) 'The Impact of Corporate Taxation on the Location of Capital: A Review' *Swedish Economic Policy Review, 9*, 79-102

Dunning, J. and S. Lundan (2008) *Multinational Enterprises and the Global Economy,* 2nd ed. Edward Elgar, Cheltenham

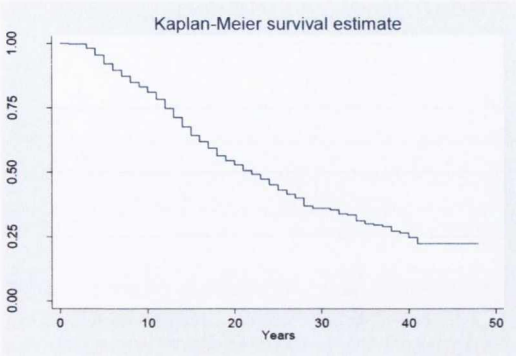
Lipsey, R. (2010) 'Measuring the Location of Production in a World of Intangible Productive Assets, FDI, and Intrafirm Trade' *Review of Income and Wealth*, *56*(s1), S99-S110

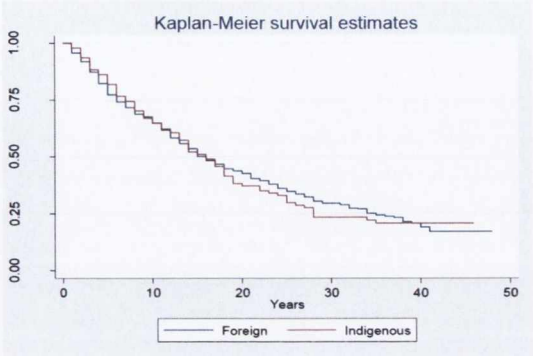
OECD (2000) *The Internationalisation of Venture Capital Activity in OECD Countries: Implications for Measurement and Policy.* Directorate for Science, Technology and Industry, DSTI/DOC (2000)7

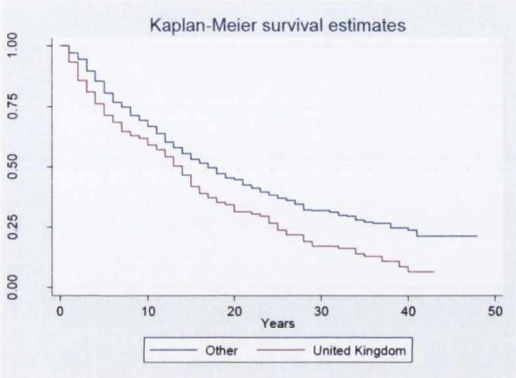
Appendix 3.1

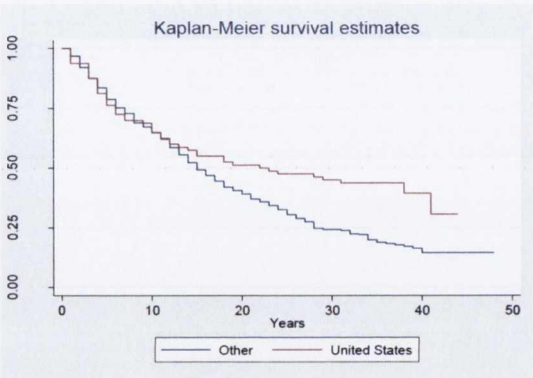
New Grant-Aided Plants: Additional Graphs

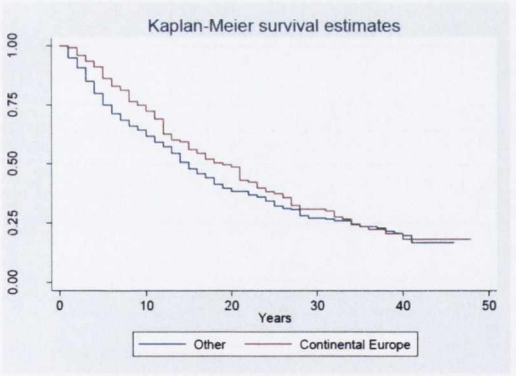
Kaplan-Meier Graphs for All Plants and by Home Regions:

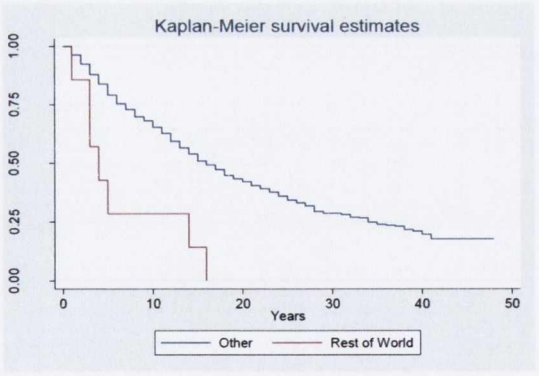




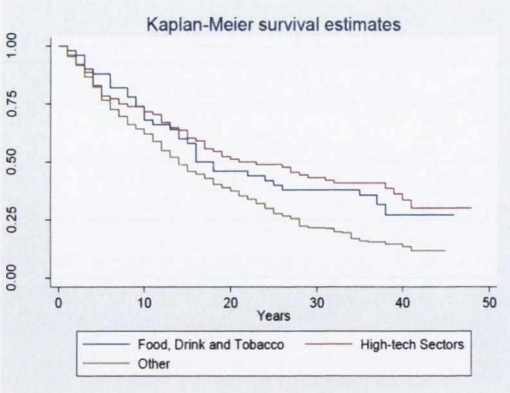


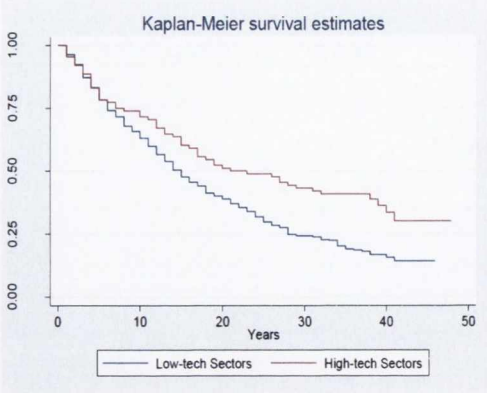


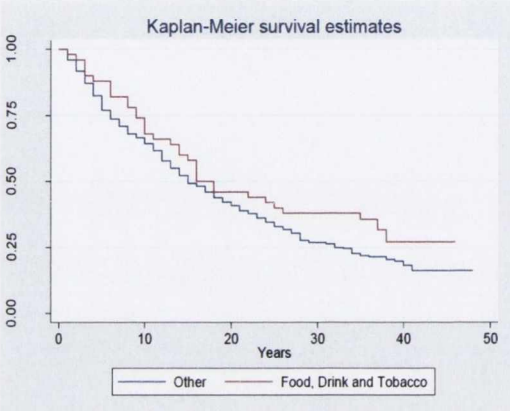


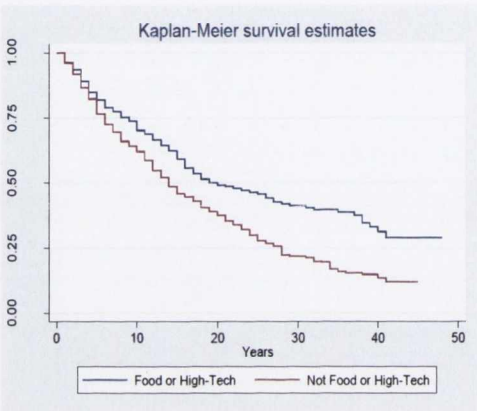


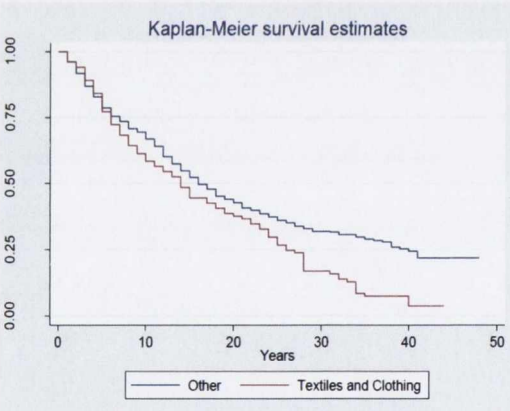
Kaplan-Meier Graphs for Main Sectors:

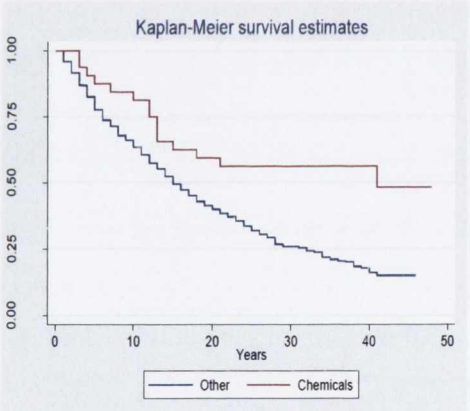




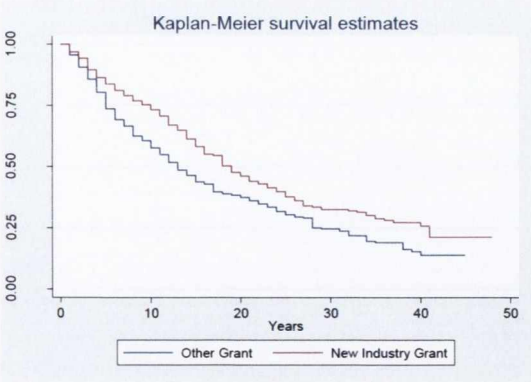


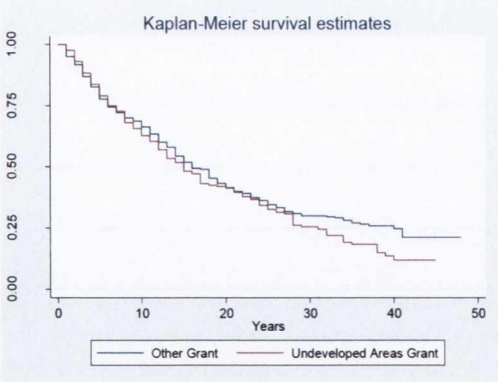


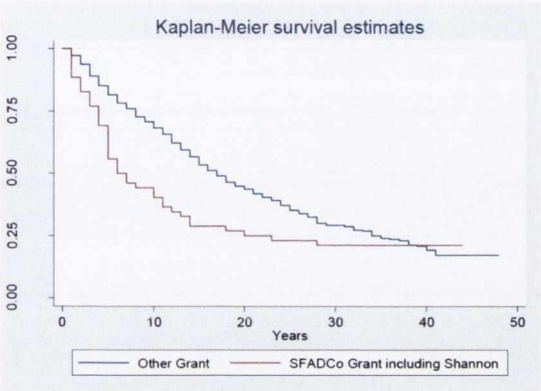


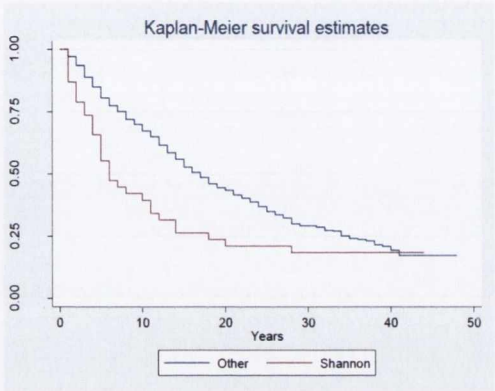


Kaplan-Meier Graphs for Grant-Type:

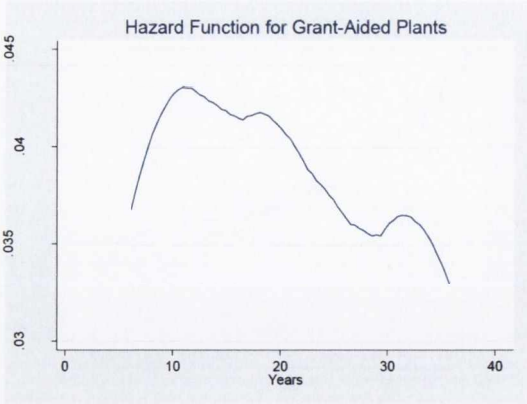


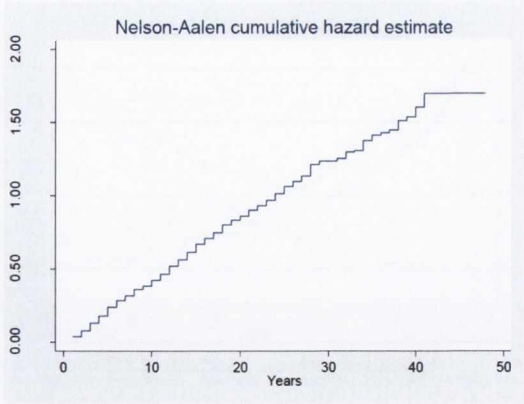




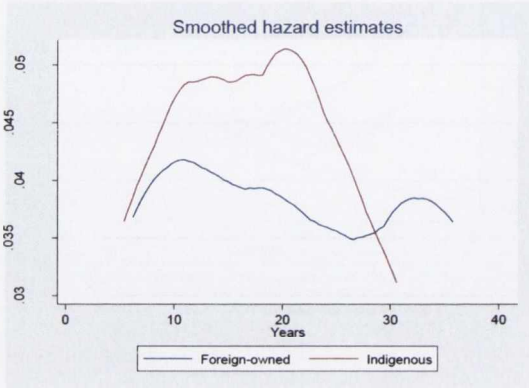


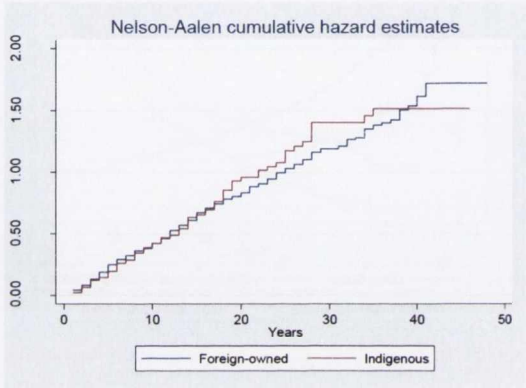
Hazard Functions for All Plants:



