EXPORTING, FOREIGN DIRECT INVESTMENT AND FIRM HETEROGENEITY IN THAILAND

By

SUPREEYA VIRAKUL

A thesis submitted to
The University of Birmingham
for the degree of
DOCTOR OF PHILOSOPHY

Department of Economics
Birmingham Business School
The University of Birmingham
August 2009

Abstract

This thesis presents an empirical investigation of the relationship between exporting, foreign direct investment (FDI) and firm heterogeneity in Thailand using a firm-level data from the Annual Survey of Thailand's manufacturing industry between 2001 and 2004. We first examine the factors affecting the export participation decision of a firm by emphasising the importance of sunk entry costs, structure of ownership and other firm-specific characteristics. If a firm has export experience, the probability of exporting is likely to increase in the current period. Other firm-specific characteristics such as ownership, productivity, firm size, training and establishment location also significantly determine the probability of exporting. Second, we consider the role of the financial factors and the export participation decision. The internal finance of a firm as a measure of financial health is used to explain the capability to invest in order to enter export markets. The liquidity ratio has a positive and significant effect on the probability of exporting whilst the leverage ratio has the opposite effect. Third, we make a distinction between single- and multi-product firms and examine the characteristics associated with a multi-product firm. Being a multi-product firm and the number of products produced are associated with various firm-specific characteristics such as productivity, firm size and research and development (R&D). Finally, we emphasise on an indirect impact of FDI inflows in the host economy by investigating spillover effects from foreign to domestic firms. The positive and significant results for horizontal productivity spillovers and vertical export spillovers confirm that foreign firms do generate some positive externalities to domestically-owned firms.

Acknowledgements

First of all, I would like to express my profound gratitude to both of my supervisors Dr. Robert Elliott and Dr. Matthew Cole for their inspiration, helpful guidance, invaluable advice and untiring support throughout my PhD study.

My appreciation also goes to staff members and research students in the Department of Economics, University of Birmingham, for all comments at the PhD workshops. I would like to thank Professor Marius Brülhart and participations at the GEP postgraduate conference, the GEP research seminar, and the ETSG annual conference in Athens 2007 and Warsaw 2008 for their useful comments. I also gratefully acknowledge the Department of Economics for providing me with maintenance scholarship.

Ultimately, I would like to deeply express my heart-felt thanks to my family especially my parents for all of their great support and encouragement.

Table of Contents

List of Tables

Abbreviations

ASEAN	Association of Southeast Asian Nations
BOI	Board of Investment
CEECs	Central and Eastern European Countries
EU	European Union
FDI	Foreign direct investment
FPRI	Fiscal Policy Research Institute
GDP	Gross domestic product
GMM	Generalized method of moment
HS	Harmonised System
IFS	International Financial Statistics
IID	Independently and identically distributed
IIT	Intra-industry trade
IO	Industrial organisation
I-O	Input-Output
ISIC	International Standard Industrial Classification
LPM	Linear probability model
M&A	Mergers and acquisitions
MNEs	Multinational enterprises
NESDB	National Economic and Social Development Board
NICs	Newly industrialised countries
OECD	Organisation for Economic Co-Operation and Development
OIE	Office of Industrial Economics

OLS	Ordinary least square
R&D	Research and development
SIC	Standard Industrial Classification
TFP	Total factor productivity
TNSO	National Statistic Office of Thailand
UK	United Kingdom
US	United States

1
Introduction

In the global economy, international trade and foreign direct investment (FDI) have become increasingly important. Both of them are known as key elements that drive an increase in economic integration and the economic development process. Therefore, policymakers from both developed and developing countries have adopted trade policies that encourage FDI inflows in order to stimulate economic growth.

In the 1960s and 1970s, the trade policy in Thailand emphasised import substitution rather than the export promotion. The government imposed tariffs on imports especially on the final goods or finished products. However, there was a shift in trade policy towards export promotion in the 1980s. Later, the government promoted openness and competition as well as a liberalised economy through trade and financial liberalisation in the 1990s.

After the relaxation of capital controls, funds could freely flow in and out of the country. Loans from abroad were used to channel money into less productive sectors and to finance long-term

projects using short-term lending. Bhaopichitr (1997) points out that the bubble actually started in 1995 when goods and wages in real estate and financial sectors were highly overvalued. Thailand faced a deficit problem in the current account. This was mainly because the value of exported goods was less than that of imported goods.

Krongkaew (1999) argues that another factor that contributed to the financial crisis was a decline in the country's export performance. An increase in wage rates and an overvalued Thai currency caused a slowdown in Thai exports as the country lost competitiveness in the world market. In addition, exported goods were expensive compared to other countries. In July 1997, the exchange system was changed to a managed float. The depreciation of the Thai currency pushed up the level of competitiveness, so the export volume increased gradually.

In terms of FDI inflows, since the 1990s, Thailand has received a large amount of FDI inflows especially in the steel and petrochemical industries.[1] In 1997 and 1998, FDI inflows increased compared to the previous year. This positive growth was explained by an increase in mergers and acquisitions (M&A) whereas multinational enterprises (MNEs) took over domestic firms that experienced liquidity problems. After 1998, the level of FDI inflows decreased by 30 percent. This was because foreign investors lacked the confidence to invest in the Thai economy.

Since the financial crisis, the Thai government has continuously implemented policies that resolve economic problems and stimulate economic growth by encouraging exports and attracting FDI inflows. The importance of export performance and FDI inflows in Thailand motivates this research to empirically investigate different aspects related to exports and FDI at a micro-level perspective.

[1] Data source: Bank of Thailand

In general, it is well recognised that a host country benefits from exporting. The implementation of an export promotion policy is aimed at encouraging more exports. However, the decision to participate in export markets is ultimately a firm-level decision. Even though exporting is considered beneficial, not every firm is able to export. This is because of the differences in firm-specific characteristics including their financial status. Many empirical studies examine the various factors affecting the export decision from the developed country perspective (see e.g. Bernard and Jensen 1999, 2004, Girma *et al.* 2004, Greenaway and Kneller 2004, Greenaway *et al.* 2005) with few linking the entry decision with financial factors (see e.g. Greenaway *et al.* 2007). Some studies look at the evidence from a developing country perspective (see e.g. Roberts and Tybout 1997, Clerides *et al.* 1998 and Alvarez and López 2005).

In regards to FDI, attracting FDI inflows are believed to generate both direct and indirect impacts that would possibly benefit the host economy. The direct benefit is, for example, through an increase in capital inflows and employment creation. At the same time, the indirect benefit can be generated through different channels of spillovers such as productivity and export spillovers to domestic firms (see e.g. Caves 1974, Blomström and Persson 1983, Aitken *et al.* 1997, Kokko *et al.* 1997 and Greenaway *et al.* 2004). In addition, different FDI incentives may have different effects on domestic firms. Blomström and Kokko (1998) and Görg and Greenaway (2004) provide a survey on productivity and export spillovers. The evidence is quite mixed. Since there is no single conclusion for spillover effects from FDI to domestic firms, it is interesting to explore the evidence of how FDI affects domestic firms in Thailand.

Another interesting feature of firm heterogeneity in international trade relates to product level analysis as recent studies pointed out, world production and trade is dominated by multi-product firms (Bernard *et al.* 2005 and 2006a). The early literature on traditional trade models does not account for the prevailing role of multi-product firms. However, a number of recent

studies develop theoretical and empirical analysis on firm heterogeneity at the product level (see e.g. Bernard *et al.* 2005 and 2006a, Eckel and Neary 2006, Nocke and Yeaple 2006 and Goldberg *et al.* 2008). The stylised facts and recent interest is the motivation for this research to explore and develop a clear understanding about the role of multi-product firms in international trade and the characteristics associated with multi-products firms from a developing country perspective.

This thesis combines four empirical studies related to exporting, FDI and firm heterogeneity in Thailand using a firm-level data from the Annual Survey of Thailand's manufacturing industry between 2001 and 2004. We first investigate the determinant of the export participation and performance of firms in Thailand and then examine the characteristics associated with multi-product firms. Finally, we search for the effects of FDI inflows to domestically-owned firms. The findings can be used as a guidance to suggest the policy implications to promote export and attract certain types of FDI inflows. The remainder of the thesis is structured as follows.

Chapter two examines the relationship between firm heterogeneity, origin of ownership and export participation. This is based on the assumption that different characteristics of a firm may have different effects on its decision to export. Sunk entry cost is also taken into consideration in determining the export participation decision as a firm must face the one-off large investment prior to the entry into the export markets. Each firm also has different specific characteristics such as structure of ownership, productivity, size, training and R&D which are included in the empirical model. Establishment location of a firm may have an influence on the decision to participate in export markets because each location exhibits different transportation costs. We also emphasise on the importance of country of origin as we assume that different countries invest in Thailand with different incentives such as export-platform or market-seeking FDI.

Chapter three re-examines the determinants of a firm's export participation decision by emphasising the financial variables that are used to measure a firm's financial health. We assume that investment and a firm's internal finance are linked. Exporting is also considered as a form of investment because a firm has to invest in sunk entry costs in order to start exporting. Therefore, we include financial variables in our analysis because they indicate a firm's ability to invest in order to enter and operate in export markets. Other firm-specific characteristics are also included.

Chapter four differs slightly from the previous two chapters. We link exporting and FDI to multi-product firms by investigating different aspects of multi-product firm production. The first part of the analysis relates to the investigation of the relationship between multi-product firms' extensive margins (number of products produced or exported) and intensive margins (output or export sales per product). In the second part, we investigate the characteristics associated with multi-product firms (being a multi-product firm and the number of products produced) and also making a distinction between domestically- and foreign-owned firms. Export status, structure of ownership and various firm characteristics are included in the estimation.

Chapter five focuses on the importance of FDI in the host economy. The fundamental framework for this chapter is that foreign firms may indirectly benefit domestic firms in the host economy through externalities arising from proprietary assets. Thus, we empirically investigate the spillover effects from foreign to domestic firms. Our analyses highlights two aspects of spillovers-- productivity and export spillovers, both intra- and inter-industry. Rather than focusing only on the spillover effects from the overall foreign firms, we also distinguish between different types of foreign firms whether they are domestic market oriented or export oriented and examine the effects on productivity and export behaviour of domestic firms.

Chapter six concludes the empirical results and discusses the limitations of this study and possible future research.

2

Firm Heterogeneity, Origin of Ownership and Export Participation

2.1 Introduction

As the world economy becomes more closely integrated as a result of the pervasive forces of globalisation, there is continued interest from both academics and policymakers in the growth strategies of developing and newly industrialised countries (NICs). Development through exporting is a widely recognised route by which small open economies, and especially the so-called Asian Tigers, have managed to grow rapidly.[1] A number of studies have now demonstrated a clear link between a country's openness and its productivity growth (Edwards 1993 and 1998).

Although exports are generally perceived to be beneficial to the exporting country, it is recognised that by no means all firms export and that the decision to enter the export market is

[1] Traditionally, the Asian Tigers were thought to consist of the countries of South Korea, Hong-Kong, Singapore and Taiwan. The new Asian Tigers are considered to be Malaysia, Thailand, the Philippines and Indonesia. Together, the "new" and "old" Asian Tigers are characterised by export-driven economic development and industrial policies aimed at encouraging inward foreign direct investment.

determined by a range of factors. To date, the majority of studies have examined the export decision of firms from developed countries (Bernard and Jensen 1999, 2004, Girma *et al.* 2004, Greenaway and Kneller 2004, Greenaway *et al.* 2005, Greenaway *et al.* 2007, and Kimura and Kiyota 2006) with few looking at the developing country experience (Roberts and Tybout 1997, Clerides *et al.* 1998, Van Biesebroeck 2005, Sjöholm 2003, and Alvarez and López 2005).

Studies that examine the export decision of firms from the perspective of one of the new Asian Tigers are limited. The only papers we are aware of are for Indonesia (Sjöholm 2003, Blalock and Gertler 2004, and Blalock and Roy 2007). This is rather surprising given the nature of the development strategy of this region that is export driven and involves significant competition for FDI. Multinationals from the developed world, Japan in particular, have used East Asian countries as an export platform to market their products globally, a strategy that led to rapid growth in Thailand. Moreover, the manufacturing sectors of the majority of NICs still constitute a large proportion of national output in contrast to many developed countries where manufacturing now typically accounts for less than 20% of GDP.

In this chapter, we employ a detailed firm-level dataset for Thailand between 2001 and 2004 to investigate the determinants of firms' decisions to participate in the export market. One significant contribution of this chapter is that we are able for the first time to break down FDI by country and region of origin for a country of the new Asian Tigers. We show that a firm's decision to export is determined by the evidence of sunk entry costs, structure of ownership, productivity, firm size and location. Our results are broadly consistent with those of developed countries and other developing countries although, as we might have expected given the nature of Thailand's economy, past export performance, foreign ownership and product quality generally have stronger effects for Thailand than the US, UK and other developing countries. As well as being one of the first studies for a new Asian Tiger economy, and the first for

Thailand, by distinguishing between different countries of ownership we are able to identify whether the nationality of ownership influences the likelihood of exporting. Our results show that US, UK, Singaporean, Japanese and Chinese ownership results in an increased propensity to export whilst Korean and other Southeast Asian ownership has a negative impact. This has potentially important policy implications for developing country governments looking to attract FDI as a means to future growth.

The remainder of this chapter is organised as follows. In Section 2.2, we provide an overview of Thailand's export performance and FDI trends. In Section 2.3, we review the theoretical and empirical literature. Section 2.4 describes our econometric specification and discusses our estimation techniques. Our results are presented in Section 2.5 while Section 2.6 concludes.

2.2 Exports and FDI in Thailand

2.2.1 Export Performance

The current structure of the Thai economy can be explained by a new macroeconomic model developed by the Fiscal Policy Research Institute (FPRI), Ministry of Finance, Thailand. The so-called "Diamond-5 Policy Paradigm" links the domestic economy through international trade with five equally important trading blocs: the US; EU; Japan; East Asia-9; and the rest of the world.[2] This builds on the more traditional "Locomotive-Wagon Paradigm" in which the economic growth of other countries depends upon three major blocs: the US, Western Europe and Japan (Chaipravat, 2003). This implies that at least in the minds of the Thai authorities that Thailand's pattern of trade has taken on a more intra-regional dimension.

[2] The 9 countries in the East Asia are China, Hong Kong, Taiwan, South Korea, Singapore, Malaysia, the Philippines, Indonesia and Thailand.

Thailand has been the third largest exporter from the Southeast Asian region for the last 10 years (ASEAN Statistical Yearbook, 2005). As an ASEAN member, Thailand shares in the benefits of the ASEAN Free Trade Area that aims to eliminate tariff and non-tariff barriers in both manufacturing and agricultural sectors among member countries.[3] As a result, the ASEAN region remains a major export market for Thailand. Table 2.1 reveals that after 2001 ASEAN replaced the US as Thailand's largest export market with an export share to ASEAN in 2007 of about 21.3 percent of total exports with 12.6 percent and 12.8 percent exported to the US and EU15 respectively.

Considering exports by country, there is no doubt that the main export destinations are concentrated in East and Southeast Asia. As explained by Chaipravat (2003), the intra-regional trade within East Asia has increased significantly with a change from horizontal to vertical integration. Such growth in trade is due in part to the development of an international production network in the region. Each country produces different parts of a product and trades with other countries within the regional bloc. According to Table 2.2, the US, Japan, China, Singapore and Hong Kong are the top-five export destinations in both 2003 and 2007, accounting for 46 percent of total Thai exports in 2007. In addition, all countries in East Asia-9 have been recognised in the top-fifteen of Thailand's export destinations that account for, on average, more than 30 percent of total Thai exports during 1998 to 2007.

[3] Attempts at organised regional co-operation between South-East Asian countries dates to August 1967 when the ASEAN was established with original members Indonesia, Malaysia, the Philippines, Singapore and Thailand. Expansions to ASEAN were Brunei in 1984, Vietnam in 1995, Myanmar and Laos in 1997 and Cambodia in 1999.