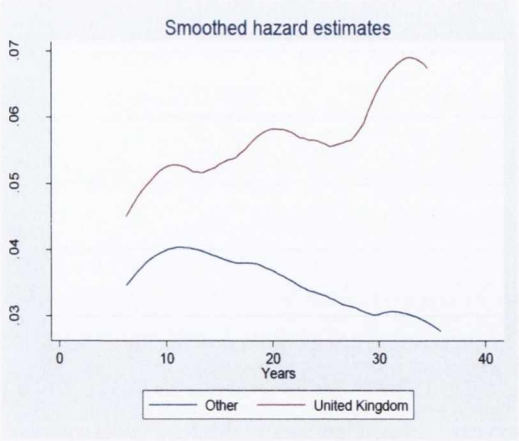


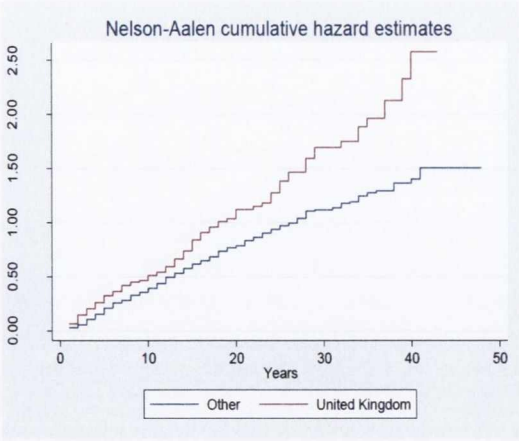
Hazard Functions for Indigenous and Foreign-Owned Plants:

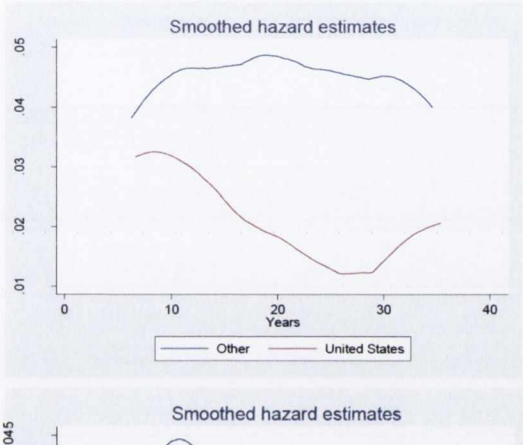


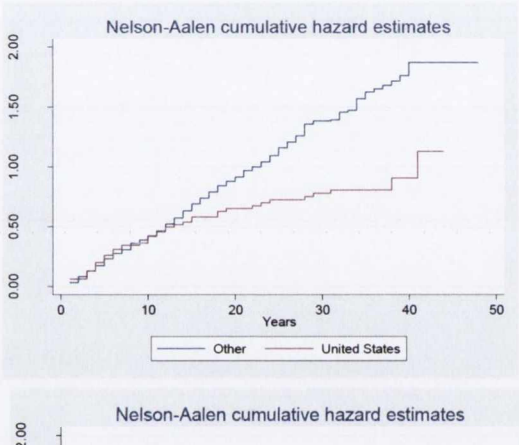


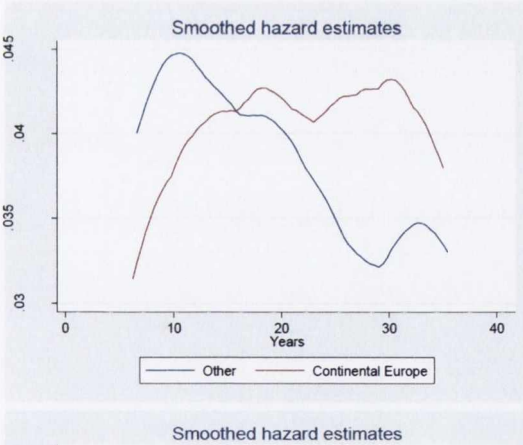
Hazard Functions by Main Home Region:

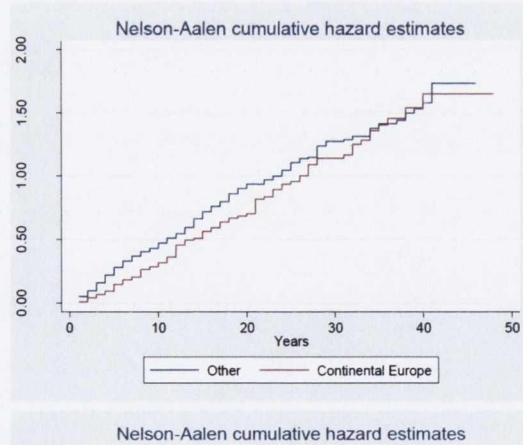


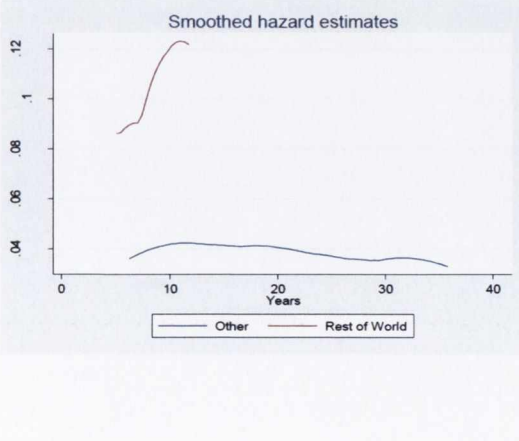


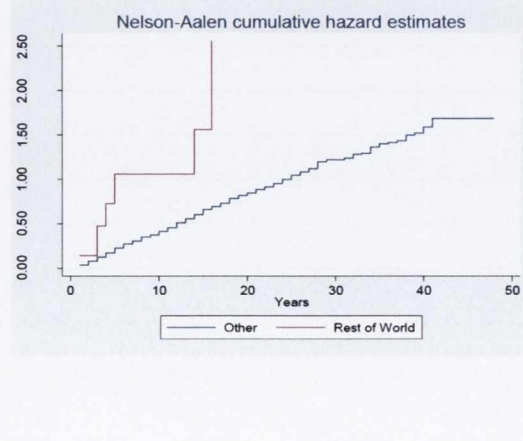




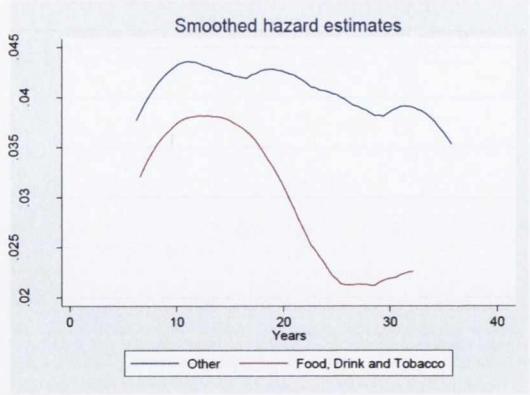


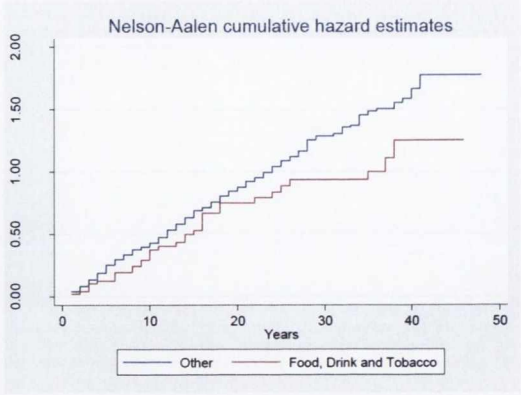


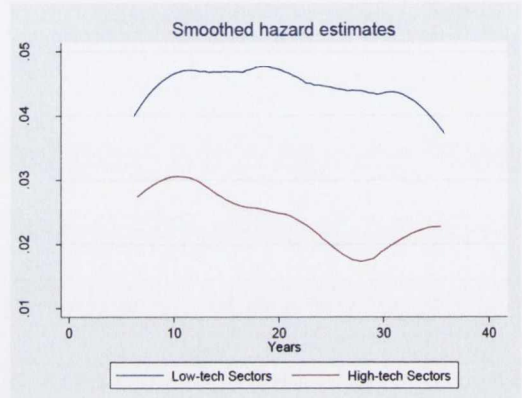


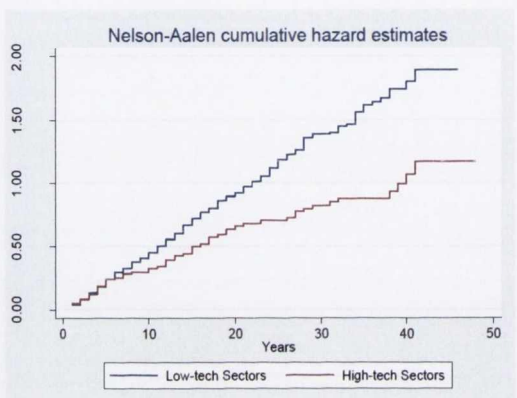


Hazard Functions by Broad Sector:

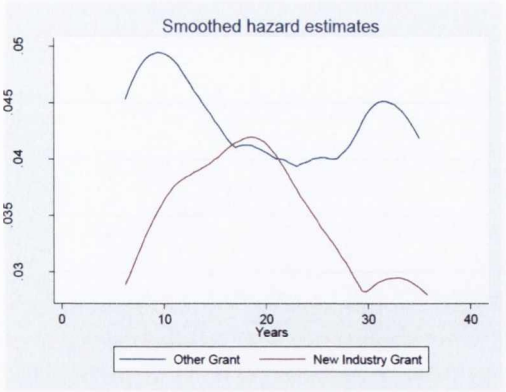


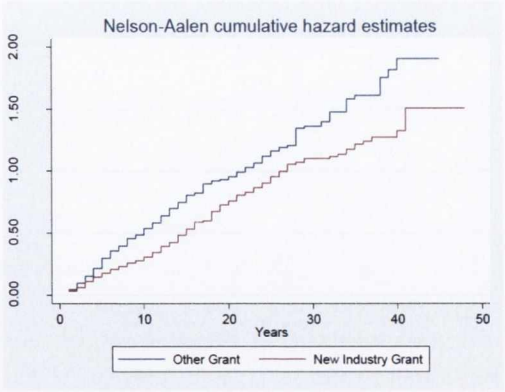


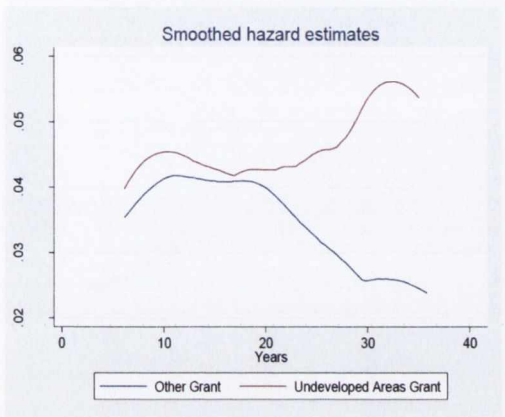


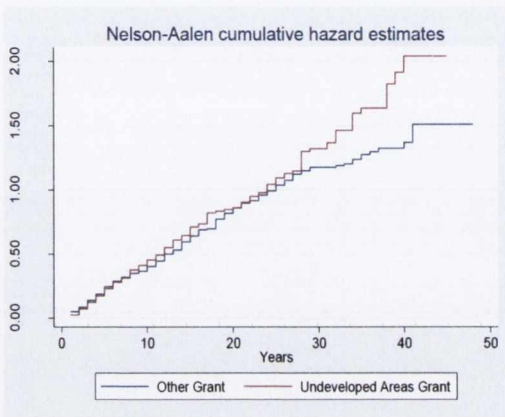


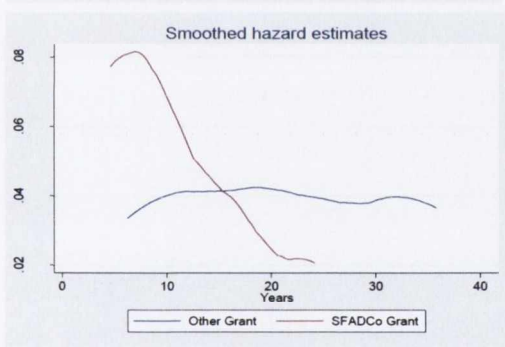
Hazard Functions by Grant-Type:

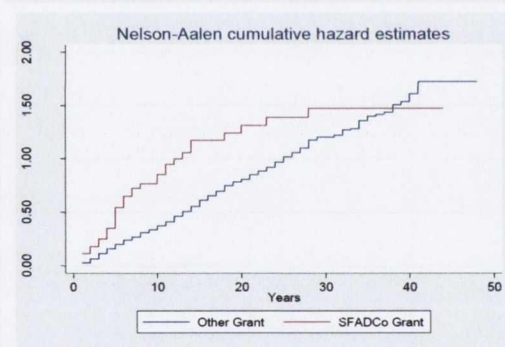




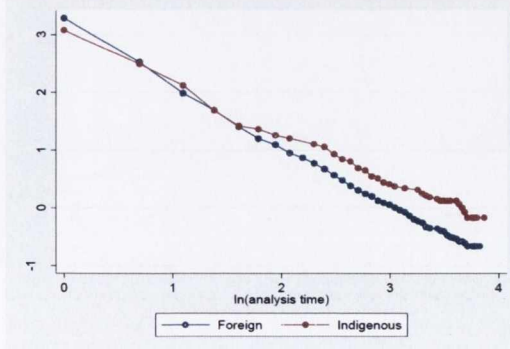


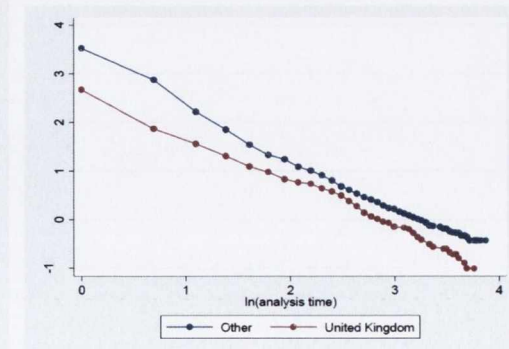


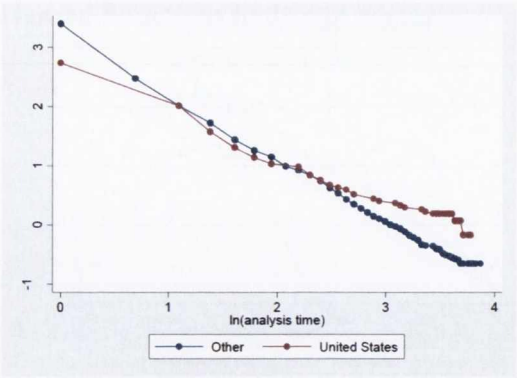


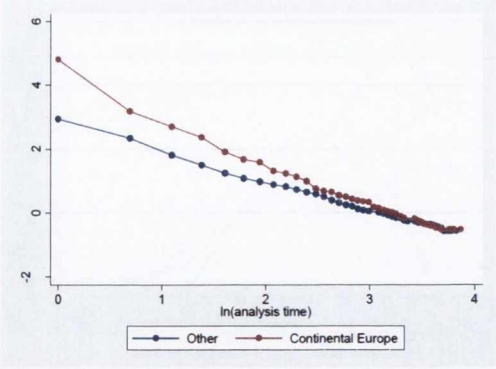


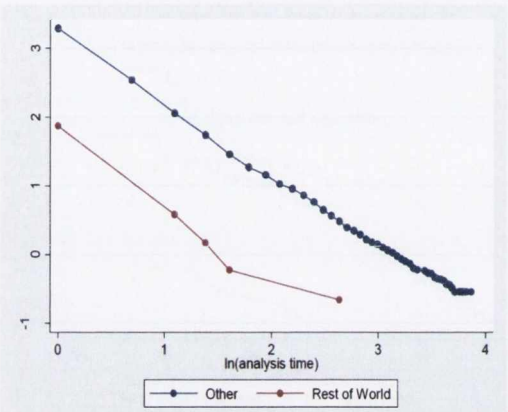
Log-log Graphs (Further Graphical Checks on Proportional Hazards):

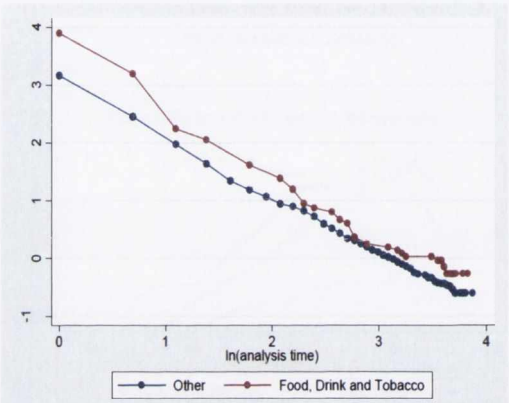


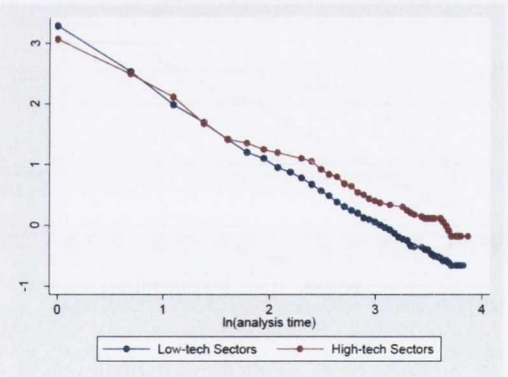


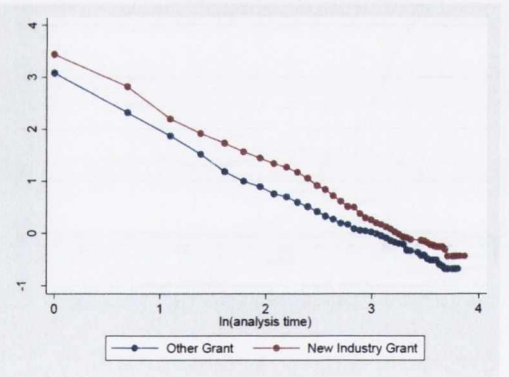

ln(analysis time)
Other
United States

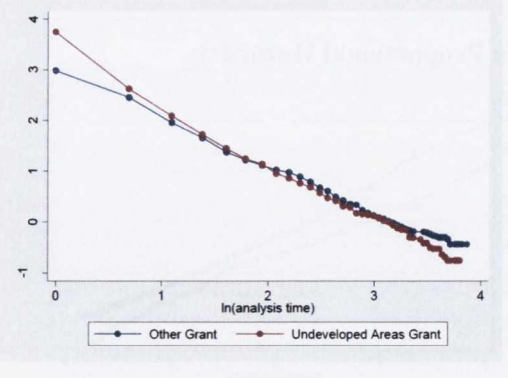

ln(analysis time)
Other
Continental Europe

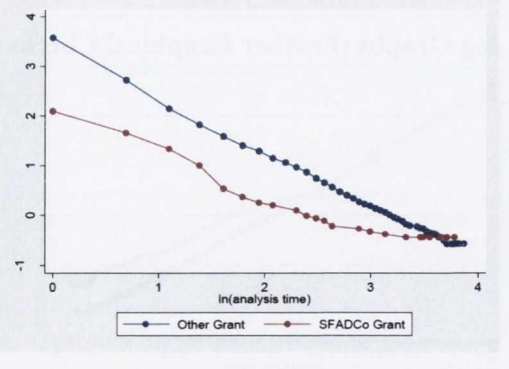

ln(analysis time)
Other
Rest of World


ln(analysis time)
Other
Food, Drink and Tobacco


ln(analysis time)
Low-tech Sectors
High-tech Sectors


ln(analysis time)
Other Grant
New Industry Grant


ln(analysis time)
Other Grant
Undeveloped Areas Grant


ln(analysis time)
Other Grant
SFADCo Grant

Appendix 3.2

New Grant-Aided Manufacturing Establishments 1955-1972 Database

ID	Nationality	Nace 2-Digit	Grant Type	Year of Entry	Year of Exit
1	Spain	25	Undeveloped Areas	1969	1971
2	United Kingdom	29	Undeveloped Areas	1961	1969
3	United States	36	Undeveloped Areas	1972	2001
4	Germany	36	New Industry	1955	1991
5	Germany	29	New Industry	1972	NA
6	United States	36	SFADCo	1969	1974
7	United Kingdom	15	New Industry	1972	1996
8	United Kingdom	15	Undeveloped Areas	1971	NA
9	United Kingdom	17	Undeveloped Areas	1969	1971
10	Germany	28	New Industry	1962	1983
11	United Kingdom	17	Undeveloped Areas	1969	1972
12	Germany	18	Undeveloped Areas	1963	1968
13	United States	24	New Industry	1971	NA
14	United Kingdom	29	New Industry	1969	1971
15	United Kingdom	18	Undeveloped Areas	1970	1971
16	United Kingdom	18	Undeveloped Areas	1970	1975
17	United Kingdom	28	New Industry	1964	1989
18	Germany	28	Undeveloped Areas	1969	2001
19	Austria	33	Undeveloped Areas	1963	2001
20	United Kingdom	18	New Industry	1968	1991
21	Italy	25	Undeveloped Areas	1971	1983
22	United Kingdom	24	Undeveloped Areas	1959	1969
23	Denmark	15	Undeveloped Areas	1958	1961
24	United Kingdom	15	New Industry	1968	NA
25	Ireland	20	New Industry	1971	1980
26	United States	29	SFADCo	1969	NA
27	Ireland	28	Undeveloped Areas	1971	1988
28	United Kingdom	18	Undeveloped Areas	1972	1998
29	United States	28	New Industry	1969	1981
30	United Kingdom	20	Undeveloped Areas	1969	1981
31	Chile	24	Undeveloped Areas	1972	1975
32	Ireland	28	New Industry	1969	1994
33	Denmark	28	Undeveloped Areas	1956	1984
34	Switzerland	25	New Industry	1969	1987
35	United States	33	Undeveloped Areas	1972	NA
36	United States	33	New Industry	1970	NA
37	United States	33	New Industry	1964	NA
38	Ireland	17	New Industry	1962	1980
39	Germany	15	Undeveloped Areas	1963	1973
40	Netherlands	17	New Industry	1972	1984
41	Ireland	15	Undeveloped Areas	1969	1972
42	Netherlands	15	Undeveloped Areas	1971	NA
43	United Kingdom	17	Undeveloped Areas	1969	2003
44	United Kingdom	18	New Industry	1972	1975
45	Italy	18	Undeveloped Areas	1969	1977
46	Ireland	17	New Industry	1970	1983
47	Ireland	28	New Industry	1968	1976
48	United Kingdom	17	SFADCo	1967	1981
49	Ireland	34	New Industry	1959	1986
50	Germany	24	New Industry	1971	NA
51	United States	36	SFADCo	1965	1976
52	United Kingdom	17	Undeveloped Areas	1968	1973
53	Ireland	15	Undeveloped Areas	1960	1974
54	Ireland	15	Undeveloped Areas	1971	NA
55	Ireland	15	Undeveloped Areas	1969	NA
56	United Kingdom	34	New Industry	1959	1962
57	United Kingdom	15	New Industry	1968	NA

ID	Nationality	Nace 2-Digit	Grant Type	Year of Entry	Year of Exit
58	Ireland	15	Undeveloped Areas	1967	1975
59	Ireland	15	New Industry	1969	1976
60	Netherlands	17	New Industry	1969	1993
61	Canada	17	New Industry	1969	2003
62	Germany	28	Undeveloped Areas	1962	1977
63	United Kingdom	25	New Industry	1964	1993
64	France	15	Undeveloped Areas	1965	1980
65	United States	36	New Industry	1967	1977
66	Germany	26	Undeveloped Areas	1962	1983
67	France	23	Undeveloped Areas	1969	NA
68	Germany	20	Undeveloped Areas	1960	1984
69	Ireland	17	New Industry	1969	1988
70	United Kingdom	18	Undeveloped Areas	1971	1993
71	United Kingdom	28	Undeveloped Areas	1970	1972
72	United States	17	SFADCo	1970	1980
73	Ireland	15	New Industry	1963	1998
74	Ireland	24	New Industry	1971	NA
75	Italy	17	New Industry	1962	1973
76	Germany	28	New Industry	1960	1981
77	United Kingdom	28	New Industry	1956	1985
78	Germany	17	Undeveloped Areas	1962	1968
79	Canada	30	SFADCo	1963	1967
80	United States	28	Undeveloped Areas	1967	NA
81	Ireland	25	New Industry	1965	1976
82	United Kingdom	24	New Industry	1961	NA
83	United Kingdom	18	SFADCo	1969	1976
84	United Kingdom	22	New Industry	1960	1976
85	United States	29	Undeveloped Areas	1961	NA
86	Netherlands	15	New Industry	1964	1980
87	United Kingdom	28	New Industry	1969	1977
88	Germany	17	Undeveloped Areas	1956	1990
89	United Kingdom	18	SFADCo	1969	1974
90	United Kingdom	29	SFADCo	1969	1970
91	Germany	33	Undeveloped Areas	1966	1983
92	United States	24	SFADCo	1965	NA
93	United States	30	Undeveloped Areas	1971	1994
94	United Kingdom	17	New Industry	1969	1976
95	Ireland	17	Undeveloped Areas	1956	1984
96	Ireland	18	Undeveloped Areas	1955	1983
97	United Kingdom	18	Undeveloped Areas	1967	1999
98	United States	26	New Industry	1968	NA
99	Netherlands	16	New Industry	1967	NA
100	Ireland	34	New Industry	1971	NA
101	Ireland	25	Undeveloped Areas	1956	1966
102	United States	31	SFADCo	1963	NA
103	Ireland	15	New Industry	1966	1984
104	United States	31	New Industry	1966	NA
105	Germany	15	New Industry	1961	1962
106	United Kingdom	18	Undeveloped Areas	1969	1984
107	Germany	31	New Industry	1965	1967
108	France	28	New Industry	1967	1982
109	Germany	31	New Industry	1971	1987
110	United Kingdom	17	Undeveloped Areas	1969	1984
111	Ireland	17	New Industry	1962	1967
112	Ireland	15	Undeveloped Areas	1962	1966
113	Canada	21	Undeveloped Areas	1960	1992
114	United Kingdom	26	New Industry	1971	1974
115	United Kingdom	22	New Industry	1966	1984
116	Ireland	15	Undeveloped Areas	1964	1966
117	France	24	New Industry	1956	NA
118	Ireland	36	Undeveloped Areas	1970	1987
119	Ireland	15	Undeveloped Areas	1968	1971
120	United States	17	New Industry	1970	1971
121	Ireland	15	Undeveloped Areas	1966	1982

ID	Nationality	Nace 2-digit	Grant Type	Year of Entry	Year of Exit
122	United States	27	SFADCo	1969	1972
123	United Kingdom	29	New Industry	1968	1970
124	Netherlands	28	SFADCo	1972	1977
125	Germany	17	Undeveloped Areas	1966	1970
126	Germany	36	Undeveloped Areas	1962	1982
127	France	15	Undeveloped Areas	1967	1976
128	United States	22	New Industry	1972	NA
129	United Kingdom	22	New Industry	1970	1984
130	United Kingdom	18	Undeveloped Areas	1958	1967
131	United Kingdom	24	New Industry	1969	1982
132	United States	25	SFADCo	1969	NA
133	United Kingdom	17	Undeveloped Areas	1970	1972
134	United Kingdom	31	New Industry	1959	1978
135	United Kingdom	18	Undeveloped Areas	1962	1997
136	Germany	28	New Industry	1971	NA
137	United States	17	Undeveloped Areas	1957	1981
138	Switzerland	17	Undeveloped Areas	1961	1986
139	Germany	29	Undeveloped Areas	1971	1978
140	United Kingdom	31	Undeveloped Areas	1955	1994
141	France	25	Undeveloped Areas	1969	NA
142	United Kingdom	15	Undeveloped Areas	1966	1982
143	Ireland	26	Undeveloped Areas	1971	1976
144	United Kingdom	15	New Industry	1966	1976
145	Ireland	15	New Industry	1964	NA
146	United Kingdom	19	New Industry	1968	1972
147	United States	33	SFADCo	1965	NA
148	Ireland	18	New Industry	1970	1976
149	United States	28	SFADCo	1972	1977
150	Ireland	17	New Industry	1969	1983
151	United Kingdom	17	Undeveloped Areas	1957	1972
152	Germany	28	Undeveloped Areas	1960	NA
153	Germany	24	New Industry	1967	NA
154	United States	22	New Industry	1959	2000
155	United States	36	SFADCo	1968	1974
156	United States	29	Undeveloped Areas	1963	2001
157	Germany	18	New Industry	1967	1993
158	Netherlands	17	New Industry	1971	1992
159	United States	26	Undeveloped Areas	1968	1969
160	Germany	29	New Industry	1964	1976
161	United Kingdom	18	Undeveloped Areas	1970	1975
162	United Kingdom	17	Undeveloped Areas	1965	1990
163	Germany	36	Undeveloped Areas	1963	1984
164	United Kingdom	24	New Industry	1961	1964
165	Amercan	17	Undeveloped Areas	1973	NA
166	Germany	18	Undeveloped Areas	1965	1977
167	United States	33	SFADCo	1972	NA
168	United States	33	Undeveloped Areas	1969	1970
169	Ireland	28	New Industry	1972	1973
170	France	25	Undeveloped Areas	1963	1975
171	Ireland	17	New Industry	1966	NA
172	Ireland	15	New Industry	1972	1986
173	United States	32	SFADCo	1962	1963
174	United Kingdom	17	New Industry	1958	1998
175	United States	31	SFADCo	1967	1977
176	Germany	18	Undeveloped Areas	1965	1992
177	United States	36	SFADCo	1959	1960
178	Ireland	15	New Industry	1956	1981
179	France	29	New Industry	1970	1978
180	Italy	36	SFADCo	1972	1975
181	United Kingdom	24	Undeveloped Areas	1971	1986
182	United Kingdom	24	SFADCo	1968	1981
183	United Kingdom	24	SFADCo	1967	1971
184	Germany	34	New Industry	1965	NA