Table 2.1: Major Export Markets

Export Markets	Value : US$ million									
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
ASEAN	9,895.85	10,871.61	13,482.22	12,599.12	13,568.90	16,486.03	21,238.38	24,390.42	27,021.71	32,791.08
EU-15	9,718.11	9,828.66	11,001.28	10,551.89	10,214.62	11,747.73	13,810.60	14,293.81	16,874.60	18,119.05
Japan	7,469.33	8,261.32	10,232.38	9,945.38	9,949.98	11,356.20	13,491.63	15,089.85	16,385.90	19,415.61
US	12,167.20	12,654.27	14,870.11	13,199.62	13,509.42	13,596.16	15,502.86	16,996.64	19,449.60	19,848.06
Others	15,239.57	16,847.59	20,038.24	18,887.22	20,913.39	26,853.87	32,459.35	40,166.93	49,988.63	63,691.16
World	54,490.06	58,463.44	69,624.23	65,183.23	68,156.31	80,039.98	96,502.82	110,937.66	129,720.43	153,864.96

Source: Department of Trade Negotiations, Ministry of Commerce

Table 2.2: Fifteen Major Export Destinations by Country

Rank		Country	Value : US$ million									
2007	2003		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	1	USA	12,167.20	12,654.27	14,870.11	13,199.62	13,509.42	13,596.16	15,502.86	16,996.64	19,449.60	19,415.61
2	2	Japan	7,469.33	8,261.32	10,232.38	9,945.38	9,949.98	11,356.20	13,491.63	15,089.85	16,430.60	18,119.05
3	4	China	1,766.75	1,860.95	2,836.47	2,873.36	3,555.04	5,688.92	7,113.45	9,167.55	11,727.95	14,846.75
4	3	Singapore	4,698.25	5,073.12	6,065.97	5,261.39	5,552.73	5,850.25	7,027.01	7,689.15	8,357.22	9,619.69
5	5	Hong Kong	2,783.06	2,981.32	3,517.88	3,306.82	3,687.89	4,315.16	4,939.56	6,165.34	7,166.74	8,694.76
6	6	Malaysia	1,780.28	2,124.23	2,832.15	2,733.44	2,835.29	3,872.01	5,312.37	5,821.92	6,613.62	7,819.19
7	11	Australia	980.18	1,316.28	1,636.11	1,361.72	1,641.74	2,159.99	2,467.73	3,174.55	4,349.60	5,937.42
8	10	Indonesia	983.61	968.45	1,354.52	1,369.76	1,680.19	2,265.65	3,215.81	3,982.86	3,313.19	4,818.55
9	9	Netherlands	2,180.43	2,198.56	2,271.00	2,037.11	1,891.70	2,364.79	2,596.90	2,774.21	3,237.45	3,860.05
10	15	Vietnam	591.67	572.83	847.37	801.23	947.98	1,262.09	1,876.51	2,363.80	3,074.97	3,804.11
11	8	UK	2,120.19	2,089.73	2,385.00	2,336.78	2,393.05	2,577.45	3,029.83	2,804.61	3,399.60	3,623.04
12	7	Taiwan	1,743.14	2,043.64	2,428.96	1,925.33	1,969.42	2,581.53	2,607.97	2,721.70	3,366.12	3,329.55
13	13	Philippines	766.90	929.17	1,095.37	1,157.65	1,275.13	1,616.26	1,834.93	2,056.91	2,571.77	3,011.86
14	14	South Korea	626.03	909.62	1,277.46	1,233.96	1,398.21	1,583.00	1,858.86	2,258.64	2,669.63	2,982.62
15	12	Germany	1,556.37	1,459.58	1,658.94	1,574.33	1,534.81	1,793.06	1,803.01	2,007.62	2,326.95	2,921.59
		Total 15 Countries	42,213.39	45,443.07	55,309.69	51,117.88	53,822.58	62,882.52	74,678.43	85,075.35	98,055.01	112,803.84
		Total Others	12,276.67	13,020.37	14,314.54	14,065.35	14,333.73	17,157.46	21,824.39	25,862.31	31,665.42	41,061.12
		Total	54,490.06	58,463.44	69,624.23	65,183.23	68,156.31	80,039.98	96,502.82	110,937.66	129,720.43	153,864.96

Source: Department of Trade Negotiations, Ministry of Commerce

Since 1998, the total export value has increased dramatically reaching US$ 152 billion in 2007. This is because the depreciation of the Thai currency in 1997 has pushed up the level of competitiveness. According to Table 2.3, the manufacturing sector still dominates, accounting for 78 percent of total exports in 2007. In the same year, the share of agriculture products, agro-industry products and mining and fuel products were 10 percent, 6 percent and 5 percent, respectively with *other* at 1 percent.

Table 2.4 illustrates the level of exports for a selection of Thai industries. Sectors with large export volumes tends to be highly-technological products such as computers (and parts), automobiles (and parts) and integrated circuits. The production of computers and parts has been Thailand's leading industrial export sector for many years accounting for 11.35 percent of the country's total exports in 2007. The other leading export industry is the automotive industry with numerous foreign automotive manufacturers from Japan, the US and Europe using Thailand as an export platform to sell their products worldwide. In 2007, some industries have shown outstanding progress, e.g. the growth rates of machinery (and components) industry and electrical appliances industry were 64.46 percent and 45.98 percent, respectively.

Other prominent export sectors include more labour-intensive products such as gems, jewellery and garments. The expansion of the gem and jewellery market is mainly from fine jewels and articles of jewellery made from gold alloy with an export growth in 2007 of about 47 percent. Garment was one of Thailand's top-five exports during 1998 and 2003. However, after 2004, the growth of exports from the textile industry fell because of the elimination of the quota restriction in early 2005 and increased competition in the garment sector from China, Vietnam and India (Bank of Thailand, 2006).

Table 2.3: Export Structure of Thailand

Product	Value : US$ million									
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Agricultural	7,110.74	7,011.70	7,336.75	7,055.66	7,117.83	8,797.09	10,327.17	10,447.33	13,131.15	15,167.65
Agro-Industrial	4,253.60	4,558.71	4,718.54	4,817.94	5,098.89	5,950.14	6,369.87	7,008.75	7,970.61	9,489.47
Manufacturing	40,310.68	43,960.11	53,252.03	49,082.80	51,901.22	61,213.94	74,595.39	86,764.91	100,068.11	120,559.56
Mining and Fuel	1,061.30	1,264.83	2,418.87	2,046.72	2,009.76	2,302.89	3,680.32	5,127.96	6,894.95	7,510.90
Other	1,753.74	1,668.09	1,898.04	2,180.11	2,028.60	1,775.92	1,530.08	1,588.71	1,655.61	1,137.38
Total	54,490.06	58,463.44	69,624.23	65,183.23	68,156.31	80,039.98	96,502.82	110,937.66	129,720.43	153,864.96

Source: Department of Trade Negotiations, Ministry of Commerce

Table 2.4: Fifteen Major Export Commodities in Thai Manufacturing Sector

Rank		Product	Value : US$ million									
2007	2003		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	1	Computer machinery, parts and accessories	7,851.04	8,121.57	8,739.55	7,947.47	7,430.35	8,189.69	9,185.45	11,848.66	14,876.39	17,331.58
2	4	Automobile, parts and accessories	1,241.01	1,902.26	2,419.36	2,655.03	2,919.71	3,965.53	5,495.24	7,745.44	9,524.19	12,978.12
3	2	Integrated circuits	2,278.69	2,944.55	4,484.03	3,512.25	3,307.99	4,624.57	4,902.78	5,950.64	7,029.98	8,418.14
4	5	Gems and Jewellery	1,815.13	1,766.30	1,741.85	1,837.16	2,169.28	2,514.47	2,645.59	3,232.66	3,668.29	5,381.75
5	7	Plastic pellets	989.56	1,215.31	1,865.63	1,615.02	1,775.24	2,148.43	3,104.60	4,198.45	4,498.43	5,212.30
6	8	Iron and steel products	905.76	954.29	1,399.16	1,091.43	1,249.69	1,687.20	2,477.84	2,895.63	3,528.61	4,570.55
7	22	Machinery and components	752.49	613.87	801.45	860.96	930.22	1,244.97	1,670.14	2,111.26	2,655.15	4,369.12
8	9	Chemicals	683.71	908.00	1,248.11	1,015.12	1,192.97	1,581.36	2,059.06	2,646.08	3,434.34	3,920.14
9	24	Electrical appliances	574.75	545.13	901.09	873.57	905.66	967.930	1,839.57	2,208.78	2,514.18	3,746.63
10	12	Rubber products	866.39	875.05	1,060.37	1,095.07	1,260.31	1,556.44	1,943.68	2,351.20	3,082.00	3,653.74
11	10	Air Conditioning machine and parts	780.42	895.52	1,079.62	1,160.50	1,108.35	1,430.29	1,997.74	2,201.41	2,287.50	3,189.10
12	6	Radio, television and parts	1,445.83	1,346.48	1,964.87	1,692.77	2,094.58	2,501.77	3,224.46	3,141.84	3,457.34	3,070.84
13	3	Garments	2,986.76	2,915.63	3,132.68	2,914.40	2,721.50	2,760.19	3,089.23	3,150.21	3,198.83	3,051.38
14	17	Plastic products	708.42	758.13	894.23	860.32	954.44	1,236.20	1,410.21	1,774.70	1,883.99	2,301.83
15	47	Reciprocating internal combustion engine and components	121.52	187.69	327.40	286.97	345.98	547.82	1,245.04	1,379.96	1,567.92	1,732.28
		Total 15 products	24,007.48	25,949.78	2,059.40	29,418.04	30,366.27	36,956.86	46,290.63	56,836.92	67,207.14	82,927.50
		Total Others	30,482.58	32,513.66	37,564.83	35,765.19	37,790.04	43,083.12	50,212.19	54,100.74	62,513.29	70,937.46
		Total	54,490.06	58,463.44	69,624.23	65,183.23	68,156.31	80,039.98	96,502.82	110,937.66	129,720.43	153,864.96

Source: Department of Trade Negotiations, Ministry of Commerce

2.2.2 FDI Trends

As a result of the Plaza accord, there was currency appreciation in Japan and NICs such as South Korea, Taiwan and Hong Kong.[4] Those countries relocated production towards more developed countries in Asia, particularly Malaysia and Thailand (Thomsen, 1999). Therefore, FDI inflows in Thailand increased significantly since the late 1980s. From Table 2.5, the depreciation of Thai currency in 1997 caused a large increase in FDI inflows of over US$ 5.1 billion in 1998 because the cost of investing in Thailand was cheaper relative to other countries and the government relaxed restrictions on the percentage of foreign equity in financial institutions. There was also an increase in M&A since MNEs took over domestic firms that faced severe liquidity problems.

The financial crisis affected foreign investors' confidence, so the value of FDI fell to US$ 3.6 billion in 1999 and US$ 2.8 billion in 2000. However, in 2001 FDI inflows increased more than double because of high investment from Japan and Singapore. Over the years, Thailand experienced fluctuations in FDI inflows. Recent figures show that the FDI inflows were more than US$ 10 billion in 2006 and 2007.

The main sources of FDI inflows have generally been from Japan, the ASEAN region particularly Singapore, the US and the EU-15. Since the 1970s, Japan has been the largest source of FDI except 1999. The large decrease of Japanese FDI in 1999 was mainly because of the economic circumstances in the home country. FDI from Japan increased again in 2000. Singapore has been the second largest source of FDI inflows since 2001. Foreign investors from Singapore invested in different sectors such as banking, telecommunications and especially in automotives and electronics industries.

[4] Plaza accord was an agreement signed in 1985 by G-5 nations (France, West Germany, Japan, the US and the UK) to depreciate the US dollar in relation to the Japanese and German currencies.

Table 2.6 illustrates the net FDI inflows by sector. Each year, the industrial sector received the highest percentage of FDI inflows. During 2000 and 2005, the percentages of manufacturing FDI to total FDI were more than 50 percent on average whilst only 38.83 and 35.80 percent in 2006 and 2007, respectively. The second largest recipient of FDI was the trade sector in 1998 and 1999. However, the trade sector was overtaken by the financial sector during 2004 and 2007.

In the manufacturing sector, FDI inflows tend to be concentrated in the production of highly-technological goods, such as machinery and transport equipment, electrical appliances, metal and non-metallic. These figures for FDI inflows are in line with the export features of Thailand of which the largest export volumes tend to be highly-technological products. For example, the second largest export industry of Thailand is the automotive industry with numerous foreign automotive manufacturers from Japan, the US and Europe using Thailand as an export platform.

Given the importance of the export sector and FDI inflows and Thailand's continued export driven development policies, it is important to have an understanding of the factors that influence a firm's decision to participate in the export market. Specifically, it is important to know whether there are any significant differences in the factors influencing the decision to export for firms in Thailand in comparison with the experience of firms from economies at different stages of development.

Table 2.5: Foreign Direct Investment Net Inflows to Thailand Classified by Country

Country	Value : US$ Million									
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Japan	1,484.69	488.35	869.86	1,955.12	1,892.41	2,297.67	2,749.93	2,926.51	2,576.42	3,135.72
US	1,283.31	641.22	617.57	395.01	182.34	336.23	540.42	750.48	165.78	570.06
EU-15	912.30	1,368.46	509.59	282.91	-216.12	607.55	697.31	335.02	955.41	1,561.89
Other EU	-1.07	-0.04	0.70	-1.07	0.99	2.07	3.49	-0.07	4.70	19.32
ASEAN-5	569.65	569.57	381.78	1,709.95	1,403.52	1,053.86	683.37	1,107.34	4,597.15	2,560.17
-Brunei Darussalam	0.02	0.00	0.00	0.00	0.10	0.07	2.09	4.71	2.20	-3.92
-Indonesia	2.71	1.19	4.26	2.81	7.43	6.72	5.87	1.06	-6.35	6.10
-Malaysia	17.15	27.06	21.33	10.66	-32.55	41.24	147.31	38.36	321.82	21.30
-Philippines	7.78	3.21	0.50	2.88	-0.41	5.43	182.96	-5.54	-0.46	7.10
-Singapore	541.97	538.10	355.68	1,693.59	1,428.95	1,000.38	345.12	1,068.74	4,279.94	2,529.58
Other ASEAN	5.26	2.47	7.25	0.73	4.77	6.58	5.31	-6.02	29.35	6.75
Hong Kong	393.91	233.65	331.31	150.58	86.25	613.08	141.40	7.16	-77.84	390.37
Taiwan	106.25	121.49	158.96	156.83	103.70	75.25	124.20	29.24	-94.55	91.50
South Korea	72.72	5.46	-3.69	50.64	93.22	23.83	93.53	29.51	79.48	75.33
China	5.01	-2.14	7.23	-2.50	20.90	23.83	-3.82	11.55	49.87	73.71
Canada	3.15	2.97	9.45	5.90	15.04	21.17	28.53	-11.22	7.06	25.52
Australia	34.58	12.94	26.60	0.56	-0.42	32.47	99.85	-1.09	11.18	69.36
Switzerland	73.22	60.37	32.16	55.34	48.07	124.12	167.30	99.81	153.90	172.37
Other	199.14	56.93	-135.55	287.94	-223.71	-52.75	-374.87	1224.89	2021.78	1446.98
Total	5,142.18	3,561.69	2,813.26	5,048.00	3,411.00	5,165.00	4,956.00	6,503.16	10,479.74	10,199.09

Source: Bank of Thailand

Table 2.6: Foreign Direct Investment Net Inflows to Thailand Classified by Sector

Sector	Value : US$ Million									
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Industry	2,206.35	1,268.63	1,810.66	2,960.26	1,844.53	2,408.58	3,785.98	3,429.86	4,068.87	3,651.17
-Food & Sugar	73.38	94.01	93.00	155.06	21.28	265.14	337.32	-24.76	118.13	120.62
-Textiles	123.96	20.81	-3.47	105.56	43.29	64.46	37.95	77.87	-7.88	71.18
-Metal & Non Metallic	341.65	262.40	-83.66	378.35	259.82	255.75	480.07	221.43	354.65	507.51
-Electrical appliances	264.31	424.99	507.23	981.29	214.93	327.44	797.01	908.29	1,080.91	380.53
-Machinery & Transport equipment	661.17	392.84	655.48	578.81	644.45	653.10	1,280.34	1,369.98	1,402.81	1,236.34
-Chemicals	226.00	7.48	393.38	167.77	334.09	295.90	387.34	472.39	173.95	-141.95
-Petroleum Products	328.66	8.57	29.30	179.93	-50.16	95.25	22.49	-72.60	332.18	378.58
-Construction materials	23.35	37.87	57.82	0.18	31.37	-7.89	45.05	21.66	7.85	31.42
-Others	163.82	19.62	161.58	413.27	345.42	459.39	398.36	455.58	606.25	1,066.92
Financial Institutions	842.14	247.13	132.97	-186.17	67.34	-24.52	221.65	1,550.89	2,490.21	1,882.23
Trade	1,051.45	1,042.29	67.79	1,069.13	682.21	817.88	182.91	295.19	787.97	602.79
Construction	191.69	-151.77	-1.70	4.53	19.32	42.98	70.67	29.89	-86.00	46.33
Mining & Quarrying	21.71	-41.82	-274.74	759.32	146.61	270.62	192.29	-110.99	206.05	808.43
Agriculture	0.49	1.90	0.70	-4.22	3.20	28.22	5.72	12.60	-1.94	3.19
Services	276.16	485.02	448.28	155.90	740.64	362.23	303.27	330.94	711.19	1,055.78
Investment	363.77	570.80	99.12	-33.69	-655.97	374.70	-236.66	173.64	2,133.33	321.81
Real Estate	27.71	148.53	69.11	70.88	67.58	126.40	-343.96	43.34	262.64	1,207.13
Others	160.70	-9.04	461.05	252.04	495.50	757.88	774.10	747.77	-92.60	620.19
Total	5,142.19	3,561.69	2,813.26	5,048.00	3,411.00	5,165.00	4,956.00	6,503.16	10,479.74	10,199.09

Source: Bank of Thailand

2.3 Literature Review

2.3.1 Sunk Entry Costs and the Decision to Export

The costs to a firm of becoming and remaining an exporter are composed of two components: sunk costs and fixed costs. The former refer to the costs that arise before a firm enters the export market; the latter occur as long as a firm remains in the export market, e.g. transport and service costs and marketing costs.

More specifically, sunk costs are defined as an initial large and one-off investment faced by a firm in order to enter the export market. Such a cost can be considered as a combination of R&D spending to improve product quality in order, for example, to conform to standards and safety regulations of a target country, and the setting up of business and marketing connections in foreign countries. Baldwin (1988) describes sunk costs as the costs of establishing a distribution and service network, and the costs of launching a product or brand advertising.

Each individual firm faces a different sunk entry cost which will depend upon firm-specific characteristics including geographical location. However, when a firm that has previously exited a market wants to re-enter, it will still face a sunk cost which will vary depending on how long it has been absent from the market. Theoretically, we follow Roberts and Tybout (1997).

For a given firm, the export status of firm i is given by Y_{it} where Y_{it} equals 1 if firm i exports at time t, and 0 otherwise. The export experience of firm i through period t is given by $Y_{i(t-j)} \mid j \geq 0$. In the current period, a firm chooses the infinite sequence of values of $Y_{i(t+j)} \mid j \geq 0$ that maximises the expected present value of revenue. The function of the maximised revenue can be written as:

$$V_{it}(\Omega_{it}) = \max_{Y_{i(t+j)}|j\geq 0} E_t(\sum_{j=t}^{\infty} \delta^{j-t} R_{ij} \,|\, \Omega_{it}) \qquad (2.1)$$

where $j = t$, $R_{ij} = R_{it}$, and thus R_{it} is the current revenue of firm i. Ω_{it} is the current specific information set of firm i. E_t represents the expected value in the current period which is conditional on the firm specific information set of firm i available in period t and δ is the discount rate. By applying Bellman's equation to the export decision, the current export status of firm i written as Y_{it} satisfies:

$$V_{it}(\Omega_{it}) = \max_{Y_{it}} \left(R_{it}(Y_{i(t-j)|j\geq 0}) + \delta E_t(V_{i(t+1)}(\Omega_{i(t+1)}) \,|\, Y_{i(t-j)|j\geq 0}) \right) \qquad (2.2)$$

From the maximisation of the revenue in Equation (2.2), we can define the current profit function $(\hat{\pi}_{it})$ as current revenue plus the difference in the expected value of the maximised revenue of firm i, conditional on the firm's export status. Thus, $\hat{\pi}_{it}$ can be written as:

$$\hat{\pi}_{it} \equiv R_{it} + \delta\Big[\Big[E_t(V_{i(t+1)}(\Omega_{i(t+1)}) \,|\, Y_{it} = 1)\Big] - \delta\Big[E_t(V_{i(t+1)}(\Omega_{i(t+1)}) \,|\, Y_{it} = 0)\Big]\Big] \qquad (2.3)$$

where $\Omega_{i(t+1)}$ is the information set of firm i in period $t+1$.

In each period, firm i has to decide whether to export or not. Firm i exports in period t if the expected gross profit and revenue of firm i at time t $(\hat{\pi}_{it})$ exceeds the current period cost (c_{it}) including the sunk entry cost (S_i). Otherwise, firm i chooses not to export. The export decision by firm i is therefore represented as:

$$Y_{it} = \begin{cases} 1 \;\; \text{if } \hat{\pi}_{it} > c_{it} + S_i * (1 - Y_{i(t-1)}) \\ 0 \;\; \text{otherwise} \end{cases} \qquad (2.4)$$

Sunk entry costs (S_i) are varied across firms, so previous experience including the characteristics of each particular firm affects a firm's decision to export.

Since the main aim of this chapter is to examine the factors that influence the export decision of a firm, firm characteristics are included in the empirical model in order to identify the probability of exporting. We therefore specify the export decision model as:

$$Y_{it} = \begin{cases} 1 \text{ if } \beta Z_{it} - S_i * (1 - Y_{i(t-1)}) + \varepsilon_{it} > 0 \\ 0 \text{ otherwise} \end{cases} \quad (2.5)$$

where Z_{it} represents a vector of firm-specific characteristics. Details on the variables we include in vector Z are discussed in Section 2.4.

2.3.2 Empirical Analysis of Firm Heterogeneity, Sunk Entry Costs and Exporting

Numerous studies have examined the factors that affect a firm's decision to export taking advantage of the increased availability of firm-level data sets. The primary question these studies address is whether good firms become exporters or whether exporters become good firms. See López (2005), Wagner (2007), and Greenaway and Kneller (2007) for detailed surveys of the firm heterogeneity and international market participation literature.

In this sub-section, we briefly outline the current state of the literature looking at first developed and second, developing country studies. One of the first US papers was Bernard and Jensen (1999) who investigate the factors that affect a firm's export decision using plant-level characteristics and lagged endogenous variables as independent regressors. They found evidence to suggest that good firms become exporters. The statistical significance of entry sunk

costs indicates that firms who have had previous export experience (either one or two years ago) seem to re-enter and remain as exporters in the following year. Firm size, wage, and productivity, all significantly increase the probability of exporting. Bernard and Jensen (2004) extend their 1999 model to include foreign ownership, spillovers and subsidies and also apply alternative estimation techniques including a linear probability model without plant effects, a linear probability model with fixed effects and generalized method of moment (GMM) in first differences. Sunk entry costs are generally positive and significant. The results from the spillover variables are of limited economic significance.

For the UK, Greenaway and Kneller (2004) find that lagged exports have a positive and significant effect on the probability of a firm exporting. Firm size and wage are also positive and significant determinants and productive firms are likely to enter the export market. One additional result of interest is that both industrial and geographical agglomerations are significant determinants of entry into export markets. In a more recent paper, Greenaway *et al.* (2007) examine a firm's export decision using firm-level financial indicators to indicate the financial health status of each firm. They hypothesise that the stronger the financial health of the firm, the more likely it is to enter the export market. Distinguishing between different types of exporters, they find that continuous exporters seem to have higher liquidity and lower leverage ratio than starters. Consistent with other studies, they find that small and domestic firms are less likely to enter the export market than large and foreign firms. However, in contrast to other UK studies, TFP is insignificant and in some specifications the sign on wage is negative. In a recent study of French manufacturing firms, Marinov *et al.* (2008) find that both the incidence and volume of foreign sales increase with size although they find no minimum threshold for entering export markets.

In a third UK study, Kneller and Pisu (2004) examine the export behaviour of foreign firms. Again, foreign firms appear to export more than domestic firms. Other results reveal a positive relationship between the decision to export and firm size, the proportion of the workforce that is skilled and productivity. One interesting result is that the origin of ownership of the firm is found to be important. The significance of several country groupings is consistent with the export-platform FDI hypothesis with firms, for example from the US and Canada, being more likely to export rather than those from Australia.

To test more accurately the self-selection and learning-by-exporting hypotheses, Girma *et al.* (2004), Greenaway *et al.* (2005) and Arnold and Hussinger (2005) apply matching techniques to examine the export performance of firms from the UK, Sweden and Germany respectively.[5] In addition to the standard size, age and productivity effects, young firms are more likely to become exporters. For Sweden, there is no evidence of differences in productivity between exporters and non-exporters affecting pre- or post-export market entry. Bernard and Wagner (2001) in a study of German firms provide consistent findings.

Fariñas and Martín-Marcos (2007) use Spanish manufacturing sector data to analyse the performance of exporting and non-exporting firms. Exporting is positively correlated with productivity size, wages and innovation. Prior to entering an export market, new-entry exporters have a better performance than non-exporters. Fariñas and Martín-Marcos (2007) also provide evidence to support the proposition that firms self-select to exit export markets as continuing exporters have a higher performance than firms that exit. These results are consistent with the self-selection hypothesis, a result also found for Taiwanese firms by Aw *et al.* (2000 and 2007).

[5] A single index identifying the probability of entry that captures all information about the characteristics of the firm pre-entry is based on the use of matching techniques.

For developing countries specifically, Roberts and Tybout (1997) investigate the factors that affect the export decision of Colombian firms using firm-level data from 1981 to 1989. They present a dynamic discrete-choice model as a theoretical explanation of a firm's behaviour in entering and exiting export markets with firms more likely to enter an export market if current net operating profits exceed sunk costs. In determining the export decision, sunk costs and a vector of firm-specific characteristics are included. The results confirm the existence of sunk entry costs. Unobserved plant heterogeneity is used to determine the probability of exporting.

Three other developing countries, Colombia, Mexico, and Morocco, are studied by Clerides *et al.* (1998). They investigate whether marginal costs affect the export decision of the firm and whether the export experience has an effect on the firm's costs. The results can be interpreted as saying that plants with low marginal costs and a large capital stock are more likely to export. Moreover, past export experience also appears to determine current export participation. There is also some evidence of geographic spillovers for Colombian plants.

Chilean manufacturing plants between 1990 and 1996 are considered by López (2004) and Alvarez and López (2005). TFP is found to be important, indicating that firms learn to export and also that firms invest in technology in order to be able to produce high quality export goods which leads to productivity upgrading in the pre-entry period. As productivity improves, firms are then able to enter the export market. In addition, Alvarez and López (2005) find some evidence of learning-by-exporting by which productivity increases after the firm becomes an exporter.

In studies from the same geographical region as our own, three recent studies examine Indonesian firms. Sjöholm (2003) emphasises foreign networks as a determinant of exporting. Imports and foreign ownership significantly increase the probability of a firm exporting. However, spillovers from FDI have no significant effect on the decision to start exporting.

Other variables such as size, the share of skilled labour, capital stock per worker, and R&D expenditure appear to be positive and significant. These results are consistent with the results from other developed and developing countries. Blalock and Gertler (2004) find some evidence of an increase in productivity after entering into export market thereby supporting learning-by-exporting rather than the self-selection hypothesis. When considering the effect of the Asian crisis on exports, Blalock and Roy (2007) discover that the devaluation of the Indonesian currency caused an increase in entry and exit from export markets. Continuing exporters were found to be those firms that were owned by foreign investors, that engaged in R&D and that also carried out considerable staff training.

Finally, Van Biesebroeck (2005) focuses on nine sub-Saharan African countries in order to observe the export performance of firms from low-income countries. The analysis reveals significant evidence to support both the self-selection and learning-by-exporting hypotheses.

2.4 Methodology and Data

2.4.1 Model

In this sub-section, we identify those factors that are believed to affect a firm's export decision building on best practice from the existing theoretical and empirical literature for both developed and developing countries. Differences in firms' characteristics determine the individual performance and the capacity of a firm to export. In addition, sunk entry costs are included to investigate the link between sunk costs and exporting. The model we test specifies the relationship between the export decision and various factors given by:

$$EX = f(Z) \tag{2.6}$$

where EX is the export decision of the firm. Z is a vector of firm characteristics.

All independent variables are lagged by one year to control for potential endogeneity problems whereby previous characteristics of the firm determine the export decision in the current period. We include the lagged dependent variable to capture the effect of sunk entry costs:

$$EX_{it} = \alpha + \beta_1 EX_{i(t-1)} + \beta_k Z_{i(t-1)} + \varepsilon_{it} \tag{2.7}$$

where ε is the error term.

Our vector of firm characteristics is based on the previous literature. Our final specification is:

$$\begin{aligned} EX_{it} = {} & \alpha + \beta_1 EX_{i(t-1)} + \beta_2 FOREIGN_{i(t-1)} + \beta_3 TFP_{i(t-1)} + \beta_4 SMALL_{i(t-1)} \\ & + \beta_5 LARGE_{i(t-1)} + \beta_6 VLARGE_{i(t-1)} + \beta_7 wage_{i(t-1)} + \beta_8 SKILL_{i(t-1)} \\ & + \beta_9 TRAIN_{i(t-1)} + \beta_{10} RD_{i(t-1)} + \sum_{r=1}^{5} \beta_r REGION_r + \varepsilon_{it} \end{aligned} \tag{2.8}$$

where

EX is the export dummy of firm i.

$FOREIGN$ is a dummy to indicate the structure of foreign ownership where a dummy equals 1 if least 10% of the firm's shares are foreign owned.

TFP is total factor productivity of the firm.

$SMALL$ is a dummy variable to represent a small firm.

$LARGE$ is a dummy variable to represent a large firm.

$VLARGE$ is a dummy variable to represent a very large firm.

$wage$ is measured by the log of wages per employee.

$SKILL$ is the ratio of skilled labour to total labour.

$TRAIN$ represents the training dummy.

RD is a dummy variable of whether a firm engages in R&D.

REGION is a vector of five regional dummies to indicate the regional location of a firm.

2.4.2 Variables

The detailed definitions of all variables are presented in Table 2A.1 of the Appendix 2A. The dependent variable is the export dummy (EX_{it}) which equals 1 if there is positive export within the firm, and 0 otherwise. Our independent variables are as follows:

The lagged dependent variable ($EX_{i(t-1)}$) is the previous export experience of a firm that can be used to captures for evidence of sunk entry costs. The significant of export experience is typically interpreted as the evidence of sunk entry costs and persistence because the theoretical model by Krugman (1989) suggests that the participation of a firm in export market is usually characterised by the persistence of export behaviour which is assumed due to the existence of sunk entry costs. According to Robert and Tybout (1997), the sunk-cost hysteresis framework can be tested by asking whether, given the current period gross profit, a firm the export experience helps to explain the export status in the current period or not.[6] If the sunk entry costs are important, they appear directly in the binary response of participation decision in the export history. Thus, a firm that has learned from their past experiences and exported in the previous year tend to also export in the current year. We expect a positive relationship between sunk entry cost and the decision to export.

[6] Several studies have shown that sunk-cost hysteresis has an effect on the entry and exit decisions of a firm (see e.g. Baldwin 1988, Dixit 1989a and 1989b, Krugman 1989). In addition, Baldwin (1989) point out that the width and position of the hysteresis band is affected by the size of the sunk costs, the volatility of uncertainty and the degree of persistence of a shock. The one of the findings shows that hysteresis band tends to widen with the greater sunk costs. This implies that if a firm has incurred in high sunk costs the ability to export in any period is an indicator of continuing long-term exports while the failure to export in the short-term may also have negative long-term impact.

Foreign ownership ($FOREIGN_{i(t-1)}$) captures the structure of a firm's ownership. A firm is defined as foreign if at least 10% of its shares are foreign owned. In this case, we generate a dummy equal to 1 if a firm is foreign owned and 0 otherwise. In our sensitivity analysis we define our foreign ownership dummy at 25% and 50% levels. We expect foreign ownership to have a positive effect on the decision to export.

In this chapter, we measure total factor productivity ($TFP_{i(t-1)}$) using three different methods. The first technique employs the semi-parametric approach of Levinsohn and Petrin (2003) by taking unobserved firm-specific productivity shocks into account where the unobserved shock is measured by the use of intermediate inputs. The estimation procedure is provided in Appendix 2B. The second method is the estimation of a semi-parametric and nonlinear least square regression of Buettner (2003) which also considers endogenous R&D in the TFP calculation (see Appendix 2C).[7] Finally, we measure productivity using a simple labour productivity measure which is calculated from the log of value added over total labour. TFP is an indicator of plant success and is based on the argument that good firms become exporters (Bernard and Jensen, 2004). Assuming firms with high TFP levels export, we expect to see a positive relationship between the two variables.

Firm size is another important determinant of exporting as it is a measure of a firm's success. Large firms tend to have higher productivity and are therefore more likely to engage in export activity. In this chapter, we categorise firm size into small, medium, large and very large to investigate how size differences affect a firm's decision to enter export markets. Small firm ($SMALL_{i(t-1)}$) is a dummy variable that equals 1 if the total number of workers in firm i at time $t-1$ is in the first quartile distribution of the total workforce for all firms operating in the same

[7] Buettner (2003) points out that R&D investment should be taken into account as part of the consideration for measuring the TFP because firms normally engage in R&D activities with the aim of improving productivity within firms. Therefore, recent R&D investment would yield a direct effect on future productivity.

two-digit International Standard Industrial Classification (ISIC) level (Revision 3) as firm i at time $t-1$. Medium ($MEDIUM_{i(t-1)}$), large ($LARGE_{i(t-1)}$) and very large firm ($VLARGE_{i(t-1)}$) are calculated using the same principle for the second, third and fourth quartile of the total worker distribution respectively. *MEDIUM* is the omitted category.

Wage ($wage_{i(t-1)}$) is the log of wages per employee calculated from the ratio of total wage payments to total workers less owners who do not receive a wage. Wage is employed as an indicator of labour quality. An increase in wages follows an increase in the quality of labour. Firms that pay high wages are expected to have a higher probability of exporting.

Skilled labour ($SKILL_{i(t-1)}$) is the ratio of professional and skilled worker to total worker and is a proxy for workforce quality within a firm. In general, export goods are assumed to have a higher quality than domestically produced goods (to meet the standards of import countries). The higher the quality of workers, therefore, the better the quality of goods that can be produced. Thus, we expect the share of skilled workers to positively influence the probability of exporting.

Training ($TRAIN_{i(t-1)}$) represents a training dummy that equals 1 if the workforce within a firm received any formal training and 0 otherwise. Formal training may consist of in-house training, outside training or both. Trained workers are assumed to be more efficient.