ID	Nationality	Nace 2-digit	Grant Type	Year of Entry	Year of Exit
185	Netherlands	36	Undeveloped Areas	1969	1977
186	France	24	New Industry	1965	1983
187	Germany	18	New Industry	1964	1975
188	Ireland	26	New Industry	1969	NA
189	Ireland	26	Undeveloped Areas	1968	1981
190	United Kingdom	28	New Industry	1970	1982
191	Ireland	15	Undeveloped Areas	1963	1971
192	United Kingdom	15	New Industry	1969	1980
193	Ireland	15	Undeveloped Areas	1956	1962
194	France	24	New Industry	1967	NA
195	Denmark	28	Undeveloped Areas	1956	1979
196	Ireland	20	Undeveloped Areas	1966	NA
197	United Kingdom	29	SFADCo	1965	1966
198	Germany	28	Undeveloped Areas	1965	1978
199	Switzerland	28	New Industry	1967	NA
200	United Kingdom	20	Undeveloped Areas	1960	1971
201	Germany	17	Undeveloped Areas	1963	1977
202	United Kingdom	25	Undeveloped Areas	1969	NA
203	United States	28	New Industry	1970	1985
204	Germany	25	Undeveloped Areas	1962	2002
205	Ireland	22	SFADCo	1968	1974
206	Sweden	29	SFADCo	1967	1969
207	United States	33	New Industry	1960	1963
208	Ireland	29	Undeveloped Areas	1961	1968
209	United States	28	Undeveloped Areas	1971	1977
210	Ireland	19	Undeveloped Areas	1973	1984
211	United Kingdom	17	Undeveloped Areas	1958	1962
212	Ireland	22	New Industry	1965	NA
213	United States	28	New Industry	1965	NA
214	Germany	28	Undeveloped Areas	1961	NA
215	Canada	18	SFADCo	1972	1980
216	United States	28	Undeveloped Areas	1969	1973
217	Germany	17	Undeveloped Areas	1961	1989
218	France	25	New Industry	1966	1992
219	Ireland	28	New Industry	1962	1964
220	United Kingdom	18	New Industry	1968	1988
221	United Kingdom	18	Undeveloped Areas	1967	1995
222	Ireland	15	Undeveloped Areas	1968	NA
223	United Kingdom	15	New Industry	1965	2002
224	Ireland	15	Undeveloped Areas	1963	NA
225	Germany	19	Undeveloped Areas	1966	1974
226	Germany	28	Undeveloped Areas	1961	1983
227	United Kingdom	18	New Industry	1958	1983
228	France	15	Undeveloped Areas	1958	1966
229	United States	18	Undeveloped Areas	1960	1974
230	United States	18	New Industry	1967	1974
231	United States	18	Undeveloped Areas	1970	1974
232	United States	18	Undeveloped Areas	1970	1974
233	Germany	24	Undeveloped Areas	1972	NA
234	Ireland	17	Undeveloped Areas	1969	1982
235	Germany	29	New Industry	1964	1999
236	United States	25	SFADCo	1972	NA
237	United States	18	SFADCo	1960	1988
238	United States	15	New Industry	1960	NA
239	United Kingdom	18	New Industry	1971	1986
240	Denmark	24	New Industry	1960	NA
241	Ireland	15	New Industry	1969	NA
242	Germany	29	Undeveloped Areas	1959	NA
243	Germany	28	Undeveloped Areas	1971	NA
244	United Kingdom	18	Undeveloped Areas	1969	1975
245	Ireland	17	Undeveloped Areas	1969	NA
246	Denmark	28	New Industry	1971	NA
247	Germany	24	New Industry	1961	NA
248	Ireland	28	Undeveloped Areas	1969	1997

ID	Nationality	Nace 2-digit	Grant Type	Year of Entry	Year of Exit
249	United Kingdom	17	Undeveloped Areas	1972	2000
250	Ireland	17	Undeveloped Areas	1970	1979
251	Ireland	17	Undeveloped Areas	1955	1977
252	United Kingdom	17	Undeveloped Areas	1970	1977
253	Ireland	28	Undeveloped Areas	1972	1977
254	United States	36	Undeveloped Areas	1972	1985
255	United Kingdom	15	Undeveloped Areas	1960	1986
256	United Kingdom	24	New Industry	1961	1974
257	France	17	New Industry	1970	1979
258	United Kingdom	15	Undeveloped Areas	1963	1976
259	Ireland	35	New Industry	1972	1983
260	United Kingdom	30	SFADCo	1970	1971
261	Ireland	24	Undeveloped Areas	1966	NA
262	Ireland	25	Undeveloped Areas	1963	1980
263	Germany	27	New Industry	1971	1994
264	United Kingdom	26	New Industry	1961	NA
265	United Kingdom	18	Undeveloped Areas	1962	1972
266	Germany	31	Undeveloped Areas	1969	2001
267	United States	28	SFADCo	1963	NA
268	United States	31	SFADCo	1971	NA
269	Germany	28	New Industry	1967	1972
270	United Kingdom	18	Undeveloped Areas	1964	1988
271	South Africa	28	New Industry	1963	1966
272	United Kingdom	17	New Industry	1969	1970
273	Ireland	26	New Industry	1969	1983
274	United Kingdom	17	New Industry	1968	NA
275	Ireland	19	New Industry	1964	1990
276	Germany	31	New Industry	1971	1975
277	Ireland	20	New Industry	1963	1979
278	Canada	35	New Industry	1968	NA
279	Ireland	17	Undeveloped Areas	1960	1968
280	United States	21	New Industry	1958	1980
281	Ireland	36	Undeveloped Areas	1968	1992
282	United States	24	SFADCo	1966	1971
283	Germany	21	Undeveloped Areas	1968	1979
284	Ireland	15	New Industry	1966	1984
285	United Kingdom	28	New Industry	1959	1971
286	United States	30	New Industry	1970	1974
287	United States	24	New Industry	1965	NA
288	Ireland	18	New Industry	1969	1992
289	United States	29	SFADCo	1964	1982
290	Germany	25	New Industry	1960	1975
291	United States	28	SFADCo	1962	1965
292	Germany	18	Undeveloped Areas	1966	1983
293	United Kingdom	28	New Industry	1960	1977
294	United States	24	New Industry	1971	NA
295	United States	24	New Industry	1970	1982
296	Netherlands	32	New Industry	1957	1984
297	United Kingdom	25	Undeveloped Areas	1962	1979
298	United Kingdom	15	New Industry	1968	1984
299	France	35	New Industry	1963	1968
300	France	28	Undeveloped Areas	1962	1974
301	Germany	20	Undeveloped Areas	1962	1975
302	Ireland	27	New Industry	1962	1965
303	Ireland	15	New Industry	1971	1981
304	Germany	29	SFADCo	1960	1972
305	Ireland	30	New Industry	1969	1976
306	Germany	25	Undeveloped Areas	1965	1971
307	Ireland	26	New Industry	1959	1960
308	Ireland	17	Undeveloped Areas	1965	1973
309	United States	28	Undeveloped Areas	1971	1978
310	United Kingdom	28	Undeveloped Areas	1971	NA
311	United Kingdom	15	New Industry	1964	NA
312	Germany	17	Undeveloped Areas	1965	1982

ID	Nationality	Nace 2-digit	Grant Type	Year of Entry	Year of Exit
313	Netherlands	36	SFADCo	1960	1971
314	Ireland	34	New Industry	1969	1983
315	Ireland	26	New Industry	1964	NA
316	Ireland	29	New Industry	1971	1989
317	Ireland	15	New Industry	1969	1991
318	United States	26	New Industry	1964	NA
319	Germany	19	Undeveloped Areas	1962	1983
320	Netherlands	35	New Industry	1971	1981
321	United States	29	New Industry	1971	1990
322	United States	24	New Industry	1959	2000
323	Germany	24	Undeveloped Areas	1960	NA
324	Ireland	36	New Industry	1971	1975
325	Germany	25	New Industry	1972	1977
326	Switzerland	28	New Industry	1965	1999
327	United States	29	New Industry	1968	1986
328	United States	28	SFADCo	1960	NA
329	United States	28	Undeveloped Areas	1967	1978
330	United Kingdom	29	SFADCo	1969	NA
331	Germany	18	New Industry	1966	1999
332	Germany	24	New Industry	1972	1993
333	Germany	33	New Industry	1963	1971
334	United Kingdom	29	Undeveloped Areas	1969	NA
335	United States	36	SFADCo	1970	1974
336	Ireland	15	New Industry	1958	NA
337	Austria	25	New Industry	1969	1996
338	United Kingdom	26	New Industry	1967	1987
339	South Africa	26	SFADCo	1961	1975
340	United Kingdom	36	Undeveloped Areas	1956	1990
341	Germany	26	SFADCo	1969	1976
342	Germany	20	New Industry	1962	1975
343	United Kingdom	28	SFADCo	1963	1983
344	United Kingdom	25	Undeveloped Areas	1971	1999
345	United Kingdom	17	Undeveloped Areas	1969	1973
346	Ireland	15	Undeveloped Areas	1965	NA
347	Ireland	33	New Industry	1963	1978
348	Germany	18	Undeveloped Areas	1955	1986
349	Ireland	17	Undeveloped Areas	1957	1963
350	Ireland	21	New Industry	1972	NA
351	Ireland	17	Undeveloped Areas	1969	1974
352	Italy	24	Undeveloped Areas	1971	1983
353	United Kingdom	24	New Industry	1960	1967
354	Japan	32	SFADCo	1960	1965
355	United Kingdom	21	New Industry	1972	1976
356	United Kingdom	35	New Industry	1966	1990
357	United States	31	Undeveloped Areas	1972	2003
358	United States	24	New Industry	1964	NA
359	United Kingdom	17	Undeveloped Areas	1970	1971
360	United Kingdom	28	New Industry	1969	1970
361	Germany	25	Undeveloped Areas	1970	NA
362	Ireland	26	New Industry	1964	NA
363	Germany	19	Undeveloped Areas	1968	NA
364	Ireland	17	New Industry	1962	1990
365	Rhodesia	32	SFADCo	1961	1962
366	Netherlands	25	New Industry	1967	NA
367	Italy	17	Undeveloped Areas	1965	NA
368	Ireland	36	Undeveloped Areas	1959	1961
369	Ireland	17	New Industry	1972	1991
370	United States	33	New Industry	1966	NA
371	United States	28	New Industry	1968	1977
372	Germany	17	Undeveloped Areas	1962	1968
373	Ireland	32	New Industry	1965	1984
374	Denmark	33	Undeveloped Areas	1964	1968
375	United Kingdom	29	Undeveloped Areas	1963	1968
376	Sweden	17	Undeveloped Areas	1968	1971

ID	Nationality	Nace 2-digit	Grant Type	Year of Entry	Year of Exit
377	United States	15	Undeveloped Areas	1961	1999
378	Belgian	26	Undeveloped Areas	1962	1964
379	United Kingdom	26	New Industry	1969	1975
380	Canada	21	New Industry	1973	1976
381	Ireland	18	Undeveloped Areas	1972	1975
382	South Africa	27	SFADCo	1967	1971
383	Ireland	29	Undeveloped Areas	1955	1957
384	Ireland	28	Undeveloped Areas	1960	1985
385	Ireland		New Industry	1968	1971
386	United States	33	New Industry	1968	1973
387	Germany	17	Undeveloped Areas	1959	1969
388	United States	35	SFADCo	1965	1971
389	United Kingdom	26	New Industry	1972	1986
390	Germany	36	SFADCo	1967	1972
391	United States	28	New Industry	1968	NA
392	Germany	34	Undeveloped Areas	1972	1991
393	United Kingdom	26	SFADCo	1967	1969
394	United States	29	New Industry	1968	NA
395	Netherlands	35	New Industry	1960	1987
396	United Kingdom	31	New Industry	1968	1970
397	United Kingdom	25	New Industry	1969	1983
398	United States	17	Undeveloped Areas	1960	NA
399	Belgium	34	New Industry	1972	1978
400	Ireland	17	New Industry	1969	NA
401	United Kingdom	29	SFADCo	1960	1962
402	United States	24	New Industry	1960	NA
403	Netherlands	17	New Industry	1969	NA
404	Ireland	15	New Industry	1968	NA
405	United States	29	New Industry	1969	1972
406	Ireland	19	New Industry	1972	1984
407	Netherlands	25	New Industry	1959	NA
408	South Africa	28	New Industry	1969	1985
409	United States	18	Undeveloped Areas	1970	1973
410	Ireland	25	New Industry	1969	1989
411	United Kingdom	17	Undeveloped Areas	1962	1980
412	United Kingdom	15	New Industry	1971	1977
413	United States	19	New Industry	1969	1985
414	Netherlands	17	New Industry	1961	1993
415	Netherlands	28	SFADCo	1972	1995

Appendix 4

Venture Capital in Ireland in Comparative Perspective

Frank Barry
Trinity College Dublin
Clare O'Mahony
Dublin Institute of Technology
and
Beata Sax
Investors TFI Fund Management, Warsaw

May 2012

Abstract

This paper assembles the most comprehensive set of data available to offer a comparative perspective on venture capital in Ireland. The paper charts the emergence of the sector and the co-evolution of the demand and supply sides of the market. On the demand side, a flow of investment opportunities emerged – particularly from the indigenous software sector – for which venture capital represented an appropriate financing vehicle. Concurrently, on the supply side, publicly provided funding and other elements of public policy dramatically enhanced its availability. State support to the demand-side has been a multiple of state support to the supply side of the market. Developing a self-sustaining VC sector, however, is found not to be a straightforward task.

1. Introduction

Venture capital refers to equity capital provided to early-stage companies, where the venture capitalist also typically contributes management support to the enterprise. This type of capital is particularly appropriate to the needs of innovative start-up companies where informational asymmetries and the absence of collateral and reputation preclude access to more conventional forms of financing, and where the provision of equity relaxes the time constraints that enterprises would otherwise face.

Because of the link with innovative start-ups, the availability of an adequate supply of venture capital (VC) is usually seen as a necessary precondition for the emergence of innovative and dynamic regions. This draws on the model of Silicon Valley, which has been portrayed as an ecosystem consisting of two elements: (i) an economy of established firms, universities, research laboratories etc., which produces output and innovations, and (ii) an institutional infrastructure, with venture capital at its core, which enables the creation and growth of new start-up firms (Kenney, 2004).

Governments across the globe have responded by adopting policies aimed at ensuring the availability of venture capital at the regional level. Many such policies have ended in failure however. Avnimelech, Kenney and Teubal (2005) suggest that part of the problem has been one of conceptualisation, where the absence of VC is seen as a purely supply-side deficiency. They point to necessary demand-side factors in sustaining a VC market, noting that 'a vibrant VC industry is dependent upon a flow of investment opportunities capable of growing in value quickly enough to provide capital gains justifying the investment risks'. An inappropriate focus solely on the supply side is one of the grounds on which Mason and Harrison (2003) critique the UK regional venture capital initiative.

The venture capital market expanded dramatically in Ireland in the early to mid-1990s just as such a flow of investment opportunities emerged, primarily in the indigenous computer software sector, the most dynamic indigenous high-tech sector of the "Celtic Tiger" era (Crone, 2004; Ó Riain, 2004).