R&D expenditure has the potential to enhance product quality and also to generate cost savings in the production process, two factors that may increase the likelihood of a firm entering the export market. R&D ($RD_{i(t-1)}$) is categorised into two groups: R&D in product development

and R&D in process development.[8] The former, R&D in product ($RDPRODUCT_{i(t-1)}$), is a dummy variable for product improvement; it equals 1 if a firm conducts R&D in the product and 0 otherwise. The latter, R&D in process ($RDPROCESS_{i(t-1)}$), is an indicator for cost saving in the production process where a dummy variable equals 1 if a firm carries out R&D in production processes and 0 otherwise.

Regional location variables ($REGION_r$) are included to measure fixed regional effects. We divide regional location into six regions namely, the Bangkok Metropolitan Area ($BKKM$), Central ($CENTRAL$), East ($EAST$), North ($NORTH$), Northeast ($NORTHEAST$) and South ($SOUTH$). The Northeast, the poorest region of Thailand, is the omitted category.

2.4.3 Data

Our data consist of a four year unbalanced panel from the Annual Survey of Thailand's manufacturing industry by the Office of Industrial Economics (OIE), Ministry of Industry, Thailand for the period between 2001 and 2004. All monetary variables are converted into US dollars using the market exchange rate from International Financial Statistics (IFS) and are expressed in 2001 constant prices using inflation rate data from IFS (2005) CD-Rom. The survey covers 79 types of manufacturing activity at the four-digit ISIC level that consist of 23 two-digit ISIC industries and includes small, medium, and large firms.[9] The sample can be considered representative of the manufacturing industry in Thailand with the value added of firms included in the survey accounting for 95% of total manufacturing GDP (OIE, 2001). The questionnaire includes twenty-five major questions that cover different aspects of a firm's

[8] We do not include both R&D variables in the model at the same time because both R&D are highly correlated (see Table 2A.3 of the Appendix 2A).
[9] In 2001 a questionnaire was sent out to 6,735 firms. The response rate was around 60%. Approximately 35% of firms were are small, 32% medium and 33% large.

characteristics and performance including balance sheet information. We control for possible outliers by excluding 0.5% tails of all the regression variables except for binary dummies. Our final unbalanced panel comprises 15,115 observations for the period 2001 to 2004.[10]

As all regressors in the model are lagged by one year to minimise possible simultaneity problems, the data in the estimated sample includes 9,049 observations. Descriptive statistics are provided in Table 2A.2 of the Appendix 2A. A correlation matrix is provided in Table 2A.3 of the Appendix 2A. The raw correlations tend to match the expected signs except for the relationship between the export dummy and the ratio of skilled labour. In addition, the correlation matrix shows that three pairwises are highly correlated. The first two pairwises are wage and TFP ($TFP^{BUETTNER}$ and $TFP^{LABPROD}$), but we cannot drop any of these variables due to their importance and we retain the consistency of variables included in the model. Correlation between wage and TFP^{LP} is relatively lower. This may suggest the appropriateness of using TFP^{LP} rather than alternative TFP variables. Another pairwise that is highly correlated is product R&D and process R&D because they could capture similar things. Thus, we do not include both R&D variables in the model at the same time.

Table 2.7 presents the mean values of different characteristics between exporters and non-exporters. We compare three groups; all firms, foreign firms, and domestic firms. For all firms, exporters have higher output, capital stock, productivity, wage and employment compared to non-exporters. However, the differences are reasonably small for wage per worker. Capital stock, output and employment of exporters is four times larger than that of non-exporters while no difference in the ratio of skilled labour is observed. Foreign exporters are more productive than foreign non-exporters and have considerably higher output, capital and employment levels.

[10] Each year some firms do not respond or even shut down which causes our data set to have an unbalanced structure. To compensate for the closure or none response of some firms in 2004 the sampling was extended and data collected for additional plants (OIE, 2004). Unfortunately we do not have specific data on firm deaths.

Surprisingly, the results show that foreign exporters have a slightly lower ratio of skilled to total labour. This could be explained by export-platform FDI where foreign investors use Thailand as a production base in order to export and utilise Thailand's relatively high stock of unskilled labour.

In the case of domestic firms, there are differences between domestic exporters and non-exporters in terms of output, capital stock, productivity, wage, ratio of skilled labour, employment. Output of domestic exporters is twice that of domestic non-exporters. These differences are even more pronounced for capital stock and employment.

Table 2.7: Mean Characteristics of Exporters vs. Non-Exporters in 2003

	All firms		Foreign Firms		Domestic Firms	
	Exporters	**Non-Exporters**	**Exporters**	**Non-Exporters**	**Exporters**	**Non-Exporters**
Output (million $US)	22.400	5.475	33.500	8.691	13.500	5.030
Capital Stock (million $US)	11.300	2.369	15.100	6.211	8.297	1.833
Total Factor Productivity	9.712	9.003	9.770	9.605	9.666	8.919
Labour Productivity	9.308	8.847	9.624	9.428	9.054	8.763
Employment	596.184	137.375	683.867	240.392	525.345	123.034
Wage per Worker ($US)	3256.014	2434.465	4000.662	3918.826	2654.413	2227.832
Ratio of Skilled Labour	0.530	0.529	0.517	0.540	0.535	0.528

Notes: Capital stock is total fixed assets. Total factor productivity is obtained from the estimation technique of Levinsohn and Petrin (2003). Labour productivity is the log of value added over total labour.

2.4.4 Econometric Methodology

In our model, the dependent variable is a binary response dummy variable for export status. The explanation for the binary choice model can be written in the form of latent variable as:

$$EX_{it}^{*} = \alpha + \beta' Z_{i(t-1)} + \varepsilon_{it} \qquad (2.9)$$

where Z is a $K \times 1$ vector of firm characteristic parameters and ε_{it} is the error term. Rather than observing the latent variable (EX_{it}^{*}) in Equation (2.9) we only observe a binary response (EX_{it}) which indicates the sign of EX_{it}^{*} where $EX_{it} = 1$ if $EX_{it}^{*} > 0$ and $EX_{it} = 0$ if $EX_{it}^{*} \leq 0$.

Because of the discrete dummy variable for export status, a probit model is used for our estimation methodology. With certain assumptions, the error term (ε_{it}) follows a normal cumulative distribution function.

The literature suggests a number of alternative estimation methods to deal with the characteristics of a binary choice model, such as GMM in first differences and the linear probability model (LPM). However, the GMM first difference estimator for dynamic panel data by Arellano and Bond (1991) requires two or more lags of the right-hand-side variables as instruments. Because of our relatively short panel we cannot use GMM in first differences. For LPM, the relationship between the occurring probability and the independent variables is assumed to be linear. However, LPM seems not to be an appropriate method of estimation for a binary choice framework because of several deficiencies. First, the value of the disturbance comprises of only two specific values. Therefore, LPM fails to fulfil the ordinary least square (OLS) requirement of a normal distribution of the disturbances. Second, LPM appears to have a problem of heteroscedastic variances of disturbances because the variances of disturbances

follow the change in the dependent variables. Finally, there is the possibility that the predicted probability of LPM lies outside the range of 0 to 1, so the estimated coefficients are likely to be biased. Although the problem of heteroscedastic standard errors can be corrected by using a robust variance estimator the first and third problems persist.[11]

Within our available firm-level panel data, we have unobserved firm heterogeneity. For each specification, unobserved firm heterogeneity should be modelled as fixed effects or random effects depending on which is the more appropriate. The error term (ε_{it}) from the latent variable model in Equation (2.9) comprises of two components where $\varepsilon_{it} = \mu_i + \eta_{it}$. μ_i is the unobserved firm specific effect and η_{it} is the stochastic disturbance term.

The fixed effects estimator captures firm specific effects. This approach assumes that μ_i are fixed parameters to be estimated that vary over the individual firm and η_{it} are independently and identically distributed over individuals, $\eta_{it} \sim IID(0, \sigma_\eta^2)$. The explanatory variables are also assumed to be independent of η_{it} for all *i* and *t*. In contrast, the random effects estimator treats μ_i as a random variable so $\mu_i \sim IID(0, \sigma_\mu^2)$, $\eta_{it} \sim IID(0, \sigma_\eta^2)$ and μ_i are independent of η_{it}. In addition, the assumption requires the unobserved explanatory variables to be independent of μ_i and η_{it} for all *i* and *t* (Baltagi, 2005).

The random effects estimator however is inappropriate as the assumption that the independent variables are strictly exogenous conditional on μ_i is likely to be violated as we include a lagged dependent variable as a measure of sunk entry cost in the model. Plant characteristics are also correlated with the unobserved firm heterogeneity such as technology within the firm,

[11] For further discussion see Gujarati (1995) pp. 542-546.

managerial capability, etc. Regarding the lagged dependent variable, the fixed effects estimator would produce biased and inconsistent results (Bernard and Jensen, 2004).

By choosing among the models and available specifications, we employ a pooled probit model to estimate the decision of a firm to engage in export markets. The response probability for the probit model can be written as:

$$P(EX_{it} = 1 \mid \mathbf{Z}_{i(t-1)}) = \Phi(\beta' Z_{i(t-1)}) \tag{2.10}$$

where P stands for outcome probability. $Z_{i(t-1)}$ is a vector of firm characteristics including sunk entry costs. $\Phi(.)$ is a normal cumulative distribution function of the error term which is assumed to lie between the range of 0 and 1, $0 < \Phi(.) < 1$.

We add industry dummies and time dummies to control for unobserved industry fixed effects and time varying effects. The former ($INDUS_j$) are categorised according to the three-digit ISIC level (Revision 3); there are 51 industries in total. For the time dummies (T_t), only two-year dummies are included to the model as we lag all the independent variables by one year. We correct for the problem of heteroscedastic errors by using a robust variance estimation that allows for clustering at the two-digit industry level. Thus, the estimated model of the export decision becomes:

$$\begin{aligned} P(EX_{it} = 1 \mid \mathbf{Z}_{i(t-1)}) = \Phi\ [&\alpha + \beta_1 EX_{i(t-1)} + \beta_2 FOREIGN_{i(t-1)} + \beta_3 TFP_{i(t-1)} \\ &+ \beta_4 SMALL_{i(t-1)} + \beta_5 LARGE_{i(t-1)} + \beta_6 VLARGE_{i(t-1)} \\ &+ \beta_7 wage_{i(t-1)} + \beta_8 SKILL_{i(t-1)} + \beta_9 TRAIN_{i(t-1)} + \beta_{10} RD_{i(t-1)} \\ &+ \sum_{r=1}^{5} \beta_r REGION_r + \sum_{j=1}^{50} \beta_j INDUS_j + \sum_{t=1}^{2} \beta_t T_t + \varepsilon_{it}] \end{aligned} \tag{2.11}$$

In our estimated results, the coefficients obtained from the probit estimation are the predicted probabilities of belonging to one of the categories. We calculate marginal effect to indicate the slope of the expected change in the probability of the outcome when the independent variable is changed one at a time. In the probit model, the marginal effect is calculated at the mean of each continuous independent variable (except for the dummy variable) and is given by:

$$\frac{\partial[P(EX_{it}=1 \mid Z_{i(t-1)})]}{\partial Z_{ki(t-1)}} = \frac{\partial[E(EX_{it})]}{\partial Z_{ki(t-1)}} = \frac{\partial[\Phi(\beta' Z_{i(t-1)})]}{\partial Z_{ki(t-1)}} = \Phi(\beta' Z_{i(t-1)})\beta_k \quad (2.12)$$

where Φ is the probability density function for a standard normal variables. Z_k is the sample mean of each independent variable and β_k is the estimated coefficient from the probit regression where $k = 1, 2, 3, \ldots, n$. When the independent variable is a dummy, the marginal effect reported is the effect of the discrete change of a dummy variable from zero to one.

2.5 Results

2.5.1 Firm Characteristics and a Firm's Decision to Export

Table 2.8 provides the marginal effect estimations, calculated at the mean of each independent variable (except for a dummy variable).[12] Three different TFP calculation techniques are performed for the purpose of sensitivity analysis. Columns (1) and (2) includes TFP^{LP} obtained from the estimation procedure of Levinsohn and Petrin (2003). Columns (3) and (4) and Columns (5) and (6) are our alternative TFP measures denoted $TFP^{BUETTNER}$ and $TFP^{LABPROD}$ from Buettner's (2003) method and the log of labour productivity respectively.

[12] In Table 2D.1 of the Appendix 2D, we also present the results obtained from marginal effects estimation where different columns demonstrate how the model is built.

The results show that the past experience of a firm have a positive and significant effect on the export decision. The coefficient on past export experience is identical and consistent across all three columns and indicates that if a firm exports in the previous period, the probability of its exporting in the current period is increased by 0.91. This strong result simply reflects a high degree of persistence in export behaviour that means that the rate of the entry into and exit from export markets are reasonably low. In general, the significance of the export experience is interpreted as evidence of sunk costs (Robert and Tybout 1997, Bugamelli and Infante 2003, Bernard and Jensen 2004, and Greenaway and Kneller 2004). From the width of hysteresis in exports by Baldwin (1989), the hysteresis band tends to widen with the greater sunk costs. Therefore, a high degree of persistence could imply that sunk entry costs are large so the ability to export in any period is an indicator of continuing long-term exports while the failure to export in the short-term may also have negative long-term impact.

For foreign ownership, it is clearly seen that foreign ownership is positively correlated with the probability of exporting. Hence, being a foreign-owned firm increases the probability of exporting by 7 percentage points relative to being a domestically-owned firm. The results for all three TFP variables are similar and are a positive and significant determinant of the decision to export. For example, the coefficients in Columns (1) and (2) can be interpreted as increasing TFP by one unit increases the probability of exporting on average by 3.2 percentage points.

As expected, firm size is another important determinant of the export decision. The three size groupings provide different results. The negative and significant coefficient on small firms indicates that small firms are less likely to become exporters. As firm sizes increase, we observe increasingly positive and significant results. The coefficients of large and very large firms indicate that the larger the size, the more likely the firm is to enter the export market.

The quality of the workforce (proxied by average wage) is also a factor that could determine the probability of exporting. However, Table 2.8 shows that wage has an insignificant effect. Other firm characteristics such as the ratio of skilled labour, training, R&D in the product, and production process have a positive effect on the probability of exporting.[13] However, such variables appear to be insignificant except for product R&D. The evidence for Thailand shows that various measures of labour quality such as wage, ratio of skilled labour and training have the expected sign but are insignificant. This perhaps can be explained by differences in the characteristic of products exported. Some products do not require skilled labour or training in their production while some do. In addition, some firms export mass-produced products or intermediate inputs that are produced using cheap labour costs. Therefore, in Thailand, the probability of exporting is not significantly determined by wage, ratio of skilled labour nor training.

For the location variables, the coefficients of the Bangkok Metropolitan Area, Central, East, North and South are positive relative to the North-Eastern region.[14] The Southern region is significant at the 1% level.[15] The probability of exporting will be on average about 16.5 percentage points higher for firms located in the South compared to other regions. One explanation for the significant coefficient may be that a firm located in the South has lower

[13] We have some concerns about the quality of our skilled labour variable from the raw data as some firms may not specify the quantity of labour skill differences correctly. When we exclude this variable there are no differences in the results for the other regressors. The sign, the significant or insignificant of all other variables in the model are broadly the same (see Table 2D.2 in Appendix 2D).

[14] According to the 2002 Gini Coefficient and Gross Regional per Capita of 2006 from Office of the National Economic and Social Development Board (NESDB), the Northeast is the poorest region of Thailand.

[15] We also try an alternative categorisation of location following the Board of Investment (BOI) ranking of privileges by location. Due to the decentralisation of industrial investment, since 1993 the BOI has divided the country into three different investment promotion zones. Approved foreign applicants will receive different privileges (tax-based and non-tax privileges) according to their establishment location. In our regression, for a firm export's decision, Zone 3-Group 2 (low-income provinces) is the omitted category. The results show that Zone 1, Zone 2 and Zone 3-Group 1 (high-income provinces) all have positive and significant effect on the probability of exporting. However, as we have some difficulty in identifying whether foreign-owned firms in our sample actually receive these privileges we do prefer our original specification.

transportation costs. Surface transport within the continent (e.g. exports to Malaysia) may be used instead of more costly aerial or ocean shipping.

As a further sensitivity check we investigate the effect of sunk entry costs and firm characteristics on the probability of exporting using different definitions of foreign ownership. Rather than define a firm as foreign when only 10% is foreign owned, we use 25% and 50% as alternative cut-off points (see Tables 2E.1 and 2E.2 of the Appendix 2E). Our results show that the higher the percentage share used to classify foreign ownership, the greater the effect on the probability of exporting. All other variables are almost identical to those in Table 2.8. We also perform other sensitivity checks on size variable by classifying size according to total fixed assets instead of total employment. The results presented in the Appendix 2E are generally consistent.

Table 2.8: Pooled Probit Model for a Firm's Decision to Export

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.914***	0.914***	0.914***	0.914***	0.914***	0.914***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$FOREIGN_{i(t-1)}$	0.072***	0.072***	0.071***	0.071***	0.070***	0.070***
	(0.027)	(0.026)	(0.027)	(0.027)	(0.027)	(0.027)
$TFP^{LP}_{i(t-1)}$	0.032***	0.032***				
	(0.012)	(0.012)				
$TFP^{BUETTNER}_{i(t-1)}$			0.030*	0.030*		
			(0.016)	(0.016)		
$TFP^{LABPROD}_{i(t-1)}$					0.037***	0.036***
					(0.013)	(0.013)
$SMALL_{i(t-1)}$	-0.101***	-0.102***	-0.099***	-0.099***	-0.110***	-0.110***
	(0.024)	(0.024)	(0.025)	(0.025)	(0.022)	(0.022)
$LARGE_{i(t-1)}$	0.106***	0.107***	0.105***	0.105***	0.114***	0.114***
	(0.030)	(0.030)	(0.031)	(0.030)	(0.028)	(0.028)
$VLARGE_{i(t-1)}$	0.155***	0.156***	0.152***	0.153***	0.170***	0.171***
	(0.037)	(0.037)	(0.040)	(0.040)	(0.032)	(0.032)
$wage_{i(t-1)}$	0.049	0.049	0.047	0.047	0.040	0.040
	(0.031)	(0.031)	(0.031)	(0.031)	(0.028)	(0.028)
$SKILL_{i(t-1)}$	0.022	0.021	0.024	0.023	0.023	0.022
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
$TRAIN_{i(t-1)}$	0.015	0.015	0.014	0.014	0.015	0.015
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
$RDPRODUCT_{i(t-1)}$	0.071*		0.068*		0.070*	
	(0.038)		(0.037)		(0.037)	
$RDPROCESS_{i(t-1)}$		0.077		0.075		0.076
		(0.058)		(0.057)		(0.058)
$BKKM$	0.093	0.093	0.094	0.094	0.096	0.096
	(0.069)	(0.069)	(0.070)	(0.070)	(0.069)	(0.068)
$CENTRAL$	0.071	0.071	0.068	0.069	0.070	0.070
	(0.091)	(0.090)	(0.091)	(0.090)	(0.091)	(0.090)
$EAST$	0.071	0.070	0.069	0.069	0.070	0.070
	(0.078)	(0.077)	(0.079)	(0.078)	(0.079)	(0.078)
$NORTH$	0.090	0.089	0.093	0.091	0.095	0.094
	(0.071)	(0.071)	(0.072)	(0.072)	(0.072)	(0.072)
$SOUTH$	0.166***	0.165***	0.166***	0.164***	0.165***	0.164***
	(0.057)	(0.057)	(0.057)	(0.057)	(0.058)	(0.058)
Observations	9049	9049	9049	9049	9049	9049

Notes: Robust clustered standard errors in parentheses. Time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

2.5.2 Country of Origin of Parent Company and a Firm's Decision to Export

In this sub-section, we examine the effect of the country of origin of firm ownership on a firm's decision to export by disaggregating our foreign dummy into different countries of origin. The details of the different country of origin groupings that we include in the model are provided in Table 2A.4 of the Appendix 2A.[16] Tables 2.9 and 2.10 show the results of the estimated marginal effects in which foreign ownership is characterised by at least 10% and 50% of shares owned by foreigners.

In Columns (1) to (6) of Table 2.9, firm-specific characteristics and regional location variables are very similar to the results previously discussed. Results of regional location variables are not included in the table for reasons of space. For the effect of country of origin on a firm's decision to export, the estimated marginal effect results show that the coefficients for Japan, Korea, Malaysia, Australia and Canada and UK are significant at the 10% level and Southeast Asia and US are significant at the 5% level.[17]

Foreign firms from Japan, Malaysia, Australia and Canada, UK and US are more likely to export compared to domestic firms where the probability of exporting is increased by average values of 0.10, 0.23, 0.16, 0.11 and 0.12, respectively. In contrast, Korean- and Southeast Asian-owned firms are less likely to export. Interestingly, there is no significant coefficient on China, the second largest investor in Thailand. The results imply that different countries invest in Thailand for different reasons. It appears that firms from Japan, Malaysia, Australia and Canada, UK, US and perhaps China invest in Thailand in order to use Thailand as an export-platform whereas firms with their parent companies from Korea and Southeast Asian countries intend to supply only the domestic market.

[16] See Table 2A.1 of the Appendix 2A for the definitions of each individual country and region dummy.
[17] Southeast Asia consists of Indonesia, Myanmar and the Philippines.

Thailand is an attractive site for value-added manufacturing because workforces are highly skilled and have a strong knowledge base. Even though the labour costs in Thailand may not be the cheapest in the region, they are relatively cheaper compared to the costs in the home countries. Therefore, firms from Japan, Malaysia, Australia and Canada, UK and US tend to concentrate on the knowledge-based and efficiency-seeking investment especially in the capital-intensive industries. For example, numerous foreign automotive manufactures from Japan and the US use Thailand to as an export-platform to sell their product worldwide. Another motivation is tariff-jumping FDI. Some countries may try to avoid certain tariffs by using Thailand as a production based to distribute products to countries within ASEAN free trade area.

Typically, motivations of Korean investors investing in Thailand are attempting to develop local and third countries markets as well as to reduce the production costs by taking advantage of low wages. Our result shows that Korean-owned firms are less likely to export and tend to target on domestic market. It is not surprising that we do not find evidence for export platform FDI. Similarly to Thailand, Korea is a country that is most affected by the currency crisis in 1997. The devaluation of Korean currency, falling prices and wages cause Korea to be an attractive site for investment. However, this incentive of investment may change as recently BOI have been trying to attract more FDI inflows from Korea by open investment promotion office in South Korea with the aim to increase attract more investment in various industries such as electronic, electrical appliances and vehicles. For investors from South East Asia (Indonesia, Myanmar and the Philippines), they invest in Thailand to seek for market opportunities where the price of certain products can be sold at a higher price.

To check the sensitivity of these results we re-estimate the model using the alternative cut-off points for foreign ownership. The results presented in Table 2.10 are for the 50% cut-off point

of foreign-owned share.[18] The main difference in the results is that the behaviour of Chinese, Malaysian, Singaporean and UK firms is now different to those from Japan and the US. As the percentage share owned by China and Singapore increases the probability of Chinese- and Singaporean-owned firms exporting also increases. However, for Malaysian and UK firms, it appears that an increase in the percentage of foreign-owned share does not have any significant effect on the probability of exporting. Even though foreign firms from Malaysia, non-EU and other countries do not significantly determine the probability of exporting, we observe that the coefficients turn out to be negative when 50% of foreign-owned share is used as a cut-off point. The explanation for the change in some results is that as the percentage of foreign-owned share increases, foreign shareholders will play a greater role in defining the strategies and policies of the firm. We also perform a sensitivity check using different definitions of our size variable but the results are generally unchanged (see Tables 2E.7 to 2E.9 of the Appendix 2E).

Our results lead to several policy implications. The significance of export experience is interpreted as the evidence of sunk entry costs, therefore, policymakers should stress on the entry promotion policies that help to reduce sunk entry costs faced by each firm such as finance trade fair, finance market research, support export credit insurance, etc. At the same time, government should actively utilise export promotion policies and focus on the export promotion in the less effected market in order to help exporters to expand their export share. Foreign ownership is also important in determining the probability of exporting. This implies that attracting more FDI inflows particularly export platform FDI will help to stimulate more exports. However, the policymakers need to think carefully about how and whom they target their inward FDI policies as the results from the break down countries of origin show that different countries have different incentives of investment. To encourage more FDI inflows,

[18] Using 25% of foreign-owned share as a cut-off point, results presented in Table 2E.3 of the Appendix 2E are broadly similar to those in Columns (1) to (6) of Table 2.9 except for Korean-owned firms which now have no significant impact on the probability of exporting.

the government should continuously open investment promotion offices in various countries that help to provide investment information to foreign investors. In addition, the investment promotion packages should focus on the strategic targeting of investment such as technology, R&D and human resource development need of industry.

Table 2.9: Pooled Probit Model for Country of Origin and a Firm's Decision to Export - 10% Cut-off Point for Foreign Ownership.

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.914***	0.914***	0.914***	0.914***	0.914***	0.915***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$TFP^{LP}_{i(t-1)}$	0.032***	0.032***				
	(0.011)	(0.011)				
$TFP^{BUETTNER}_{i(t-1)}$			0.030*	0.030*		
			(0.015)	(0.015)		
$TFP^{LABPROD}_{i(t-1)}$					0.036***	0.036***
					(0.012)	(0.012)
$SMALL_{i(t-1)}$	-0.100***	-0.100***	-0.098***	-0.098***	-0.108***	-0.108***
	(0.023)	(0.023)	(0.025)	(0.025)	(0.022)	(0.022)
$LARGE_{i(t-1)}$	0.107***	0.107***	0.106***	0.106***	0.114***	0.115***
	(0.030)	(0.029)	(0.030)	(0.030)	(0.028)	(0.028)
$VLARGE_{i(t-1)}$	0.153***	0.154***	0.151***	0.152***	0.169***	0.170***
	(0.036)	(0.036)	(0.039)	(0.039)	(0.032)	(0.032)
$wage_{i(t-1)}$	0.046	0.046	0.045	0.044	0.038	0.038
	(0.031)	(0.031)	(0.030)	(0.030)	(0.029)	(0.029)
$SKILL_{i(t-1)}$	0.022	0.021	0.023	0.022	0.022	0.021
	(0.036)	(0.037)	(0.036)	(0.036)	(0.036)	(0.037)
$TRAIN_{i(t-1)}$	0.015	0.015	0.014	0.014	0.014	0.015
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
$RDPRODUCT_{i(t-1)}$	0.068*		0.066*		0.068*	
	(0.038)		(0.037)		(0.037)	
$RDPROCESS_{i(t-1)}$		0.074		0.072		0.073
		(0.058)		(0.057)		(0.058)
$CHINA_{i(t-1)}$	0.053	0.052	0.051	0.050	0.051	0.050
	(0.047)	(0.047)	(0.047)	(0.047)	(0.046)	(0.047)
$EU_{i(t-1)}$	0.035	0.036	0.031	0.033	0.029	0.030
	(0.081)	(0.080)	(0.081)	(0.081)	(0.080)	(0.080)
$JAPAN_{i(t-1)}$	0.098*	0.099*	0.097*	0.098*	0.097*	0.097*
	(0.055)	(0.055)	(0.055)	(0.054)	(0.055)	(0.054)
$KOREA_{i(t-1)}$	-0.127*	-0.126*	-0.128*	-0.127*	-0.125*	-0.123*
	(0.074)	(0.073)	(0.070)	(0.069)	(0.072)	(0.071)
$MALAYSIA_{i(t-1)}$	0.225*	0.224*	0.225*	0.224*	0.223*	0.222*
	(0.118)	(0.118)	(0.115)	(0.115)	(0.116)	(0.116)
$NONEU_{i(t-1)}$	0.077	0.079	0.080	0.082	0.080	0.082
	(0.134)	(0.135)	(0.133)	(0.133)	(0.133)	(0.133)
$OTHER_{i(t-1)}$	0.054	0.053	0.053	0.052	0.052	0.051
	(0.105)	(0.105)	(0.106)	(0.106)	(0.107)	(0.107)
$AUSCAN_{i(t-1)}$	0.164*	0.163*	0.161*	0.160*	0.165*	0.164*
	(0.098)	(0.098)	(0.096)	(0.097)	(0.096)	(0.097)
$SOUTHASIA_{i(t-1)}$	-0.038	-0.037	-0.031	-0.029	-0.031	-0.029
	(0.047)	(0.047)	(0.045)	(0.045)	(0.045)	(0.045)
$SEASIA_{i(t-1)}$	-0.197**	-0.192**	-0.197**	-0.193**	-0.197**	-0.193**
	(0.094)	(0.097)	(0.095)	(0.097)	(0.095)	(0.098)
$SINGAPORE_{i(t-1)}$	0.038	0.036	0.044	0.043	0.036	0.034
	(0.061)	(0.061)	(0.067)	(0.067)	(0.062)	(0.062)
$UK_{i(t-1)}$	0.110*	0.110*	0.110*	0.109*	0.108*	0.107*
	(0.057)	(0.057)	(0.058)	(0.058)	(0.057)	(0.057)
$US_{i(t-1)}$	0.124**	0.126**	0.122**	0.124**	0.122**	0.125**
	(0.050)	(0.050)	(0.050)	(0.050)	(0.051)	(0.051)
Observations	9049	9049	9049	9049	9049	9049

Notes: Robust clustered standard errors in parentheses. Region, time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2.10: Pooled Probit Model for Country of Origin and a Firm's Decision to Export - 50% Cut-off Point for Foreign Ownership.

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.914***	0.914***	0.913***	0.914***	0.914***	0.914***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$TFP^{LP}_{i(t-1)}$	0.036***	0.035***				
	(0.011)	(0.011)				
$TFP^{BUETTNER}_{i(t-1)}$			0.035**	0.034**		
			(0.015)	(0.015)		
$TFP^{LABPROD}_{i(t-1)}$					0.040***	0.039***
					(0.013)	(0.013)
$SMALL_{i(t-1)}$	-0.102***	-0.103***	-0.100***	-0.100***	-0.111***	-0.112***
	(0.024)	(0.024)	(0.025)	(0.025)	(0.022)	(0.022)
$LARGE_{i(t-1)}$	0.104***	0.105***	0.102***	0.103***	0.112***	0.113***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.029)	(0.029)
$VLARGE_{i(t-1)}$	0.152***	0.152***	0.147***	0.148***	0.169***	0.170***
	(0.036)	(0.036)	(0.040)	(0.040)	(0.032)	(0.032)
$wage_{i(t-1)}$	0.047	0.047	0.043	0.043	0.037	0.037
	(0.030)	(0.031)	(0.029)	(0.029)	(0.028)	(0.028)
$SKILL_{i(t-1)}$	0.027	0.026	0.029	0.028	0.027	0.027
	(0.037)	(0.037)	(0.036)	(0.037)	(0.037)	(0.037)
$TRAIN_{i(t-1)}$	0.015	0.016	0.014	0.014	0.015	0.016
	(0.035)	(0.035)	(0.035)	(0.036)	(0.036)	(0.036)
$RDPRODUCT_{i(t-1)}$	0.075*		0.071*		0.074*	
	(0.039)		(0.038)		(0.038)	
$RDPROCESS_{i(t-1)}$		0.081		0.078		0.080
		(0.058)		(0.057)		(0.058)
$CHINA_{i(t-1)}$	0.177**	0.177**	0.175**	0.175**	0.174**	0.174**
	(0.078)	(0.078)	(0.078)	(0.078)	(0.078)	(0.078)
$EU_{i(t-1)}$	0.130	0.134	0.129	0.133	0.128	0.131
	(0.127)	(0.126)	(0.126)	(0.126)	(0.127)	(0.126)
$JAPAN_{i(t-1)}$	0.137***	0.137***	0.137***	0.137***	0.136***	0.136***
	(0.042)	(0.041)	(0.042)	(0.041)	(0.042)	(0.041)
$KOREA_{i(t-1)}$	-0.063	-0.061	-0.069	-0.067	-0.063	-0.061
	(0.076)	(0.075)	(0.074)	(0.073)	(0.072)	(0.071)
$MALAYSIA_{i(t-1)}$	-0.062	-0.064	-0.056	-0.057	-0.064	-0.065
	(0.057)	(0.056)	(0.053)	(0.052)	(0.056)	(0.055)
$NONEU_{i(t-1)}$	-0.028	-0.026	-0.024	-0.021	-0.022	-0.019
	(0.084)	(0.085)	(0.082)	(0.083)	(0.082)	(0.083)
$OTHER_{i(t-1)}$	-0.070	-0.071	-0.073	-0.074	-0.074	-0.075
	(0.076)	(0.076)	(0.075)	(0.075)	(0.077)	(0.077)
$AUSCAN_{i(t-1)}$						
$SOUTHASIA_{i(t-1)}$	-0.044	-0.044	-0.041	-0.041	-0.042	-0.043
	(0.067)	(0.067)	(0.066)	(0.066)	(0.067)	(0.067)
$SEASIA_{i(t-1)}$						
$SINGAPORE_{i(t-1)}$	0.206***	0.204***	0.236***	0.234***	0.209***	0.207***
	(0.053)	(0.054)	(0.068)	(0.068)	(0.057)	(0.057)
$UK_{i(t-1)}$	0.109	0.107	0.109	0.107	0.110	0.109
	(0.074)	(0.074)	(0.074)	(0.074)	(0.074)	(0.074)
$US_{i(t-1)}$	0.149***	0.149***	0.149***	0.149***	0.149***	0.149***
	(0.053)	(0.053)	(0.052)	(0.052)	(0.052)	(0.052)
Observations	9036	9036	9036	9036	9036	9036

Notes: Robust clustered standard errors in parentheses. Region, time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

2.6 Conclusions

This chapter examines the export decision of firms using a firm-level dataset from the manufacturing industry in Thailand over the period 2001 to 2004. Consistent with both the theoretical and past empirical explanations, the export experience is the most important determinant of the probability of exporting in the current period. The significant of export experience is interpreted as the evidence of sunk entry cost. Firms enter the export market if the expected profit of the current period is greater than the sunk entry costs. Once firms export, they are likely to gain experience from being exporters.

To estimate the effect of productivity we employ three alternative estimation techniques to measure TFP; a standard labour productivity measure; a semi-parametric approach that takes account of unobserved firm-specific productivity shocks and a system estimation which allows for endogenous R&D. The estimated results are robust with positive and significant coefficients implying that firms with high productivity have a higher probability of exporting. For our other independent variables, the results show a positive and significant relationship between foreign ownership and export status. Firms with high wages are likely to enter export markets and firm size is also important, small firms are less likely to export but the larger a firm then becomes the more likely it is to export.