The paper is structured as follows. The next section presents an overview of venture capital and private equity markets in the US, Europe and Ireland. Section 3 looks in more detail at the supply of VC and how it has been influenced by legislation and by the provision of public funds, with the latter ranging from unimportant in the case of the US to being of well above average European importance in the Irish case. This section also illustrates the very high degree of internationalisation of the Irish VC market and addresses the justification for

state provision of VC funds under these conditions. Section 4 analyses the sectoral allocation of VC and the demand side of the market, investigating the role of Ireland's development agencies in directly supporting the types of firms for which VC finance is appropriate. The concluding comments focus on the co-evolution of the supply and demand sides of the VC market and seek to draw lessons of broader applicability from the Irish experience.

2. Overview of Venture Capital and Private Equity Markets in the US, Europe and Ireland

Prior to 1980, venture capital financing in the US was regarded by many as a "cottage industry". Significant new legislation adopted around this time would influence its further development. This legislation included:

- *The Revenue Act of 1978* and *The Economic Recovery Tax Act of 1981* which reduced the capital gains tax rate and raised the incentives for long-term investments
- *ERISA 1979* (the *"Prudent Man" Rule*) which changed the investment rules for pension fund managers, allowing them to place funds in high-risk investments
- *The Small Business Investment Incentive Act of 1980* which defined venture capital-type funds as companies that stimulated economic growth by encouraging entrepreneurship , and
- *ERISA 1980* (*"Safe Harbor"*) which clearly distinguished between investment fund and pension fund managers. This made it possible for pension funds to be accepted as partners in venture capital funds, without the risk of incurring the same extent of liability as in the case of investment funds.

Implementation of this new legislation (amongst which the "Prudent Man" Rule was seen by many as the most important) helped the market to develop in the 1980s. Venture capitalists of that time were instrumental in such success stories as Apple Computers, Cisco Systems, Genentech, Microsoft, Netscape, Sun Microsystems, and Starbucks (Gompers, 2007). Growth was particularly dramatic in the 1990s: while the market reached a maximum of only $5.5 billion in the 1980s, the number of venture capital funds increased from 43 to 629 between 1991 and 2000, by which time capital commitments had risen to well over $100 billion. As Table 1 reveals, the US market not yet returned to the levels prevailing before the collapse in 2000 of the dot-com bubble.

Table 1: The US Venture Capital Market (€billion), Annual Averages

	1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
Funds raised	6.4	63.9	23.6	21.7	15.4
Funds invested	4.8	57.3	26.8	18.8	17.6

Source: NVCA. Data converted to euros (ECUs prior to 1999) using Eurostat exchange rates.

The equivalent data for Europe, which are available only for funds invested, are shown in Table 2.[175] European VC funding expanded over the 1990s as it did in the US but the bubble and subsequent downturn were far less dramatic than in the latter case. Ireland is seen to conform to the general European pattern.

Table 2: Venture Capital Funds Invested (€billion), Annual Averages

	1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
Europe	2.8	12.1	10.1	13.4	5.2
UK	0.7	3.4	2.6	6.1	1.3
Germany	0.5	2.6	1.6	1.1	0.8
France	0.5	1.8	1.3	1.6	1.0
Ireland	0.03	0.11	0.10	0.09	0.05

Source: Own calculations based on EVCA data.

Table 3 reveals that a turn-of-the-millennium bubble is much less in evidence in the aggregate private equity market. Funds raised and invested generally continued to grow until the onset of the global financial crisis, though Ireland stood somewhat apart from the general European trend.

Table 3:
Private Equity Funds Raised and Invested (€billion), Annual Averages

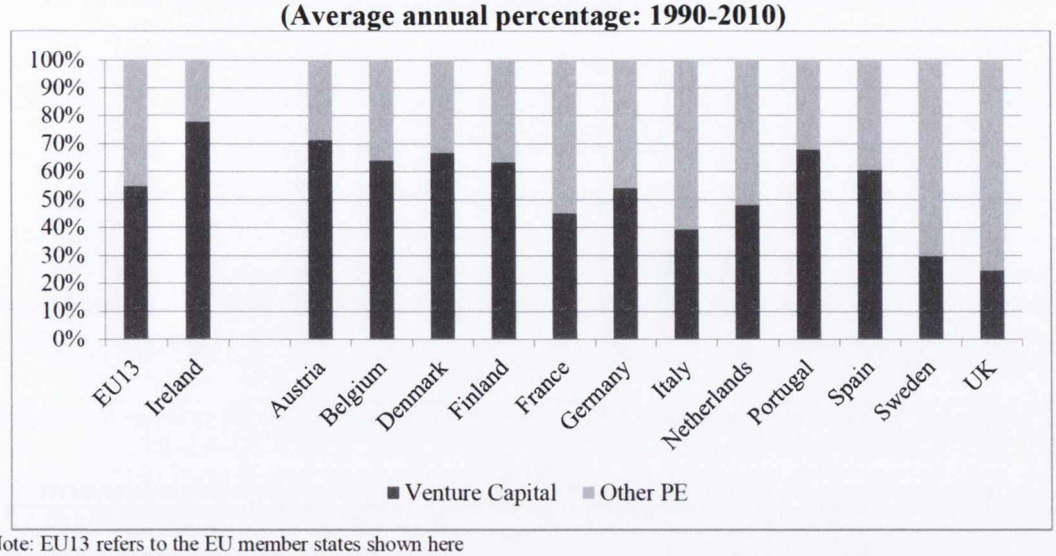
	1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
FUNDS RAISED					
Europe	6.9	31.3	31.5	70.5	49.4
UK	3.4	12.2	16.6	43.6	26.7
Germany	0.7	3.9	2.2	2.6	2.4
France	1.0	5.2	4.1	8.2	5.5
Ireland	0.05	0.23	0.16	0.05	0.17
FUNDS INVESTED					
Europe	5.6	24.9	27.0	51.7	48.3
UK	2.4	10.6	10.3	27.9	21.3
Germany	0.7	3.3	3.1	3.3	5.6
France	1.0	3.3	4.5	7.5	7.5
Ireland	0.03	0.13	0.17	0.09	0.13

Source: Own calculations based on data from EVCA; Converted where necessary to euros (ECUs prior to 1999) using Eurostat exchange rates.

A large part of the European private equity industry constitutes buyout transactions, particularly for the UK (Figure 1).[176] The Irish situation is quite different.

[175] Both the US and European data generally follow the *country of management* approach, meaning that they refer to the activities of locally managed funds only. Some insights to be gleaned from alternative approaches are offered later.
[176] See e.g. the discussion of UK merchant capital in Sunley et al. (2005).

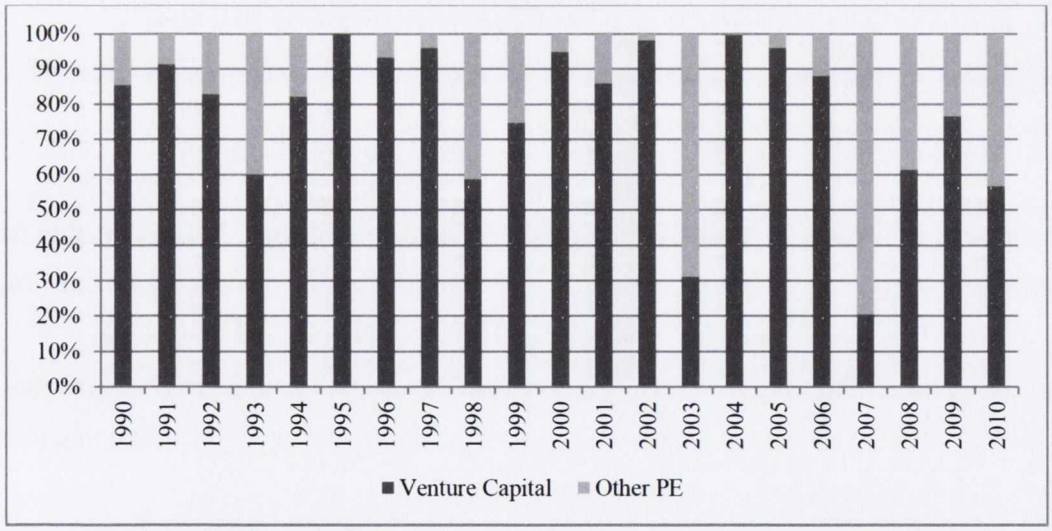
Figure 1:
Venture capital investments as a share of all Private Equity transactions, (Average annual percentage: 1990-2010)



Note: EU13 refers to the EU member states shown here
Source: Own calculations based on EVCA data

Buyout transactions constituted only a very small part of all private equity transactions in Ireland other than in 2003 and 2007 (Figure 2).

Figure 2:
Venture capital investments as a share of all Private Equity transactions in Ireland (1990-2010)



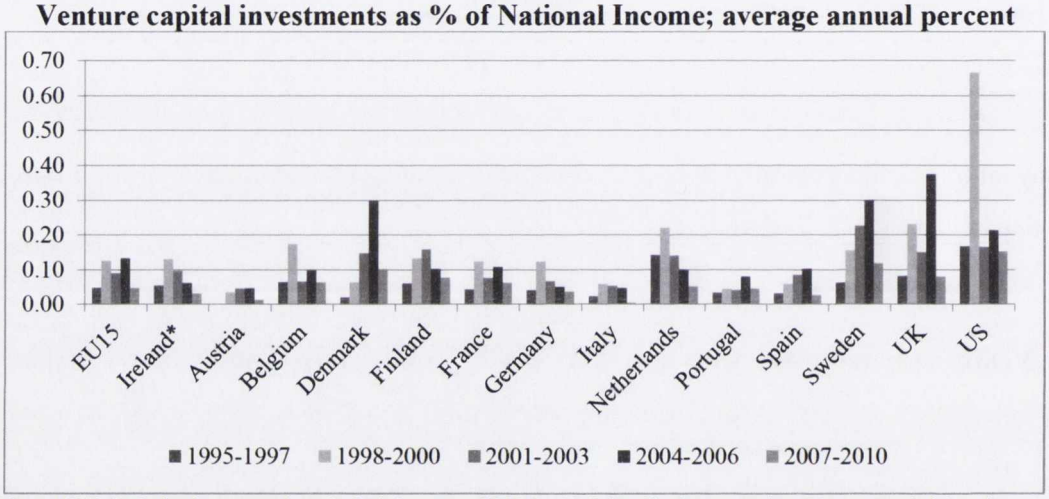
Source: Own calculations based on EVCA data

These two years, 2003 and 2007, represented the highest volumes of funds ever invested by Irish VC funds, with the vast bulk of the investments occurring in Ireland. Of the €255

million invested in 2003, for example, only €13 million went overseas, as will be shown later (Figure 9). The remainder included seven buyout transactions totalling €176 million.[177]

Figure 3 expresses venture capital investments as a share of national income. Even for the US at the height of the dot-com bubble, investments per annum came to less than one percent of GDP. Ireland until the second half of the 2000s recorded values close to the EU15 average, even though it is likely that Irish indigenous firms – which make up the demand side of the VC market – are less concentrated in high-tech sectors than would be the case for the EU15.[178]

Figure 3:
Venture capital investments as % of National Income; average annual percent



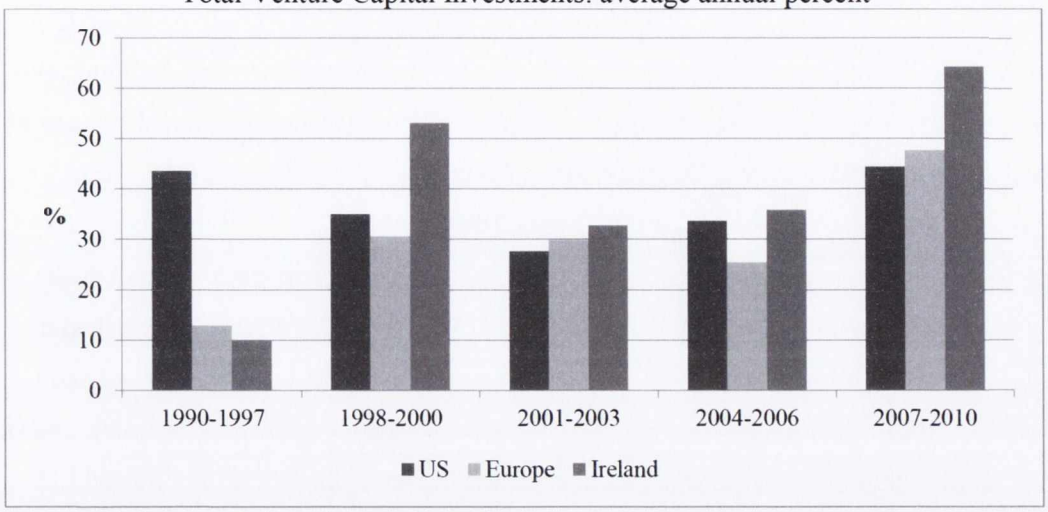
Notes: GNP for Ireland, except where included as part of EU15. GDP for all other countries. Venture capital data for Luxembourg are only included from 2007
Source: Own calculations based on EVCA and NVCA data

Figure 4 provides data on the breakdown of VC finance as between funds committed to the early seed and start-up phases versus the expansion phases of enterprise development. The share of early stage financing in Ireland changed substantially over the years, with expansion phase projects predominant prior to 1998. Since then, Ireland has been far above both the European average and the US in terms of the proportion of VC finance going to early stage investments.

[177] 2003 also saw an unprecedented increase in the activity of other European VC funds who invested some €293 million in Irish companies, bringing the total invested in Ireland by domestic and other European VC funds to more than €535 million (EVCA Yearbook 2005, p. 173), as shown in Figure 9. We have been unable to discover any data on funds invested in Irish enterprises by non-European VC funds (see OECD, 2000). These are likely to be of some importance as Irish software companies in particular are known to seek financing from US VCs.

[178] The Census of Industrial Production provides data on the sectoral location of Irish indigenous manufacturing firms, but data specifically for indigenous (as opposed to foreign multinational) firms are not generally available across the EU.

Figure 4:
Early Stage (Seed and Start Up) Investments as Share of
Total Venture Capital Investments: average annual percent



Source: Own calculations on the basis of EVCA and NVCA data

By contrast, there is not much difference between Ireland and the rest of Europe in terms of mode of exit (Table 4). Trade sales have been predominant, representing a somewhat higher share for Ireland than for the rest of Europe. Write-offs were also higher for Ireland. The US data on mode of exit distinguish only between acquisitions and VC-backed IPOs, with the ratio of the former to the latter running at around 3 to 1.

Table 4:
Mode of Exit; average annual percentage

	Ireland		Europe	
	1998-2003	**2004-2010**	**1998-2003**	**2004-2010**
Trade Sales	46	42	35	26
Divestment by public offering	7	4	15	11
• Divestment on flotation (IPO)	1	0	6	5
• Sale of quoted equity	7	4	8	6
Write-offs	18	26	14	12
Repayment of principal loans	11	4	13	13
Sale to another private equity house	5	8	8	22
Sale to a financial institution	0	1	5	4
Other modes	12	14	10	13

Source: EVCA.