One of the key contributions of this chapter is to disaggregate the level of foreign ownership into different countries and regions of origin in order to examine the effect on the decision of a firm to export. The results show that certain countries or regions such as China, Japan, Singapore, US and UK are more strongly reliant on Thailand as an export platform. We also observe that the behaviour of Chinese- and Singaporean-owned firms are different to others with the probability of exporting correlated with the size of the foreign-owned share.

Overall, the determinants of a firm's export decision from a Thai perspective are broadly consistent with those findings from other developed and developing country studies. We can conclude that good firms become exporters whereas firms self-select into the export market based on differences in their export experience, productivity, location and other firm-specific characteristics. More importantly, we show that country of origin matters in determining the export decision of a firm. Finally, the effects of export experience and foreign ownership appear to be more pronounced for firms in Thailand than those of other studies. We believe that this reflects the importance of exporting to the previous, current and future development strategy of the new Asian Tigers. This is an analysis that until now had not been undertaken.

The implication of our results for governments of developing countries is the need to think carefully about how and to whom they target their inward FDI policies as a means of growth. The heterogeneous behaviour of multinationals from different nations means that policies targeting specific regions or countries may be preferable to general tax concessions or the implementation of special economic zones that are open to all.

Appendix 2A: Definition of Variables and Descriptive Statistics

Table 2A.1: Definition of Variables

Variable	Definition
EX_{it}	A dummy variable for export status where EX_{it} equals 1 if firm i exports and 0 otherwise.
$EX_{i(t-1)}$	Export experience that is a dummy variable for export status at time $t-1$ where $EX_{i(t-1)}$ equals 1 if firm i at time $t-1$ exports and 0 otherwise.
$FOREIGN_{i(t-1)}$	A dummy variable that indicates the structure of foreign ownership where a dummy equals 1 if shares of at least 10% are foreign owned.
$FOREIGN25_{i(t-1)}$	A dummy variable that indicates the structure of foreign ownership where a dummy equals 1 if shares of at least 25% are foreign owned.
$FOREIGN50_{i(t-1)}$	A dummy variable that indicates the structure of foreign ownership where a dummy equals 1 if shares of at least 50% are foreign owned.
$TFP^{LP}_{i(t-1)}$	Total factor productivity that is obtained from the estimation of the semi-parametric approach of Levinsohn and Petrin (2003).
$TFP^{BUETTNER}_{i(t-1)}$	Total factor productivity that is obtained from a system estimation of Buettner (2003).
$TFP^{LABPROD}_{i(t-1)}$	Labour productivity that is calculated from the log of value added divided by total labour.
$SMALL_{i(t-1)}$	A dummy variable equals 1 if the total labour of the firm i at time $t-1$ is in the first quartile of the distribution of the total labour of all firms operating in the same two-digit ISIC level (Rev. 3) as firm i at time $t-1$.
$LARGE_{i(t-1)}$	A dummy variable equals 1 if the total labour of the firm i at time $t-1$ is in the third quartile of the distribution of the total labour of all firms operating in the same two-digit ISIC level (Rev. 3) as firm i at time $t-1$.
$VLARGE_{i(t-1)}$	A dummy variable equals 1 if the total labour of the firm i at time $t-1$ is in the forth quartile of the distribution of the total labour of all firms operating in the same two-digit ISIC level (Rev. 3) as firm i at time $t-1$.
$SMALL^{A}_{i(t-1)}$	A firm is categorised as small firm if total fixed assets of firm i at time $t-1$ is in the first quartile of the distribution of the total fixed assets of all firms operating in the same two-digit ISIC level (Rev. 3) as firm i at time $t-1$.
$LARGE^{A}_{i(t-1)}$	A firm is categorised as large firm if the total fixed assets of firm i at time $t-1$ is in the third quartile of the distribution of the total fixed assets of all firms operating in the same two-digit ISIC level (Rev. 3) as firm i at time $t-1$.
$VLARGE^{A}_{i(t-1)}$	A firm is categorised as very large firm if the total fixed assets of firm i at time $t-1$ is in the forth quartile of the distribution of the total fixed assets of all firms operating in the same two-digit ISIC level (Rev. 3) as firm i at time $t-1$.

$wage_{i(t-1)}$	The log of wage per employee from the ratio of total labour payments over total labour less owner's wage.
$SKILL_{i(t-1)}$	The ratio of professional and skilled labour to total labour.
$TRAIN_{i(t-1)}$	A training dummy equals 1 if the workforce within a firm has received formal training either in-house training or outside training or both at least once, and 0 otherwise.
$RDPRODUCT_{i(t-1)}$	A dummy variable equals 1 if a firm carries out R&D in product development and 0 otherwise.
$RDPROCESS_{i(t-1)}$	A dummy variable equals 1 if a firm performs R&D in the development of production processes and 0 otherwise.
$BKKM$	A dummy variable identifies whether firm locates in Bangkok Metropolitan Area or not.
$CENTRAL$	A dummy variable equals 1 if a firm locates in Central region excluding Bangkok and Metropolitan Area and 0 otherwise.
$EAST$	A dummy variable equals 1 if a firm locates in Eastern region and 0 otherwise.
$NORTH$	A dummy variable equals 1 if a firm locates in the North of Thailand and 0 otherwise.
$SOUTH$	A dummy variable equals 1 if a firm locates in the South of Thailand and 0 otherwise.
$CHINA_{i(t-1)}$	A dummy variable equals 1 if a firm owned by Chinese including Taiwan and Hong Kong and 0 otherwise.
$EU_{i(t-1)}$	A dummy variable equals 1 if a firm owned by one of the country in EU-14 which does not include UK and 0 otherwise.
$JAPAN_{i(t-1)}$	A dummy variable equals 1 if a firm owned by Japanese and 0 otherwise.
$KOREA_{i(t-1)}$	A dummy variable equals 1 if a firm owned by South Korean and 0 otherwise.
$MALAYSIA_{i(t-1)}$	A dummy variable equals 1 if a firm owned by Malaysian and 0 otherwise.
$NONEU_{i(t-1)}$	A dummy variable equals 1 if a firm owned by a country in Europe excluding countries in the EU-15 and 0 otherwise.
$AUSCAN_{i(t-1)}$	A dummy variable equals 1 if a firm owned by either Australian or Canadian and 0 otherwise.
$SOUTHASIA_{i(t-1)}$	A dummy variable equals 1 if a firm owned by a country in the South Asia (India and Pakistan) and 0 otherwise.
$SEASIA_{i(t-1)}$	A dummy variable equals 1 if a firm owned by a country in the Southeast Asia (Indonesia, Myanmar and the Philippines) and 0 otherwise.
$SINGAPORE_{i(t-1)}$	A dummy variable equals 1 if a firm owned by Singaporean and 0 otherwise.
$UK_{i(t-1)}$	A dummy variable equals 1 if a firm owned by UK and 0 otherwise.
$US_{i(t-1)}$	A dummy variable equals 1 if a firm owned by US and 0 otherwise.
$OTHER_{i(t-1)}$	A dummy variable equals 1 if a firm owned by countries in Africa, Middle East, Caribbean, Central America, Oceania and South Pacific Ocean and 0 otherwise.

Table 2A.2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
EX_{it}	9049	0.50	0.50	0	1
$EX_{i(t-1)}$	9049	0.50	0.50	0	1
$FOREIGN_{i(t-1)}$	9049	0.28	0.45	0	1
$FOREIGN25_{i(t-1)}$	9049	0.24	0.43	0	1
$FOREIGN50_{i(t-1)}$	9049	0.14	0.35	0	1
$SMALL_{i(t-1)}$	9049	0.26	0.44	0	1
$LARGE_{i(t-1)}$	9049	0.24	0.43	0	1
$VLARGE_{i(t-1)}$	9049	0.25	0.43	0	1
$SMALL^{A}_{i(t-1)}$	9049	0.26	0.44	0	1
$LARGE^{A}_{i(t-1)}$	9049	0.24	0.43	0	1
$VLARGE^{A}_{i(t-1)}$	9049	0.25	0.43	0	1
$wage_{i(t-1)}$	9049	7.71	0.54	3.08	10.29
$SKILL_{i(t-1)}$	9049	0.53	0.33	0	1
$TRAIN_{i(t-1)}$	9049	0.87	0.33	0	1
$RDPRODUCT_{i(t-1)}$	9049	0.06	0.23	0	1
$RDPROCESS_{i(t-1)}$	9049	0.04	0.20	0	1
$TFP^{LP}_{i(t-1)}$	9049	9.22	1.83	0.47	16.69
$TFP^{BUETTNER}_{i(t-1)}$	9049	10.19	1.28	1.21	15.31
$TFP^{LABPROD}_{i(t-1)}$	9049	8.98	1.04	1.45	14.00

Table 2A.3: Correlation Matrix

	EX	$EX_{i(t-1)}$	*FOREGIN*	*FOREGIN25*	*FOREGIN50*	*SMALL*	*LARGE*	*VLARGE*	$SMALL^A$	$LARGE^A$	$VLARGE^A$	*wage*	*SKILL*	*TRAIN*	*RDPRODUCT*	*RDPROCESS*	TFP^{LP}	$TFP^{LABPROD}$	$TFP^{LABPROD}$
EX	1.00																		
$EX_{i(t-1)}$	0.94	1.00																	
FOREGIN	0.37	0.37	1.00																
FOREGIN25	0.36	0.37	0.92	1.00															
FOREGIN50	0.32	0.33	0.66	0.72	1.00														
SMALL	-0.37	-0.37	-0.18	-0.17	-0.17	1.00													
LARGE	0.14	0.13	0.02	0.02	0.02	-0.34	1.00												
VLARGE	0.36	0.36	0.22	0.21	0.20	-0.34	-0.33	1.00											
$SMALL^A$	-0.37	-0.37	-0.24	-0.22	-0.20	0.58	-0.26	-0.33	1.00										
$LARGE^A$	0.14	0.13	0.07	0.06	0.05	-0.24	0.28	-0.03	-0.34	1.00									
$VLARGE^A$	0.34	0.34	0.27	0.26	0.26	-0.34	-0.04	0.63	-0.34	-0.33	1.00								
wage	0.28	0.27	0.41	0.40	0.34	-0.23	0.08	0.18	-0.32	0.11	0.31	1.00							
SKILL	-0.02	-0.02	-0.02	-0.01	-0.01	0.11	-0.05	-0.06	0.06	-0.04	-0.02	0.08	1.00						
TRAIN	0.22	0.22	0.14	0.13	0.11	-0.28	0.11	0.19	-0.25	0.09	0.20	0.21	-0.03	1.00					
RDPRODUCT	0.13	0.13	0.05	0.05	0.04	-0.10	0.01	0.15	-0.10	0.04	0.11	0.08	-0.04	0.08	1.00				
RDPROCESS	0.10	0.10	0.05	0.04	0.02	-0.08	0.02	0.11	-0.09	0.02	0.10	0.08	-0.02	0.07	0.58	1.00			
TFP^{LP}	0.21	0.20	0.15	0.13	0.08	-0.26	0.07	0.25	-0.26	0.06	0.30	0.42	-0.04	0.17	0.08	0.08	1.00		
$TFP^{BUETTNER}$	0.40	0.40	0.38	0.36	0.31	-0.46	0.13	0.44	-0.50	0.12	0.55	0.65	-0.03	0.29	0.15	0.13	0.63	1.00	
$TFP^{LABPROD}$	0.27	0.26	0.35	0.33	0.28	-0.25	0.08	0.22	-0.38	0.10	0.41	0.70	0.01	0.22	0.11	0.10	0.61	0.93	1.00

Table 2A.4: Country of Origin of a Parent Company by Year

Country	2001		2002		2003	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Foreign:						
China	210	6.27	195	6.33	167	6.38
EU-14	75	2.24	73	2.37	62	2.37
Japan	359	10.72	344	11.16	322	12.30
Korea	17	0.51	18	0.58	19	0.73
Malaysia	15	0.45	13	0.42	9	0.34
Non EU-15	22	0.66	23	0.75	16	0.61
Australia and Canada	10	0.30	9	0.29	6	0.23
South Asia	12	0.36	12	0.39	9	0.34
Southeast Asia	4	0.12	4	0.13	6	0.23
Singapore	57	1.70	46	1.49	44	1.68
UK	34	1.01	34	1.10	24	0.92
US	67	2.00	65	2.11	55	2.10
Other Countries	9	0.27	13	0.42	10	0.38
Domestic:						
Thailand	2,459	73.40	2,233	72.45	1,868	71.38
Total	3,350	100.00	3,082	100.00	2,617	100.00

Appendix 2B: TFP Estimation Using Levinsohn and Petrin's (2003) Method

In the chapter, the estimation of TFP is accomplished using a Cobb-Douglas production function and the semi-parametric approach of Levinsohn and Petrin (2003). The approach was adapted from Olley and Pakes (1996) which considered the endogeneity problem by taking unobserved firm-specific productivity shocks into account.

A consequence of the endogeneity problem is that OLS yields biased and inconsistent results in productivity estimations because it fails to take unobserved productivity shock into account. Olley and Pakes (1996) resolve the endogeneity problem by using an investment proxy to control for the simultaneity problem between the correlation of input levels and unobserved productivity shocks.

Levinsohn and Petrin (2003) point out that such an investment proxy may not respond to the productivity shock smoothly due to adjustment costs. Additionally, such a variable is valid only among those firms who report non-zero investment. Firms with zero investment have to be dropped from the sample.

To avoid the zero investment and adjustment problems, Levinsohn and Petrin (2003) introduce, with the modification of Olley and Pakes (1996), the use of intermediate inputs to measure the correlation between input levels and productivity shocks. If intermediate inputs are less costly to adjust, they may perhaps respond smoothly and fully to productivity shocks.

TFP in the chapter is separately estimated for each of the two-digit ISIC manufacturing sectors, 22 in total.[19] The estimated production function can be expressed as follow:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \omega_{it} + \eta_{it} \quad (2B.1)$$

where y_{it} is the log of value added of plant i at time t defined as sales net raw material costs, l_{it} is the log of total labour[20], k_{it} is the log of plant's capital stock which is defined as value of fixed assets. The error terms comprises two components, ω_{it} and η_{it}, where the former is unobserved productivity shocks which are correlated with the input choice while the latter is the error term which has no impact on the firms' decision.

The demand function for intermediate input is a function of state variables – capital and unobserved productivity shock – as given in Equation (2B.2)

$$m_{it} = m_{it}(k_{it}, \omega_{it}) \quad (2B.2)$$

The relationship between intermediate inputs and unobserved firm productivity shocks is assumed to be monotonic where firms respond to positive productivity shocks by using more intermediate inputs so as to enlarge their output. Thus, the demand function for intermediate input in Equation (2B.2) can be inverted. Unobserved productivity shocks can be written as a function of capital and intermediate inputs as follows:

$$\omega_{it} = \omega_{it}(k_{it}, m_{it}) \quad (2B.3)$$

where m_{it} denotes log of a fuel and energy cost as a proxy for intermediate inputs.

With substitution of (2B.3) into (2B.1)

[19] Due to the insufficient observations, the manufacture of tobacco products is grouped with the manufacture of food products and beverages.

[20] We use total labour rather than the number of skilled and unskilled workers. This is because of concerns that we have previously expressed about the quality of our raw data as some firms may be mis-specifying the number of skilled and unskilled workers.

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \omega_{it}(k_{it}, m_{it}) + \eta_{it} \quad (2B.4)$$

Since $\omega_{it}(k_{it}, m_{it})$ is an unknown function of intermediate input and capital, Levinsohn and Petrin (2003) has generated a function of $\phi_{it}(k_{it}, m_{it})$ in order to estimate the parameters.

$$\phi_{it}(k_{it}, m_{it}) = \beta_0 + \beta_k k_{it} + \omega_{it}(k_{it}, m_{it}) \quad (2B.5)$$

So,

$$\omega_{it}(k_{it}, m_{it}) = \phi_{it}(k_{it}, m_{it}) - \beta_0 + \beta_k k_{it} \quad (2B.6)$$

Substituting (2B.6) into (2B.4) gives us the production function as if a fuel and energy cost is used as the proxy variable.

$$y_{it} = \beta_l l_{it} + \phi_{it}(k_{it}, m_{it}) + \eta_{it} \quad (2B.7)$$

The estimation procedure in the chapter follows the two stage estimation in the value-added case as discussed in Petrin *et al.* (2004).

In the first stage, the estimation of production function (2B.7) using OLS by the substitution of $\phi_{it}(k_{it}, m_{it})$ with a third-order polynomial in k_{it} and m_{it} yields $\hat{\beta}_l$ and $\hat{\phi}_{it}$ (up to the intercept).

$$y_{it} = \alpha_0 + \beta_l l_{it} + \sum_{h=0}^{3} \sum_{j=0}^{3-h} \alpha_{hj} k_{it}^h m_{it}^j + \eta_{it} \quad (2B.8)$$

Once the estimated elasticity of β_l and ϕ_{it} in the first stage is achieved, the next stage is to identify the residual of the production function and the estimated $\hat{\beta}_k$.

The relationship of the estimate residual from the production function can be written as

$$\widehat{\eta_{it} + \xi_{it}} = y_{it} - \hat{\beta}_l l_{it} - \beta_k^* k_{it} - E[\omega_{it} | \widehat{\omega_{it-1}}] \quad (2B.9)$$

where ξ_{it} is the error term namely the productivity innovation uncorrelated to capital, β_k^* is computed from a prediction of $\widehat{\omega}_{it} = \hat{\phi}_{it} - \beta_k^* k_{it}$, while $E[\omega_{it}|\widehat{\omega_{it-1}}]$ is a predicted unobserved productivity shock from a nonparametric approximation regression of $\widehat{\omega}_{it} = \lambda_0 + \lambda_1 \omega_{it-1} + \lambda_2 \omega_{it-1}^2 + \lambda_3 \omega_{t-1}^3 + \mu_{it}$.

The estimate $\hat{\beta}_k$ is defined as to minimise β_k^* the solution of

$$\min_{\beta_k^*} \sum_i \sum_t (y_{it} - \hat{\beta}_l l_{it} - \beta_k^* k_{it} - E[\omega_{it}|\widehat{\omega_{it-1}}])^2 \qquad (2B.10)$$

The estimated elasticities of inputs obtained from the procedure of Petrin *et al.* (2004) are eventually used to predict the level of productivity.

$$\widehat{\omega}_{it} = \exp\left(y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it}\right) \qquad (2B.11)$$

The number of bootstrap replications performed in the chapter is 250 to estimate standard errors.

Appendix 2C: TFP Estimation Using Buettner's (2003) Method

Firms normally engage in R&D activities with the aim of improving productivity within firms. Recent R&D investment would yield a direct effect on future productivity. Therefore, Buettner (2003) points out that R&D investment should be taken into account as part of the consideration for measuring the TFP. The study provides the estimation framework on the distribution of the future productivity conditionally based on the R&D investment and current productivity. In addition, the structural model for firm dynamics is used to build up the estimation of the unobserved productivity state.

To begin with Cobb-Douglas's production function can be written as follows:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \omega_{it} + \eta_{it} \qquad (2C.1)$$

Here y_{it} is the log of the value added of plant i at time t. l_{it} and k_{it} are the log of the total labour and plant's capital stock respectively. There are two components of the error terms in Equation (2C.1), ω_{it} is the productivity shock which correlates with the input choice while η_{it} represents the measurement error that has no impact on the firms' decision.

Buettner (2003) explains the estimation algorithm in two stages. Stage one is indistinguishable from Olley and Pakes's (1996) technique in the estimation of factors of input(s) coefficient. However, in the second stage, Buettner (2003) had modified Olley and Pakes (1996) in the estimation of the quasi-fixed inputs by assuming that the future productivity depends on current productivity and also the current R&D investment.

Stage one: Estimation of the Coefficients of the Variable Input(s)

The nonparametric approach is used as the estimation strategy to control the unobserved productivity shock which has an impact on the firms' decisions.

The level of firm investment i at time t is a function of the state variables, current capital stock (k_{it}) and current productivity shock (ω_{it}), as given; $i_{it} = i_{it}(k_{it}, \omega_{it})$. This level of investment function has a monotonic property – a positive productivity shock influences firms to invest more. Thus, the investment function can be inverted and rewritten so the relationship of the unobserved productivity is:

$$\omega_{it} = \widetilde{\omega}_{it}(i_{it}, k_{it})^{21} \tag{2C.2}$$

Substituting (2C.2) into Cobb-Douglas's production function (2C.1) gives us:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \widetilde{\omega}_{it}(i_{it}, k_{it}) + \eta_{it} \tag{2C.3}$$

Since $\widetilde{\omega}_{it}(i_{it}, k_{it})$ has an unknown functional form, Olley and Pakes (1996) and Levinsohn and Petrin (2003) have generated another unknown function of $\phi_{it}(i_{it}, k_{it})$ which can be written as the Equation (2C.4):

$$\phi_{it}(i_{it}, k_{it}) = \beta_0 + \beta_k k_{it} + \widetilde{\omega}_{it}(i_{it}, k_{it}) \tag{2C.4}$$

Hence,

$$\widetilde{\omega}_{it}(i_{it}, k_{it}) = \phi_{it}(i_{it}, k_{it}) - \beta_0 - \beta_k k_{it} \tag{2C.5}$$

Substitute (2C.5) into (2C.3) to obtain the production function to give:

$$y_{it} = \beta_l l_{it} + \phi_{it}(i_{it}, k_{it}) + \eta_{it} \tag{2C.6}$$

[21] Similarly, unobserved productivity can also be written as the function of next period and current capital of firm i: $\omega_{it} = \widetilde{\omega}_{it}(k_{it+1}, k_t)$ because next period capital is formed as $k_{it+1} = (1 - \delta)k_{it} + i_{it}$.

Buettner (2003) estimates the semi-parametric regression model (2C.6) using OLS which yields a consistent estimation of coefficient β_l; however, it does not identify the coefficient of β_k.

Stage two: Estimation of the Coefficients of the Quasi-fixed Input(s)

This stage aims to obtain the production function coefficient(s). Buettner (2003) applies the identical strategy in stage two as Olley and Pakes (1996), but the only difference is that Buettner (2003) controls the expected productivity restricted on the past information at time $t-1$ for the reason that it correlates with the current period's capital stock which was chosen at time $t-1$.

Rearrange the Equation (2C.3) as similarly:

$$y_{it} - \beta_l l_{it} = \beta_0 + \beta_k k_{it} + \tilde{\omega}_{it}(i_{it}, k_{it}) + \eta_{it} \qquad (2C.7)$$

The expectation of the transformed dependent variable in Equation (2C.7) is restricted on the information at time $t-1$ and survival until t, can be written as:

$$E[(y_{it} - \beta_l l_{it})|I_{it-1}, \chi_{it} = 1] = \beta_0 + \beta_k k_{it} + E[\omega_{it}|\psi_{it}, \chi_{it} = 1] \qquad (2C.8)$$

where I_{it-1} is the past information at time $t-1$, χ_{it} represents the survival firm, ψ_{it} denotes the current distribution choice of the productivity which is influenced by the firm decision on the R&D investment.

Regarding Markov's assumption for the productivity process, the function of productivity condition on survival can be written as:

$$\omega_{it} = E[\omega_{it}|\psi_{it}, \chi_{it} = 1] + \xi_{it} \qquad (2C.9)$$

where ξ_{it} is the productivity innovation which is uncorrelated with k_{it}.

Substitute (2C.9) into (2C.7) to obtain the second stage estimation equation:

$$y_{it} - \beta_l l_{it} = \beta_0 + \beta_k k_{it} + E[\omega_{it}|\psi_{it}, \chi_{it} = 1] + \xi_{it} + \eta_{it} \qquad (2C.10)$$

In order to obtain the consistent coefficient of β_k from the estimation of the Equation (2C.10), the expected productivity condition on survival is needed to be controlled. The next step is similar to the approach in the first stage. Since the expectation $E[\omega_{it}|\psi_{it}, \chi_{it} = 1]$ is an unknown function, we have to generate another unknown function of g(.) and estimate g(.) using the non-parametrically approach. From the distribution choice of the policy function, $\psi_{it} = \tilde{\psi}(\omega_{it-1}, k_{it-1})$, the expectation term of the current productivity shock becomes:

$$E[\omega_{it}|\psi_{it}, \chi_{it} = 1] = E[\omega_{it}|\psi_{it}] = \int \omega_{it+1} dF(\omega_{it+1}|\psi_{it}) \qquad (2C.11)$$
$$\equiv g(\psi_{it}) - \beta_0$$

No R&D:

In the model of Olley and Pakes (1996) by means of the absence of R&D, the productivity distribution only depends on the productivity shock at time $t-1$, $\psi_{it} = \omega_{it-1}$. The second state estimation equation, then, becomes:

$$y_{it} - \beta_l l_{it} = \beta_k k_{it} + g(\omega_{it-1}) + \xi_{it} + \eta_{it} \qquad (2C.12)$$

where $\omega_{it-1} = \phi_{it-1} - \beta_k k_{it-1} - \beta_0$. Equation (2C.12) is estimated by the nonlinear least square of which $g(\omega_{it-1})$ can be approximated by the nonparametric approach in $\phi_{it-1} - \beta_k k_{it-1}$. Consequently, the coefficient of β_k is obtained from the estimation of the linear term $\beta_k k_{it}$ and nonlinear function in $\phi_{it-1} - \beta_k k_{it-1}$.

R&D:

For endogenous R&D, firms improve the next period productivity shock ω_{it+1} by increasing the R&D investment in the current period. Rather than having a direct effect, ω_{it+1} is affected by the R&D investment and ω_{it} the current period productivity shock through the ψ_{it+1}. The policy function indicates the current distribution choice of productivity as a function of productivity shock and capital at time $t-1$, $\psi_{it} = \tilde{\psi}(\omega_{it-1}, k_{it-1})$.

The R&D investment can be written as a function of the current distribution and previous period productivity shock, $r(\psi_{it}, \omega_{it-1})$. The relationship is assumed to be monotonic with the increase in ψ_{it} for fixed ω_{it-1}, thus, the R&D function can be inverted.

$$\psi_{it} = r^{-1}(r_{it-1}, \omega_{it-1}) \qquad \text{(2C.13)}$$

where r_{it-1} is the observed R&D investment of a firm i at time $t-1$. Buettner (2003) uses the Equation (2C.13) to control the current distribution choice of the productivity. Therefore, the second stage estimation equation becomes:

$$y_{it} - \beta_l l_{it} = \beta_k k_{it} + g(r^{-1}(r_{it-1}, \omega_{it-1})) + \xi_{it} + \eta_{it} \qquad \text{(2C.14)}$$

Replace $g(r^{-1}(r_{it-1}, \omega_{it-1}))$ with the nonlinear function of $\tilde{g}(.,.)$ in r_{it-1} and $\phi_{it-1} - \beta_k k_{it-1}$ and rewrite the Equation (2C.14) as follows:

$$y_{it} - \beta_l l_{it} = \beta_k k_{it} + \tilde{g}(r_{it-1}, \phi_{it-1} - \beta_k k_{it-1}) + \xi_{it} + \eta_{it} \qquad \text{(2C.15)}$$

The assumption for a consistent estimation of the Equation (2C.15) requires R&D to be uncorrelated with the error terms. In the chapter, R&D expenses are used in the computation of value added; therefore, the estimation of the Equation (2C.15) is likely to be violated.

By avoiding R&D data, the second alternative approach of the estimation in stage two develops the property of structural model by referring to the choice of distribution. The optimal choice of distribution ψ_{it} is as a function of the state variable ω_{it-1} and the optimal choice of capital k_{it}. The relationship can be written as:

$$\psi_{it} = \bar{\psi}(\omega_{it-1}, k_{it}) \tag{2C.16}$$

There is no direct relationship of ψ_{it} on k_{it-1}. k_{it-1} affects ψ_{it} only through the link of k_{it}. For the endogenous R&D model, the stage two estimation equation becomes:

$$\begin{aligned} y_{it} - \beta_l l_{it} &= \beta_k k_{it} + g(\bar{\psi}(\omega_{it-1}, k_{it})) + \xi_{it} + \eta_{it} \\ &= \int(\phi_{it-1} - \beta_k k_{it-1}, k_{it}) + \xi_{it} + \eta_{it} \end{aligned} \tag{2C.17}$$

Rather than a partially linear semi-parametric equation, the Equation (2C.17) becomes a fully nonlinear equation. Therefore, we run the nonlinear least square regression of the Equation (2C.17) on a nonparametric function in $\phi_{it-1} - \beta_k k_{it-1}$ and k_{it} to obtain a consistent estimate of β_k.

In the chapter, we work with a system estimation of Equations (2C.6) and (2C.17) which yields consistent estimate coefficients of β_l and β_k. As a consequence, log of TFP_{it} is measured from $y_{it} - \beta_l k_{it} - \beta_k k_{it}$.

Appendix 2D: Additional Results

Table 2D.1: Building a Pooled Probit Model for a Firm's Decision to Export

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$EX_{i(t-1)}$	0.933***	0.928***	0.921***	0.914***	0.914***	0.914***	0.914***	0.914***	0.913***	0.913***	0.914***	0.914***
	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$FOREIGN_{i(t-1)}$		0.136***	0.081***	0.076***	0.076***	0.064**	0.064**	0.065**	0.065**	0.065**	0.072***	0.072***
		(0.025)	(0.027)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.027)	(0.026)
$TFP^{LP}_{i(t-1)}$			0.091***	0.048***	0.048***	0.033***	0.033***	0.032***	0.032***	0.031**	0.032***	0.032***
			(0.009)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
$SMALL_{i(t-1)}$				-0.101***	-0.101***	-0.102***	-0.104***	-0.102***	-0.102***	-0.102***	-0.101***	-0.102***
				(0.023)	(0.023)	(0.023)	(0.025)	(0.025)	(0.024)	(0.024)	(0.024)	(0.024)
$LARGE_{i(t-1)}$				0.107***	0.107***	0.109***	0.109***	0.109***	0.107***	0.107***	0.106***	0.107***
				(0.029)	(0.029)	(0.029)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
$VLARGE_{i(t-1)}$				0.152***	0.152***	0.158***	0.159***	0.157***	0.155***	0.155***	0.155***	0.156***
				(0.034)	(0.034)	(0.034)	(0.034)	(0.035)	(0.035)	(0.035)	(0.037)	(0.037)
$wage_{i(t-1)}$						0.054**	0.053**	0.052**	0.052**	0.052**	0.049	0.049
						(0.026)	(0.026)	(0.027)	(0.026)	(0.027)	(0.031)	(0.031)
$SKILL_{i(t-1)}$							0.021	0.021	0.021	0.020	0.022	0.021
							(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
$TRAIN_{i(t-1)}$								0.015	0.013	0.014	0.015	0.015
								(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
$RDPRODUCT_{i(t-1)}$									0.070*		0.071*	
									(0.037)		(0.038)	
$RDPROCESS_{i(t-1)}$										0.078		0.077
										(0.057)		(0.058)
BKKM											0.093	0.093
											(0.069)	(0.069)
CENTRAL											0.071	0.071
											(0.091)	(0.090)
EAST											0.071	0.070
											(0.078)	(0.077)
NORTH											0.090	0.089
											(0.071)	(0.071)
SOUTH											0.166***	0.165***
											(0.057)	(0.057)
Observations	9058	9057	9057	9057	9057	9053	9053	9049	9049	9049	9049	9049

Notes: Robust clustered standard errors in parentheses. Time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2D.2: Pooled Probit Model for a Firm's Decision to Export (Excluding $SKILL_{i(t-1)}$)

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.914***	0.914***	0.914***	0.914***	0.914***	0.914***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$FOREIGN_{i(t-1)}$	0.071***	0.071***	0.071***	0.071***	0.070***	0.070***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
$TFP^{LP}_{i(t-1)}$	0.033***	0.032***				
	(0.012)	(0.012)				
$TFP^{BUETTNER}_{i(t-1)}$			0.030*	0.030*		
			(0.016)	(0.016)		
$TFP^{LABPROD}_{i(t-1)}$					0.037***	0.036***
					(0.013)	(0.013)
$SMALL_{i(t-1)}$	-0.100***	-0.100***	-0.098***	-0.098***	-0.108***	-0.108***
	(0.022)	(0.022)	(0.023)	(0.023)	(0.020)	(0.020)
$LARGE_{i(t-1)}$	0.106***	0.106***	0.104***	0.105***	0.113***	0.114***
	(0.030)	(0.029)	(0.030)	(0.030)	(0.028)	(0.028)
$VLARGE_{i(t-1)}$	0.154***	0.155***	0.151***	0.152***	0.170***	0.170***
	(0.036)	(0.036)	(0.040)	(0.040)	(0.032)	(0.032)
$wage_{i(t-1)}$	0.051*	0.051*	0.049	0.049	0.042	0.042
	(0.030)	(0.031)	(0.030)	(0.031)	(0.028)	(0.028)
$TRAIN_{i(t-1)}$	0.015	0.016	0.014	0.015	0.015	0.015
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
$RDPRODUCT_{i(t-1)}$	0.071*		0.068*		0.070*	
	(0.038)		(0.037)		(0.037)	
$RDPROCESS_{i(t-1)}$		0.077		0.075		0.076
		(0.057)		(0.057)		(0.058)
$BKKM$	0.093	0.092	0.094	0.093	0.096	0.095
	(0.069)	(0.068)	(0.070)	(0.069)	(0.069)	(0.068)
$CENTRAL$	0.071	0.072	0.069	0.069	0.070	0.071
	(0.090)	(0.090)	(0.091)	(0.090)	(0.091)	(0.090)
$EAST$	0.070	0.070	0.069	0.069	0.070	0.069
	(0.078)	(0.077)	(0.078)	(0.077)	(0.078)	(0.077)
$NORTH$	0.091	0.090	0.094	0.093	0.097	0.095
	(0.072)	(0.071)	(0.073)	(0.072)	(0.072)	(0.072)
$SOUTH$	0.166***	0.164***	0.165***	0.164***	0.165***	0.163***
	(0.057)	(0.057)	(0.057)	(0.057)	(0.058)	(0.058)
Observations	9049	9049	9049	9049	9049	9049

Notes: Robust clustered standard errors in parentheses. Time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix 2E: Sensitivity Analysis

In the Appendix 2E, we present a range of sensitivity checks on our independent variables by using different definitions of foreign ownership and firm size. 25% and 50% cut-off points of foreign-owned share are used instead of 10%. We also classify the firm size according to total fixed assets instead of the total employment. In Sections 2E.1.1 and 2E.2.1, we report the marginal effects of the pooled probit model using different cut-off points for foreign ownership and classifying size by total employment whereas results presented in Sections 2E.1.2 and 2E.2.2 are from the model estimations that classify size by total fixed assets.