3. Expanding the Supply of Venture Capital in Ireland

Early developments in the Irish venture capital market included the setting up of the IDA's Enterprise Development Programme in 1978; the establishment of the National Enterprise Agency in 1981, its replacement by the National Development Corporation in 1986 and its amalgamation with the IDA in 1991; and the introduction of the Business Expansion Scheme in 1984 and the Seed Capital Scheme in 1993.
The Irish Venture Capital Association (IVCA) had been founded in 1985 and had three members by the end of the 1980s. These were (i) Allied Combined Trust, established in 1972 with Allied Irish Investment Bank as a major shareholder; (ii) the Industrial Credit Company, established by the state in the 1930s to encourage investment in industry, and (iii) the Dublin Business Innovation Centre, established in 1987 with private, public and EU support.

1994 was a crucial year in the development of the Irish VC market, with a number of significant changes introduced that year (Murphy, 2000; Jeng and Wells, 2000). One was the establishment in Irish law of "the investment limited partnership", which had proved a suitable vehicle for venture capital activities in the US. It provides double taxation relief such that investments through qualifying venture capital funds are treated as though they are direct investments in the underlying companies.[179]

1994 also saw the publication of government guidelines advocating that pension funds "support the venture capital industry by becoming a recognized form of finance for entrepreneurial companies" (Murphy, 2000). The guidelines had their origins in a report commissioned by the Irish Association of Pension Funds, the Irish Insurance Federation and the Department of Finance, which found that pension-fund investments in Ireland were negligible in comparison to the situation in the US and the UK. The guidelines were issued as an alternative to legislation which would have required pension funds to make certain commitments to venture capital. They instead suggested that pension funds "should support the venture capital industry by becoming a recognised form of finance for entrepreneurial companies" and advocated that pension funds should place 0.08 percent of their assets annually into venture capital funds over the next five years. Since then, the proportion of new funds accounted for by the pension funds sector in Ireland has fluctuated around the European average level.

[179] For more detailed information on the advantages of the investment limited partnership as a special vehicle for venture capitalists, see Lyons (2004).

From 1994 the state's industrial development agencies also adopted new policies towards venture capital. One strand of the new approach saw them shift away from grant assistance towards equity participation in companies to which they advanced support. This had been advocated in the report of the Industrial Policy Review Group (the *Culliton Report* of 1992) "to meet gaps in financial markets for venture capital and seed capital". The Industrial Development Authority (IDA), it was suggested, should become more of an "aggressive venture capitalist" and should be prepared to take stakes of up to 50-60 percent in the companies it supported. To fulfil these tasks adequately, the report advised that the IDA should be restructured into separate bodies, which eventually emerged as Forfás, with responsibility for research and policy, IDA-Ireland with responsibility for foreign direct investment, and Enterprise Ireland with responsibility for indigenous industry. This equity participation approach will be discussed in a later section of the paper which focuses on the demand side of the VC market (since it directly supports the kinds of firms that are likely to seek or attract VC finance).

The other strand of the new approach was to expand the availability of venture capital by investing state capital, through Enterprise Ireland, in commercial VC funds.[180] The Indigenous Industry Operational Programme for Industrial Development, a sub-section of the National Development Plan 1994-99, had identified as important the difficulties that SMEs faced in raising equity capital. This led to the establishment by Enterprise Ireland of the Seed and Venture Capital Measure 1994-1999, which had the objectives of (i) making seed and equity capital available to SMEs, primarily in the knowledge economy; (ii) developing the seed and venture capital market in Ireland; (iii) encouraging private sector participation, and (iv) developing seed and VC management skills.

EU and national funding of the measure amounted to a total of €40 million and this was matched at the beginning by a further €40 million in private investments. The VC funds established were run on a purely commercial basis, with investment decisions taken solely by private-sector VC fund managers. Returns were to be fed back into the funds and a ten-year lifecycle was envisaged, with a five year investment period and five years in which to exit and realise returns.

In 2001, the Seed and Venture Capital Fund Scheme was recommenced under the National Development Plan 2001-2006 with a commitment of national and EU funds amounting to €95 million. The objective of the programme was to leverage €400 million in private

[180] See Sterne (2004, pps. 247-251, 284) on the history of commercial VC firms in Ireland.

funding. This had already been achieved by 2002, and by 2004 the 15 funds established under the programme (with about €500 million in capital raised) had made investments in 75 companies totalling €133 million (Enterprise Ireland, 2005). By 2005 the state commitment to 30 VC funds had totalled €164 million (€66 million in total in the first programme and €98 million in the second), and about €30 million in returns had been received. The 2000-06 programme was followed by a further Seed and Venture Capital Programme set to run from 2007 to 2012, with an Enterprise Ireland commitment of €175 million.

In Europe as a whole, government provision of VC funds also grew over this period. It has typically contributed a smaller share than in Ireland since the initiatives of the mid-1990s, and the contrast has grown dramatically in recent years (Table 5). In the US, by contrast, the government plays no direct role in the provision of venture capital.

Table 5:
Sources of new funds: Europe, Ireland and the US
(average annual percentage by type of investor)

		1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
Corporations	Europe	8	11	6	5	3
	Ireland	5	5	2	0	1
	US	6	5	6	5	2
Financial Institutions	Europe	51	40	36	29	19
	Ireland	46	28	18	22	16
	US	11	11	9	8	5
Government	Europe	5	5	8	8	6
	Ireland	9	9	18	10	34

Note: Figures do not sum to 100 because some categories of investor (particularly private investors and pension funds) are excluded.
Source: Own calculations based on EVCA and NVCA data, exchange rates from Eurostat.

Table 6 shows that of the European countries for which data are available, Portugal, Ireland, Austria and Finland record the highest shares for government as a source of new funds. Portugal and Austria, as has been seen, have very small VC sectors relative to GDP, while Finland is at the opposite end of the spectrum.

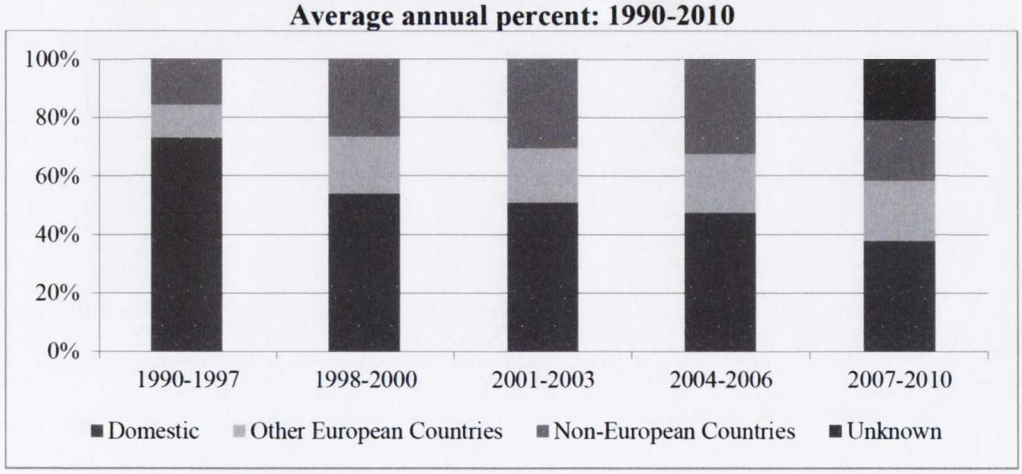
Table 6: Sources of New Funds for European Economies, Average annual percentage by type of investor, 1994-2010

	Corporations	Private	Financial Institutions	Pension funds	Government
Austria	4	5	51	3	17
Belgium	11	7	40	5	13
Denmark	7	7	28	27	9
Finland	7	2	28	23	15
France	8	8	47	11	3
Germany	8	8	49	6	11
Ireland	3	9	25	17	19
Italy	7	10	47	7	3
Netherlands	5	5	5	12	2
Portugal	3	1	54	4	31
Spain	9	6	42	7	12
Sweden	9	4	20	21	6
UK	6	5	26	32	5

Note: Country figures do not sum to 100 because some categories of investor are omitted.
Source: Own calculations based on EVCA data

As noted earlier, the VC data are generally classified according to the "country of management" approach; i.e. they refer to locally managed funds only. VC funds which are managed in a particular country can be raised from both domestic and non-domestic investors however. Funding sources in both Europe and Ireland have become increasingly internationalised over the period of analysis. Figure 5 shows that for European countries on average, funds raised from non-domestic sources grew from less than one-third of the total in the early 1990s to over one-half of the total in more recent years.

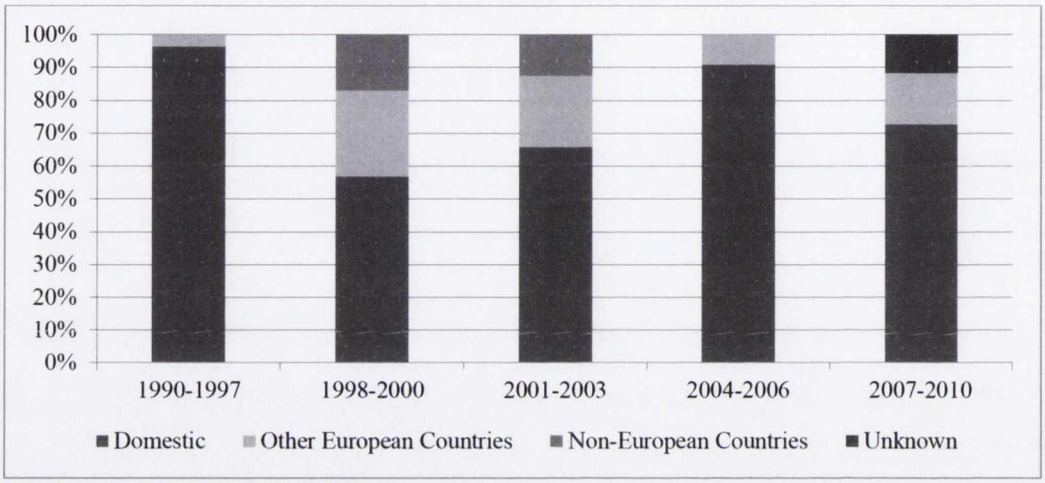
Figure 5:
Geographical sources of funds raised by the European PE industry, Average annual percent: 1990-2010



Source: Own calculations based on EVCA data

Funds managed in Ireland displayed a much weaker degree of internationalisation (Figure 6), though the year 2002 stood out as exceptional, with more than 90 percent of the capital raised that year coming from outside Ireland.

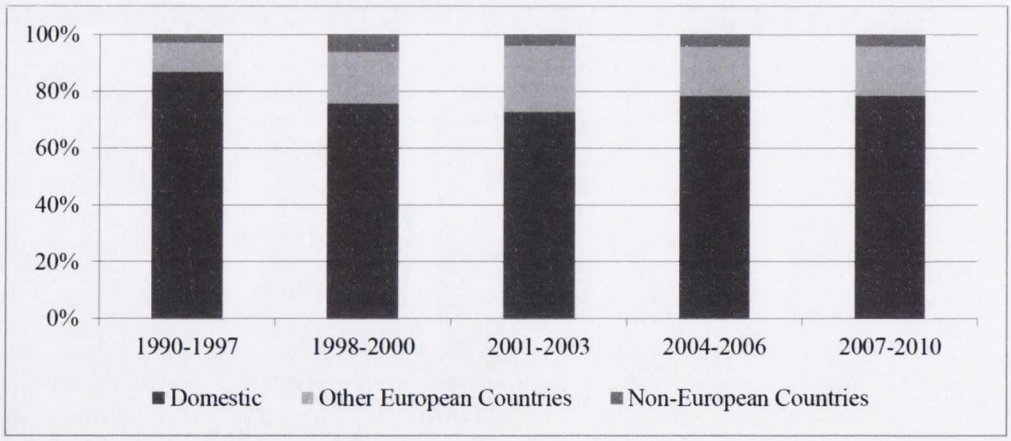
Figure 6:
Sources of funds raised by the Irish PE industry, geographical breakdown
Average annual percentages 1990-2010



Source: Own calculations based on EVCA data

Figure 7 displays the propensity of European-managed funds to invest overseas.

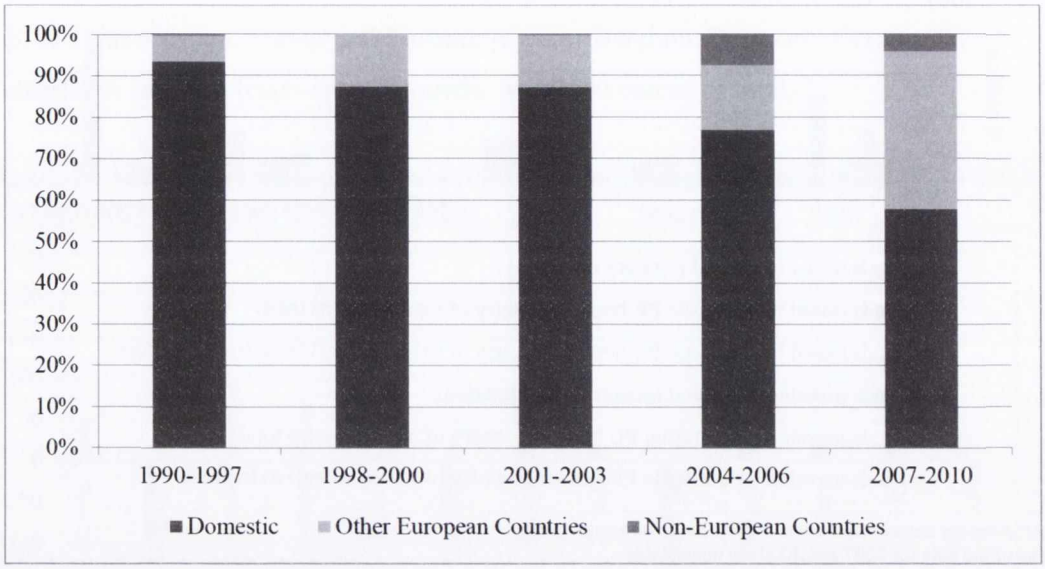
Figure 7:
Geographical Destination of funds invested by the European PE industry,
Average annual: 1990-2010



Source: Own calculations based on EVCA data

Figure 8 shows that Irish-managed VC funds have come to match this propensity to invest overseas over recent years.

Figure 8:
Geographical Destination of Funds Invested by the Irish PE industry, Average annual: 1990-2010



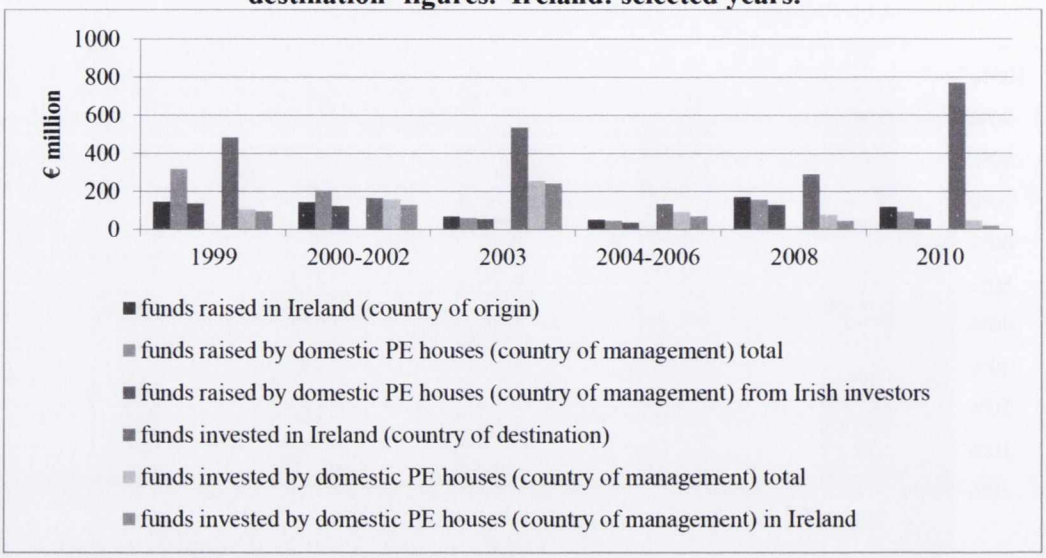
Source: Own calculations based on EVCA data

We now depart briefly from the "country of management" approach to explore how much funding is raised in Ireland and how much is invested in Ireland (in each case by European-managed funds only). These are described in the EVCA statistics as the "country of origin" approach for funds raised, and the "country of destination" approach for funds invested.[181]

Figure 9 presents data on funds raised and funds invested in Ireland for the period 1999-2003, comparing "country of management" and "country of origin" for funds raised, and "country of management" and "country of destination" for investments.

[181] These statistics do not record funds raised or invested by VC funds managed outside Europe.

Figure 9:
Comparison of 'country of management', 'country of origin' and 'country of destination' figures. Ireland: selected years.



Note: Average annual values where years have been aggregated.
Some of the data for 2007 and 2009 are unavailable.
Source: Own calculations based on EVCA data

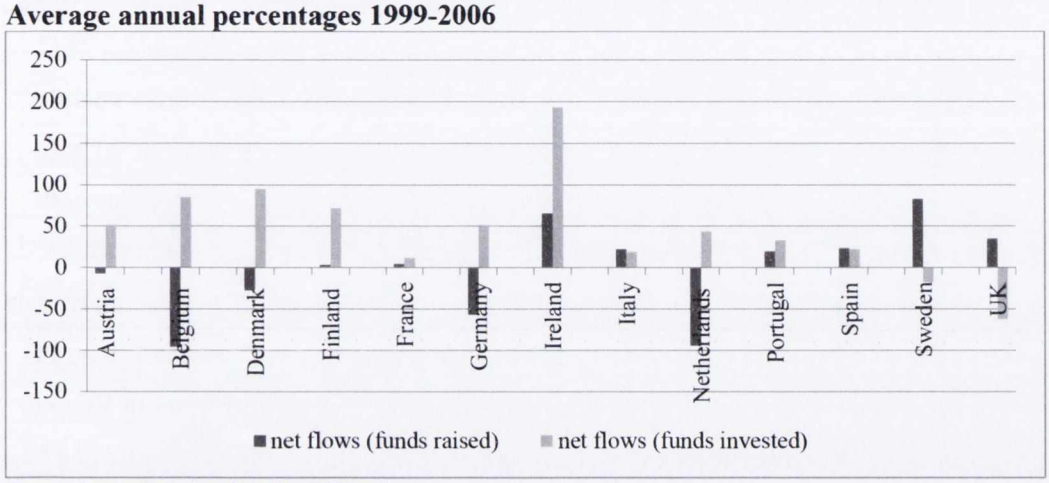
The major asymmetries on the "funds raised" side arise in 1999 and 2002.[182] In both of these years, the amounts raised from foreign investors were larger than those raised from domestic investors. This indicates substantial net flows of funds raised. A similar situation can be observed on the investment side. In 1999, 2003, 2009 and 2010, much greater investments were made in domestic industry than came from domestically-managed VC funds. The greatest asymmetry arose in 2010, when investments in Ireland ('country of destination') were €770 million, while funds invested by Irish-managed funds were only €48 million.

A comparison with other countries reveals how internationalised or, more precisely, Europeanised the Irish market is compared to other European countries.[183] For the period 1999-2006, Ireland exhibited the greatest average net inflows for all European countries for funds invested and the second highest, after Sweden, for funds raised (see Figure 10). On average over the period, net inflows of investment into Ireland (i.e. the excess of Foreign VC fund investments in Ireland over Irish VC fund investments overseas) came to almost 200 per cent of domestic investments by domestic VC funds. In terms of the countries charted, all were net recipients of investment other than Sweden and the UK.

[182] Not all years are shown separately in the figure.
[183] As the data for comparing the *country of management*, *country of origin* and *country of destination* approaches are limited in regard to non-European countries, only flows to and from European countries can be taken into consideration in the analysis.

For Ireland, net inflows of funds from abroad (i.e. the excess of overseas funds coming to domestic venture capital companies over funds raised in Ireland by foreign companies) represented, on average, 66 per cent of funds raised in Ireland by Irish venture capitalists. Net recipients of funds in this sense included Ireland, Italy, Portugal, Spain, Sweden, the UK and, to a lesser extent, France and Finland, whereas Belgium, Denmark, Germany, the Netherlands and, to a lesser extent, Austria, were net sources of funds.

Figure 10:Flows in funds raised and invested in Ireland and other European countries: Average annual percentages 1999-2006



Source: Own calculations based on EVCA data
Data for 2007 and 2009 unavailable.

The equivalent data for 2010 are as shown in Table 7. The percentage figure for net inflows of funds invested for Ireland is so large because funds invested from abroad came to €751m., funds invested abroad by Irish investors came to €27m, and domestic investment by domestic VC funds was only €19m (in rounded figures).

Table 7:
Net Flows (%) raised and invested in Ireland and other European countries, 2010

	net flows (funds invested)	net flows (funds raised)
Austria	700	-8
Belgium	192	-6
Denmark	-1	-4
Finland	55	-44
France	14	18
Germany	1	-20
Ireland	3740	-44
Italy	53	-47
Netherlands	67	100
Portugal	-1	56
Spain	19	2
Sweden	-17	68
UK	-37	46
Europe	4	0

Source: Own calculations based on EVCA data

Given the internationalisation of the Irish VC market, the question arises as to why it is perceived as important for the government – acting through Enterprise Ireland – to create a local VC market, since there appears to be many more investment opportunities in Ireland than Irish investors are able or willing to finance, and Irish companies themselves are not biased against foreign investors.[184]

The answer is suggested by Florida and Kenney (1988) who, in discussing the localised nature of the VC process, point out that although long-distance investing occurs when deals are syndicated between several VC firms, the presence of a local venture capitalist to lead the deal is generally essential. Similarly, practitioners point out that when foreign venture capitalists invest in the Irish market, they usually do so by co-investing (syndication) with Irish venture capitalists.[185] If they invest directly, in turn, it tends to be in companies with some track record, financing later stage transactions (post first or even post second round financing) and frequently only when domestic VC is already in place.[186] Unfortunately, data provided by the EVCA do not specify the stages of transactions in which non-domestic PE houses are involved, making it difficult to ascertain whether the investments are in VC projects or in other PE transactions.

4. The Sectoral Location of VC Investments and the Demand Side of the Market

Although at the beginning of the 1990s Irish VC investment activity was directed towards more traditional *consumer related* and *other manufacturing* sectors, towards the late 1990s it began to focus on "new technology" – i.e. on *communications* and *computer and consumer electronics* – with life sciences becoming important over the new millennium (Table 8).

[184] "Overseas founders are often considered attractive to Irish companies due to their established far reaching networks and international presence which bring added value with their investments" (FitzGerald, 2002).
[185] See for example FitzGerald (2002) and Berkery (2001)
[186] Berkery (2001)

Table 8: Sectoral distribution of investments in Ireland; average annual percentage: 1990-2010

	1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
Communications	7.8	15.9	14.3	16.2	21.9
Computer and consumer electronics	13.3	51.4	72.5	49.8	20.9
Life sciences	4.4	3.4	6.5	18.0	20.6
Energy and environment	0.6	0.2	0.4	0.0	4.2
Consumer goods and retail	36.5	3.4	1.0	10.5	4.4
Consumer services	na	na	na	na	3.7
Business and industrial products	15.5	15.4	3.0	2.2	4.4
Business and industrial services	5.4	5.5	1.9	0.7	1.3
Chemicals and materials	3.0	0.3	0.1	2.3	0.3
Transportation	4.8	0.0	0.2	0.0	7.8
Financial services	0.4	0.0	0.1	0.0	0.1
Real estate	na	na	na	na	0.0
Agriculture	1.3	1.1	0.0	0.0	0.2
Construction	5.2	1.6	0.0	0.0	3.0
Unknown	0.2	1.7	0.1	0.2	7.1
Total investment	100.0	100.0	100.0	100.0	100.0

Note: EVCA sectoral classifications changed in 2007, prior to this 'consumer services' and 'real estate' did not exist as separate categories.
Source: Own calculations based on EVCA data

In Europe, on the other hand, although there was some shift towards *communications* over the new millennium, more traditional sectors (*consumer goods* and *business and industrial products*) remained strong throughout the period of analysis (Table 9).

Table 9:
Sectoral distribution of investments in Europe, average annual percentage: 1990-2010

	1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
Communications	3.3	11.3	13.3	14.2	12.4
Computer and consumer electronics	9.5	14.1	10.2	7.7	7.2
Life sciences	6.1	8.2	9.9	9.8	12.4
Energy and environment	1.5	1.0	1.7	2.0	5.9
Consumer goods and retail	21.2	17.4	18.9	22.0	14.8
Consumer services	na	na	na	na	8.2
Business and industrial products	24.3	19.0	18.7	15.6	12.1
Business and industrial services	10.6	7.9	8.0	11.5	9.3
Chemicals and materials	3.6	3.6	4.0	2.5	3.5
Transportation	5.4	5.5	3.4	2.5	3.8
Financial services	4.3	2.2	2.9	3.6	6.0
Real estate	na	na	na	na	0.3
Agriculture	1.5	0.9	0.5	0.3	0.6
Construction	4.1	2.2	3.8	2.5	2.9
Unknown	4.4	6.7	4.8	5.8	0.6
Total investment	100.0	100.0	100.0	100.0	100.0

Note: EVCA sectoral classifications changed in 2007, prior to this 'consumer services' and 'real estate' did not exist as separate categories.
Source: Own calculations based on EVCA data

Across the Atlantic, VC investments also focus on new technology sectors, although they are more evenly distributed across these sectors, including in the *biotech* and *medical and health related* areas (Tables 10).

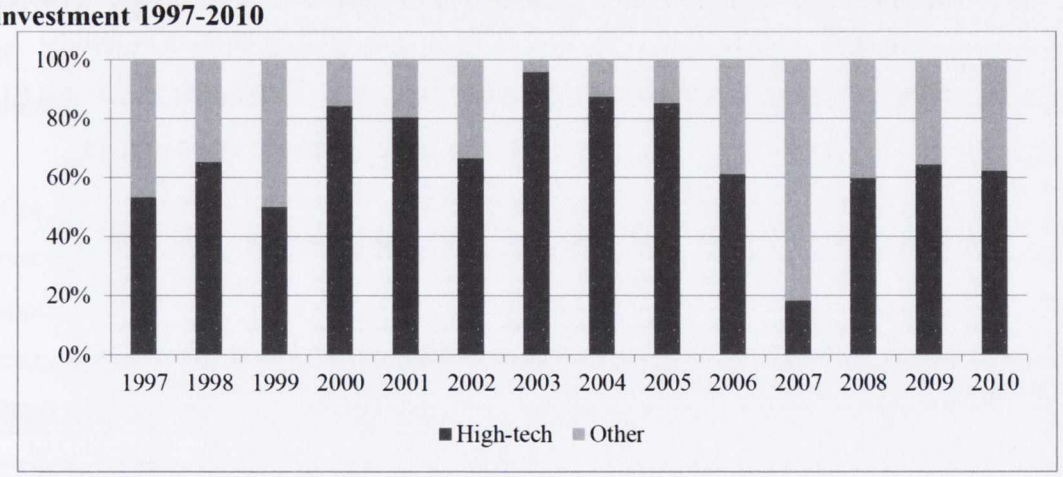
Table 10: Sectoral distribution of investments in the US, average annual percentage 1990-2010

	1990-1997	1998-2000	2001-2003	2004-2006	2007-2010
Biotechnology	12.2	5.1	14.4	17.6	17.4
Business Products and Services	2.3	4.4	2.7	1.7	1.7
Computers and Peripherals	5.2	1.7	1.9	2.3	2.0
Consumer Products and Services	4.8	3.6	1.1	1.4	1.8
Electronics/Instrumentation	2.0	0.8	1.1	2.0	1.9
Financial Services	2.6	3.9	2.3	2.6	2.1
Healthcare Services	4.7	2.7	1.4	1.6	0.9
Industrial/Energy	6.7	4.3	3.3	4.9	13.9
IT Services	2.4	7.2	4.8	4.5	6.7
Media and Entertainment	6.7	10.5	4.5	5.2	6.5
Medical Devices and Equipment	10.1	3.5	7.1	9.5	12.2
Networking and Equipment	7.2	9.1	11.9	6.1	3.9
Semiconductors	3.7	3.0	7.5	8.7	5.2
Software	18.4	21.6	24.8	21.6	18.2
Telecommunications	8.2	14.7	10.5	9.2	4.7
Undisclosed/Other	0.3	0.2	0.0	0.1	0.0
Total	100.0	100.0	100.0	100.0	100.0

Source: Own calculations based on NVCA data

Although investments in high-tech sectors frequently involve investments in high-tech projects, there is no necessary overlap between the two categories; account must be taken of the quality and type of the specific investments involved. The EVCA began to record investments in high-technology *projects* from 1997 and Figure 11 presents data on Irish VC investments in such projects for the period 1997-2003.

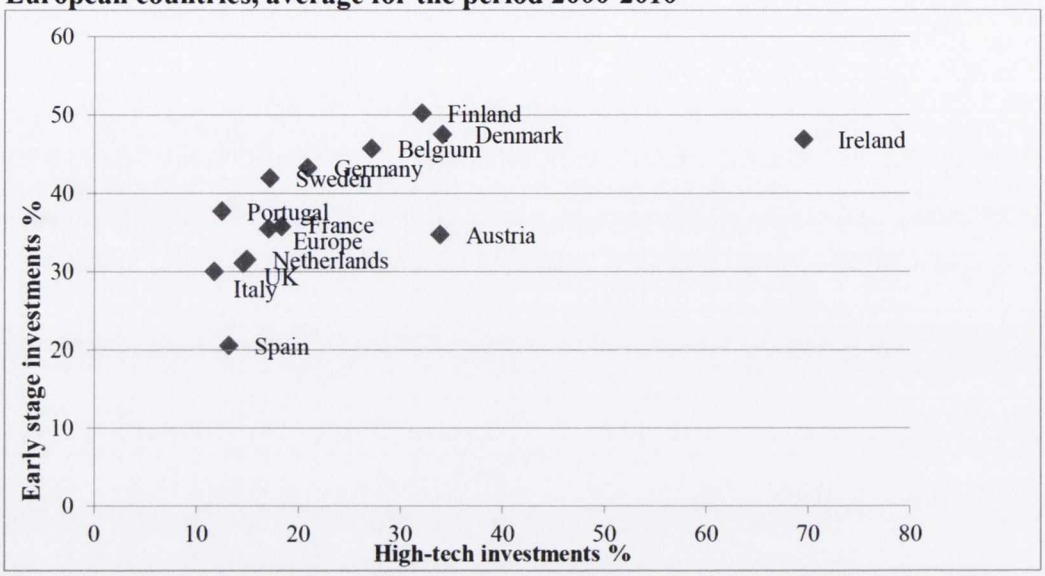
Figure 11: Investments in high-tech projects in Ireland, share of total amount of PE investment 1997-2010



Source: EVCA data

Figure 12 charts various national VC markets in terms of the shares of VC investments in early-stage and in high-technology projects. Of the European countries for which data are available, Ireland appears to be something of an outlier, with high proportions of both early stage investments and high-tech investments in the total.

Figure 12: Early stage and high-tech investments: Comparison of Ireland and other European countries, average for the period 2000-2010



Note: Percentages of total amounts invested in each market. 'Early stage investments' are presented as a share of VC investments. High-tech investments are presented as a share of PE transactions.
Source: Own calculations on the basis of EVCA data.

Besides seeding the emergence of venture capital, the Irish state also offers direct hands-on support to the types of firms for which venture capital is an appropriate financing vehicle. Indeed supports to the demand side are a multiple of the supports to the supply side of the VC market discussed heretofore. One form of such direct support is equity participation. Following the recommendation of the Industrial Policy Review Group of 1992, equity participation – in the form of both ordinary shareholdings and preference shares – on the part of what would become Enterprise Ireland increased from 5 percent of total financial supports in 1989 to 28 percent in 1998 (Forfás, 2000, Table 5.2).[187] Table 11 shows that EI direct equity participation in the companies it supports exceeds the sum total of funds provided by EI to private-sector VC managers to support companies of their own choosing.[188]

Table 11:Direct EI investments versus EI Seed and Venture Capital Investments (€million); Four-year totals 1999-2010

	1999-2002	2003-2006	2007-2010
Direct EI investments	83.90	95.00	172.84
EI Seed and Venture Capital Investments	91.62	46.68	51.65

Source: Enterprise Ireland Financial Statements 2000-2010

[187] Preference shares with a low coupon rate are used to provide a form of long term finance at low cost to SMEs that are unable to raise development finance from the market on similar terms.
[188] The EI Seed and Venture Capital Investments reported in the table amount to €131.17 for the period 2000-2006. This exceeds the €98 million reported by the 2006 Seed and Venture Capital Programme Report as EI funds committed for the period. The latter appears to refer to new funds earmarked from the EI budget while the former includes profits, possibly from previous programmes, ploughed back into the current programme.

This reflects the fact that Enterprise Ireland, as a development agency, has different motives from those of the VC companies, which seek only to maximise returns. The priority for the state agencies has been to develop knowledge-based industries in Ireland because of possible spill-over benefits and other market imperfections, rather than to achieve the best return on their investments.

Most Enterprise Ireland support is targeted towards the very small number of indigenous companies that it identifies as High-Potential Start Ups (HPSUs). Of the hundreds of thousands of new business start ups in the country over the period 1989 to 2006, only 637 were selected by Enterprise Ireland as HPSUs. Loosely, these are export-oriented firms with innovative products in dynamic market segments, that are deemed capable of meeting rigorous growth targets.[189]

To be deemed eligible for support (though with no automatic entitlement), projects must first successfully pass a formal cost-benefit analysis, while qualitative and other factors that are difficult to quantify are then taken into account in a Quality Ranking Matrix.[190] Enterprise Ireland has in fact worked with the majority of these HPSUs from embryonic concept stage to the point where they were formally recognised as HPSUs. Supports available from the embryonic stage are dependent on agreement with the agency on an integrated development plan, and the agency then customises a support package that can include helping companies to monitor markets and exploit new market opportunities, encouraging process and operations improvement and the development of better products through access to appropriate research, and promoting increased management and employee training levels.

The agency works intensively with the HPSUs to ensure access to the best external management advice; it helps them to attract expertise to their boards – e.g., through appointment of experienced non-executive directors – and to build an appropriate management team; it provides support for in-company training and for product and process development through direct support for in-company R&D and through establishing technology innovation networks, and it helps them develop contacts with private-sector financiers. It may also, where necessary, offer direct financial support (Forfás, 2000).

[189]Companies in software and ICT comprised almost half of these HPSUs, particularly since 1994, while in more recent years there has been a growth in the share represented by the pharmaceuticals and medical devices sectors (O'Brien, 2008).
[190] The focus of the development agencies on export development has been criticised in some quarters as overly mercantilist. It has been pointed out in defence however that non-traded-sector firms are likely to be competing largely with each other, which would put the state in a vulnerable position were it to support some and not others. In the case of software, the strong focus of the relevant agency has always been on software-product firms, which tend to be much more export-oriented than software services.

Ó Riain (2004, pps. 98-105) suggests that the mentoring programmes that pair small companies with experienced industry figures and the Enterprise Development Programme that provides one-on-one support and advice in terms of business plan development have been of particular importance to indigenous software firms, and indeed, according to Walsh (1985), the latter had been instituted in 1978 partly in response to the lack of venture capital finance available at that time. The state has also extensively subsidised the R&D expenditures of indigenous software companies.

Concluding Comments

Drawing primarily on the Israeli experience, Avnimelech and Teubal (2008) present an Innovation and Technology Policy Cycle model of the emergence of innovation-intensive clusters in industrialising economies. The early phase identified in the model relates to the emergence of innovation capabilities and the diffusion of R&D across the economy. The background conditions were established in Israel in the wake of the Six Day war of 1967 which saw a sharp increase in military R&D spending, significant investments by foreign multinationals in R&D laboratories and a state-orchestrated process to expand innovation in the business sector.

The second phase of the model sees venture capital emerge, alongside an acceleration in the growth of high-tech start-ups, and IPO and M&A activity. They describe how VC funding was purposefully developed by the Israeli state, after a number of false starts, through the enduring Yozma Program of 1993. This government-owned VC fund invested directly in early stage activities as well as operating as a fund of funds invested through private VC companies.

More generally, Avnimelech, Kenney and Teubal (2005) caution that the emergence of a dynamic regional or national VC market requires not just that supply-side shortages of funds be addressed but also that appropriate demand-side conditions prevail, notably "a flow of investment opportunities capable of growing in value quickly enough to provide capital gains justifying the investment risks".

The Irish experience corresponds in broad detail to that of Israel. Table 12 shows that Irish gross expenditures on R&D have risen as a share of both the EU and the OECD over the period under discussion, suggestive of the spread of innovation capabilities representing Phase 1 of the Avnimelech and Teubal model.

Table 12: Gross Domestic Expenditure on R&D in Ireland as % share of EU27 and OECD, 1995-2009

	1995-1997	1998-2000	2001-2003	2004-2006	2007-2009
Ireland as share of EU27	0.63	0.68	0.71	0.87	0.97
Ireland as share of OECD	0.19	0.20	0.22	0.26	0.29

Source: OECD, Main Science and Technology Indicators database

In Ireland, as in Israel, there was substantial government support of Business Sector R&D and innovative start-up companies. Table 13 provides a measure of the Irish state's increasing participation in the funding of R&D. While the share of R&D financed by government has declined in both the EU and the OECD over the period depicted, it has risen in Ireland.

Table 13: % of GERD financed by government; Ireland, EU27, OECD

	1995	2003	2004	2005	2006
Ireland	22.5	29.8	31.1	32	30.1
EU27	39.5	35.8	35.6	34.8	34.1
OECD	33.9	30.1	30.2	29.4	28.6

Source: OECD, Main Science and Technology Indicators database
Note: missing observations confine our analysis to the years shown.

Again as in the Israeli case, government provision of direct support to the VC sector only came on stream once innovative start-up companies began to appear. Avnimelech and Teubal (2006) argue that the background conditions in Israel would have been unlikely to trigger the necessary supply of VC without government involvement because of market or system failures. This proposition would seem to apply in the Irish case also.

It appears too early to be able to say in the Irish case however – as has been said of Israel – that the authorities can now take a back seat in the VC process.[191] An extensive review undertaken for the state agency Forfás in 2006 suggested not only that most Irish VC funds were below what would be regarded as a commercially viable size (of at least €40-€50 million) but also that the VC market in Ireland had not yet reached a point where it could be considered sustainable in its own right. Three reasons were offered for this assessment. Firstly, it is difficult to assess performance in such a relatively young market. Secondly, the downturn in the technology sector represented a serious obstacle, and thirdly, it was thought that State withdrawal of funds at this time would send a negative signal both to local institutional investors and to overseas investors, who tend to look to the local market for

[191] Nor are the internal rates of return (IRR) data unambiguous. For the period 1994-2005 the EVCA has reported the average European IRR as 9.4 percent, while the only available evidence for Ireland suggests an Irish IRR of 15.7 percent (http://goliath.ecnext.com/coms2/gi_0199-6804294/Venture-capital-wanted-despite-the.html). It transpires however that this figure is based on the performance of only three particular funds and cannot be taken as representative.

evidence of support for VC. This is in spite of the fact that Ireland ranked second only to the UK in an evaluation by EVCA (2003) of the favourability of the legal and tax aspects of the environment to venture capital investors and entrepreneurs.

The task of developing a self-sustaining VC sector is clearly not straightforward. Nor are the kinds of interventionist strategies followed in the Irish and Israeli cases necessarily appropriate to all emerging regions. The weaker the standards of public-sector governance, the more the fear of "government failures" should dominate the desire to correct market failures.

Acknowledgements

We thank Garrett Murray of Enterprise Ireland for helpful discussions and suggestions, and Morris Teubal for stimulating our initial interest in the subject.

References

Avnimelech, G., Kenney, M. and M. Teubal (2005): "The Life Cycle Model for the Creation of National Venture Capital Industries: The US and Israeli Experiences", in E. Giuliani, R. Rabellotti and M.P. van Dijk (eds.): *Clusters Facing Competition: The Importance of External Linkages*. Aldershot: Ashgate.

Avnimelech, G., and M. Teubal (2006) "Creating Venture Capital Industries that Co-Evolve with High-Tech: Insight from an Extended Industry Life Cycle Perspective on the Israeli Experience", *Research Policy*, 35, 1477-1498.

Avnimelech, G., and M. Teubal (2008) "From Direct Support of Business Sector R&D/Innovation to Targeting Venture Capital/Private Equity: A Catching-Up Innovation and Technology Policy Life Cycle Perspective", *Economics of Innovation and New Technology*, 17, 1, 153-172.

Berkery, D. (2001) *Technology in Ireland*, Dublin: Delta Partners.
Commission of the European Communities (2005), *Best Practices of Public Support for Early-Stage Equity Finance: Final Report*, DG Enterprise and Industry.

Crone, M. (2004) "Celtic Tiger Cubs: Ireland's VC-Funded Software Start-ups", paper presented at Institute of Small Business Affairs National Entrepreneurship and SME Development Conference, Newcastle-Gateshead, November.

Enterprise Ireland (2005), *Seed and Venture Capital Programme 2000-2006*.

European Venture Capital Association (2003) *Benchmarking European Tax & Legal Environments. Indicators of Tax &Legal Environment Favouring the Development of Private Equity and Venture Capital in European Union Member States*.

FitzGerald, E. (2002), *Venture capital opportunities in the Irish market*, Dublin: A&L Goodbody.

Florida, R., and M. Kenney (1988) "Venture Capital, High Technology and Regional Development", *Regional Studies*, 22, 1, 33-48.

Forfás (2000) *Enterprise 2010: New Strategy for the Promotion of Enterprise in Ireland in the 21st Century*, Dublin: Forfás.

Forfás (2008) Appendix to *Annual Business Survey Of Economic Impact*, Dublin, Forfás.

Forfás (2009) *Annual Employment Survey, Dublin*, Forfás.

Gompers, P. A. (2007) "Venture Capital", Chapter 9 in B.E. Eckbo (ed.) *Handbook of Corporate Finance: Empirical Corporate Finance*, Volume 1, Elsevier/North-Holland.
Industrial Policy Review Group (1992) *A Time for Change: Industrial Policy for the 1990s*, Dublin : Stationery Office.

Jeng, L.A., and P.C. Wells (2000) "The Determinants Of Venture Capital Funding: Evidence Across Countries", *Journal of Corporate Finance*, 6, 241-289.

Kenney, M. (2004) "Supportive Economic Institutions: Silicon Valley's Lessons for Developing Countries", in A. Bartzokas and S. Mani (eds.) *Financial Systems, Corporate Investments in Innovation and Venture Capital*, Edward Elgar.

Lyons, S. (2004), *Limited Partnership: Restriction on Size of Partnerships Now Relaxed*, LK Shield Solicitors.

Mason, C. and R .Harrison (2003) "Closing the Regional Equity Gap? A Critique of the Department of Trade and Industry's Regional Venture Capital Funds Initiative, *Regional Studies*, 37, 855-868.

Murphy, M. (2000) "Ireland: Venturing Far And Near", *European Venture Capital Journal*, September, 46.

O'Brien, G. (2008) *Irish Policy for Selecting and Supporting High Potential Start-Up Companies*, M.Sc. in Economic Policy Studies dissertation, Trinity College Dublin.

Ó Riain, S. (2004) *The Politics of High-Tech Growth: Developmental Network States in the Global Economy*, Cambridge: Cambridge University Press.

OECD (2000) *The Internationalisation Of Venture Capital Activity In OECD Countries: Implications For Measurement And Policy*. Directorate for Science, Technology and Industry, DSTI/DOC(2000)7.

Sterne, J. (2004) *Adventures in Code: the Story of the Irish Software Industry*, Dublin: Liffey Press.

Sunley, P., B. Klagge, C. Berndt and R. Martin (2005) "Venture Capital Programmes in the UK and Germany: In What Sense Regional Policies?", *Regional Studies*, 39, 2, 255-273.

Walsh, M. (1985) "Venture Capital in Ireland", *Irish Journal of Irish Business and Administrative Research*, 7, 1, 33-45.