Using 25% and 50% of foreign-owned share as alternatives cut-off points, results in Tables 2E.1 and 2E.2 are consistent with those in Table 2.8. The coefficients of sunk entry costs, foreign ownership, TFP, large and very large firms and product R&D are positive and significant whilst being a small firm has a negative and significant effect on the probability of exporting. Different percentage share used to classify foreign ownership show that the higher the percentage, the greater the effect on the probability of exporting. When total fixed assets instead of total employment are used to classify firm size, results in Tables 2E.3 to 2E.5 are generally consistent. For the origin of ownership, results in Table 2E.6 are broadly similar to Table 2.9 except for Korean-owned firms which now have no significant impact on the probability of exporting.

2E.1 The Model for a Firm's Decision to Export

2E.1.1 Classified Size by Total Labour

Table 2E.1: The Model for a Firm's Decision to Export with $FOREIGN25$, $SMALL$, $LARGE$ and $VLARGE$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.914***	0.914***	0.913***	0.914***	0.914***	0.914***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$FOREIGN25_{i(t-1)}$	0.092***	0.092***	0.091***	0.091***	0.090***	0.090***
	(0.032)	(0.032)	(0.033)	(0.032)	(0.032)	(0.032)
$TFP^{LP}_{i(t-1)}$	0.033***	0.033***				
	(0.012)	(0.012)				
$TFP^{BUETTNER}_{i(t-1)}$			0.031*	0.031*		
			(0.016)	(0.016)		
$TFP^{LABPROD}_{i(t-1)}$					0.037***	0.037***
					(0.013)	(0.013)
$SMALL_{i(t-1)}$	-0.102***	-0.102***	-0.100***	-0.100***	-0.110***	-0.110***
	(0.023)	(0.023)	(0.025)	(0.025)	(0.022)	(0.022)
$LARGE_{i(t-1)}$	0.107***	0.107***	0.105***	0.106***	0.114***	0.115***
	(0.030)	(0.030)	(0.031)	(0.030)	(0.028)	(0.028)
$VLARGE_{i(t-1)}$	0.154***	0.155***	0.151***	0.152***	0.170***	0.171***
	(0.037)	(0.037)	(0.040)	(0.040)	(0.032)	(0.032)
$wage_{i(t-1)}$	0.045	0.045	0.043	0.042	0.036	0.036
	(0.030)	(0.031)	(0.029)	(0.029)	(0.028)	(0.028)
$SKILL_{i(t-1)}$	0.023	0.022	0.025	0.024	0.023	0.022
	(0.035)	(0.036)	(0.035)	(0.035)	(0.035)	(0.036)
$TRAIN_{i(t-1)}$	0.015	0.015	0.014	0.014	0.015	0.015
	(0.035)	(0.035)	(0.036)	(0.036)	(0.036)	(0.036)
$RDPRODUCT_{i(t-1)}$	0.070*		0.067*		0.070*	
	(0.038)		(0.037)		(0.037)	
$RDPROCESS_{i(t-1)}$		0.076		0.074		0.075
		(0.058)		(0.057)		(0.058)
$BKKM$	0.092	0.092	0.093	0.093	0.095	0.095
	(0.069)	(0.069)	(0.070)	(0.070)	(0.069)	(0.068)
$CENTRAL$	0.070	0.070	0.067	0.067	0.069	0.069
	(0.091)	(0.091)	(0.092)	(0.091)	(0.092)	(0.091)
$EAST$	0.064	0.063	0.063	0.062	0.063	0.063
	(0.080)	(0.079)	(0.080)	(0.079)	(0.080)	(0.079)
$NORTH$	0.085	0.084	0.088	0.087	0.090	0.089
	(0.071)	(0.071)	(0.072)	(0.072)	(0.072)	(0.072)
$SOUTH$	0.165***	0.164***	0.164***	0.163***	0.164***	0.162***
	(0.057)	(0.057)	(0.057)	(0.057)	(0.058)	(0.058)
Observations	9049	9049	9049	9049	9049	9049

Notes: Robust clustered standard errors in parentheses. Time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2E.2: The Model for a Firm's Decision to Export with $FOREIGN50$, $SMALL$, $LARGE$ and $VLARGE$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.914***	0.914***	0.914***	0.914***	0.914***	0.914***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$FOREIGN50_{i(t-1)}$	0.127***	0.127***	0.128***	0.129***	0.126***	0.127***
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
$TFP^{LP}_{i(t-1)}$	0.035***	0.035***				
	(0.012)	(0.012)				
$TFP^{BUETTNER}_{i(t-1)}$			0.033**	0.033**		
			(0.015)	(0.015)		
$TFP^{LABPROD}_{i(t-1)}$					0.040***	0.039***
					(0.013)	(0.013)
$SMALL_{i(t-1)}$	-0.101***	-0.101***	-0.098***	-0.098***	-0.109***	-0.110***
	(0.023)	(0.023)	(0.025)	(0.025)	(0.022)	(0.022)
$LARGE_{i(t-1)}$	0.104***	0.105***	0.103***	0.103***	0.113***	0.113***
	(0.031)	(0.031)	(0.032)	(0.031)	(0.030)	(0.029)
$VLARGE_{i(t-1)}$	0.151***	0.152***	0.148***	0.149***	0.169***	0.169***
	(0.036)	(0.036)	(0.040)	(0.039)	(0.032)	(0.032)
$wage_{i(t-1)}$	0.046	0.046	0.044	0.043	0.036	0.036
	(0.030)	(0.031)	(0.029)	(0.029)	(0.028)	(0.028)
$SKILL_{i(t-1)}$	0.024	0.023	0.025	0.024	0.024	0.023
	(0.035)	(0.036)	(0.035)	(0.035)	(0.035)	(0.036)
$TRAIN_{i(t-1)}$	0.016	0.016	0.015	0.015	0.015	0.016
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
$RDPRODUCT_{i(t-1)}$	0.074*		0.071*		0.074*	
	(0.039)		(0.038)		(0.038)	
$RDPROCESS_{i(t-1)}$		0.082		0.079		0.080
		(0.058)		(0.057)		(0.058)
$BKKM$	0.098	0.097	0.099	0.099	0.101	0.100
	(0.069)	(0.068)	(0.070)	(0.069)	(0.069)	(0.068)
$CENTRAL$	0.067	0.068	0.064	0.065	0.066	0.067
	(0.094)	(0.093)	(0.094)	(0.094)	(0.094)	(0.093)
$EAST$	0.065	0.065	0.064	0.063	0.064	0.064
	(0.080)	(0.079)	(0.081)	(0.080)	(0.081)	(0.079)
$NORTH$	0.088	0.087	0.092	0.090	0.094	0.093
	(0.071)	(0.071)	(0.073)	(0.072)	(0.072)	(0.072)
$SOUTH$	0.162***	0.161***	0.162***	0.161***	0.161***	0.160***
	(0.056)	(0.056)	(0.056)	(0.056)	(0.057)	(0.057)
Observations	9049	9049	9049	9049	9049	9049

Notes: Robust clustered standard errors in parentheses. Time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

2E.1.2 Classified Size by Total Fixed Assets

Table 2E.3: The Model for a Firm's Decision to Export with $FOREIGN$, $SMALL^A$, $LARGE^A$ and $VLARGE^A$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.916***	0.916***	0.916***	0.916***	0.917***	0.917***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)
$FOREIGN_{i(t-1)}$	0.068**	0.068**	0.068**	0.068**	0.069***	0.069***
	(0.027)	(0.027)	(0.028)	(0.027)	(0.027)	(0.026)
$TFP^{LP}_{i(t-1)}$	0.047***	0.047***				
	(0.011)	(0.011)				
$TFP^{BUETTNER}_{i(t-1)}$			0.039**	0.040**		
			(0.017)	(0.017)		
$TFP^{LABPROD}_{i(t-1)}$					0.020	0.019
					(0.014)	(0.014)
$SMALL^A_{i(t-1)}$	-0.076***	-0.076***	-0.070**	-0.069**	-0.084***	-0.084***
	(0.027)	(0.026)	(0.028)	(0.027)	(0.026)	(0.026)
$LARGE^A_{i(t-1)}$	0.079**	0.081**	0.077**	0.078**	0.089***	0.090***
	(0.032)	(0.032)	(0.034)	(0.034)	(0.031)	(0.031)
$VLARGE^A_{i(t-1)}$	0.134***	0.135***	0.130**	0.131**	0.161***	0.163***
	(0.048)	(0.048)	(0.056)	(0.056)	(0.047)	(0.047)
$wage_{i(t-1)}$	0.012	0.012	0.017	0.017	0.034	0.035
	(0.029)	(0.029)	(0.028)	(0.028)	(0.028)	(0.029)
$SKILL_{i(t-1)}$	0.010	0.009	0.012	0.011	0.009	0.008
	(0.034)	(0.035)	(0.034)	(0.035)	(0.035)	(0.035)
$TRAIN_{i(t-1)}$	0.031	0.032	0.032	0.032	0.038	0.039
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
$RDPRODUCT_{i(t-1)}$	0.074**		0.072**		0.079**	
	(0.038)		(0.037)		(0.037)	
$RDPROCESS_{i(t-1)}$		0.079		0.078		0.085
		(0.058)		(0.057)		(0.057)
$BKKM$	0.117*	0.116*	0.116	0.116	0.115	0.114*
	(0.071)	(0.070)	(0.071)	(0.071)	(0.070)	(0.069)
$CENTRAL$	0.075	0.075	0.072	0.072	0.073	0.073
	(0.093)	(0.093)	(0.094)	(0.093)	(0.092)	(0.092)
$EAST$	0.071	0.071	0.070	0.069	0.068	0.067
	(0.081)	(0.080)	(0.081)	(0.080)	(0.079)	(0.079)
$NORTH$	0.107	0.106	0.111	0.109	0.112	0.110
	(0.072)	(0.072)	(0.074)	(0.074)	(0.072)	(0.072)
$SOUTH$	0.164***	0.162***	0.164***	0.162***	0.164***	0.163***
	(0.060)	(0.059)	(0.059)	(0.059)	(0.058)	(0.058)
Observations	9049	9049	9049	9049	9049	9049

Notes: Robust clustered standard errors in parentheses. Time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2E.4: The Model for a Firm's Decision to Export with $FOREIGN25$, $SMALL^A$, $LARGE^A$ and $VLARGE^A$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.916***	0.916***	0.916***	0.916***	0.916***	0.917***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$FOREIGN25_{i(t-1)}$	0.086***	0.086***	0.087***	0.086***	0.086***	0.086***
	(0.033)	(0.032)	(0.033)	(0.033)	(0.032)	(0.032)
$TFP^{LP}_{i(t-1)}$	0.048***	0.048***				
	(0.011)	(0.011)				
$TFP^{BUETTNER}_{i(t-1)}$			0.040**	0.040**		
			(0.017)	(0.017)		
$TFP^{LABPROD}_{i(t-1)}$					0.021	0.020
					(0.015)	(0.015)
$SMALL^A_{i(t-1)}$	-0.077***	-0.077***	-0.070**	-0.070**	-0.085***	-0.084***
	(0.027)	(0.026)	(0.028)	(0.028)	(0.027)	(0.026)
$LARGE^A_{i(t-1)}$	0.079**	0.080**	0.077**	0.078**	0.089***	0.090***
	(0.032)	(0.032)	(0.034)	(0.034)	(0.031)	(0.031)
$VLARGE^A_{i(t-1)}$	0.132***	0.133***	0.128**	0.129**	0.160***	0.162***
	(0.048)	(0.048)	(0.057)	(0.057)	(0.047)	(0.047)
$wage_{i(t-1)}$	0.008	0.008	0.013	0.013	0.030	0.031
	(0.028)	(0.029)	(0.027)	(0.027)	(0.028)	(0.028)
$SKILL_{i(t-1)}$	0.011	0.010	0.012	0.011	0.010	0.009
	(0.035)	(0.035)	(0.034)	(0.035)	(0.035)	(0.035)
$TRAIN_{i(t-1)}$	0.032	0.032	0.032	0.032	0.038	0.039
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
$RDPRODUCT_{i(t-1)}$	0.074*		0.072*		0.078**	
	(0.038)		(0.037)		(0.037)	
$RDPROCESS_{i(t-1)}$		0.078		0.077		0.084
		(0.057)		(0.057)		(0.057)
$BKKM$	0.116	0.116	0.115	0.115	0.113	0.113
	(0.071)	(0.070)	(0.071)	(0.071)	(0.070)	(0.069)
$CENTRAL$	0.074	0.074	0.071	0.071	0.072	0.072
	(0.094)	(0.094)	(0.094)	(0.094)	(0.093)	(0.093)
$EAST$	0.066	0.065	0.064	0.064	0.062	0.062
	(0.082)	(0.081)	(0.082)	(0.081)	(0.081)	(0.080)
$NORTH$	0.103	0.102	0.106	0.105	0.107	0.106
	(0.072)	(0.072)	(0.074)	(0.074)	(0.073)	(0.072)
$SOUTH$	0.163***	0.161***	0.163***	0.161***	0.163***	0.162***
	(0.060)	(0.060)	(0.059)	(0.059)	(0.058)	(0.058)
Observations	9049	9049	9049	9049	9049	9049

Notes: Robust clustered standard errors in parentheses. Time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2E.5: The Model for a Firm's Decision to Export with $FOREIGN50$, $SMALL^A$, $LARGE^A$ and $VLARGE^A$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.916***	0.916***	0.916***	0.916***	0.917***	0.917***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$FOREIGN50_{i(t-1)}$	0.127***	0.126***	0.129***	0.129***	0.125***	0.125***
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
$TFP^{LP}_{i(t-1)}$	0.050***	0.050***				
	(0.011)	(0.011)				
$TFP^{BUETTNER}_{i(t-1)}$			0.043**	0.043**		
			(0.017)	(0.017)		
$TFP^{LABPROD}_{i(t-1)}$					0.023	0.023
					(0.015)	(0.015)
$SMALL^A_{i(t-1)}$	-0.077***	-0.077***	-0.070**	-0.069**	-0.085***	-0.085***
	(0.027)	(0.026)	(0.028)	(0.027)	(0.026)	(0.026)
$LARGE^A_{i(t-1)}$	0.077**	0.079**	0.074**	0.076**	0.087***	0.089***
	(0.032)	(0.032)	(0.034)	(0.034)	(0.031)	(0.030)
$VLARGE^A_{i(t-1)}$	0.127***	0.128***	0.122**	0.123**	0.155***	0.157***
	(0.048)	(0.048)	(0.057)	(0.057)	(0.047)	(0.047)
$wage_{i(t-1)}$	0.010	0.010	0.014	0.013	0.031	0.032
	(0.029)	(0.029)	(0.028)	(0.028)	(0.028)	(0.029)
$SKILL_{i(t-1)}$	0.012	0.011	0.014	0.013	0.011	0.010
	(0.034)	(0.035)	(0.034)	(0.035)	(0.035)	(0.035)
$TRAIN_{i(t-1)}$	0.033	0.033	0.033	0.033	0.039	0.040
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
$RDPRODUCT_{i(t-1)}$	0.078**		0.076**		0.082**	
	(0.039)		(0.037)		(0.038)	
$RDPROCESS_{i(t-1)}$		0.083		0.082		0.089
		(0.058)		(0.057)		(0.057)
$BKKM$	0.121*	0.121*	0.121*	0.121*	0.119*	0.118*
	(0.071)	(0.070)	(0.071)	(0.071)	(0.070)	(0.069)
$CENTRAL$	0.072	0.072	0.069	0.069	0.070	0.070
	(0.096)	(0.096)	(0.097)	(0.096)	(0.095)	(0.095)
$EAST$	0.067	0.067	0.065	0.065	0.064	0.063
	(0.082)	(0.081)	(0.082)	(0.082)	(0.081)	(0.080)
$NORTH$	0.105	0.104	0.109	0.108	0.110	0.109
	(0.073)	(0.072)	(0.074)	(0.074)	(0.073)	(0.072)
$SOUTH$	0.160***	0.159***	0.160***	0.159***	0.161***	0.159***
	(0.059)	(0.058)	(0.058)	(0.058)	(0.057)	(0.057)
Observations	9049	9049	9049	9049	9049	9049

Notes: Robust clustered standard errors in parentheses. Time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

2E.2 The Model for Country of Origin and a Firm's Decision to Export

2E.2.1 Classified Size by Total Labour

Table 2E.6: The Model for Country of Origin and a Firm's Decision to Export with, *SMALL*, *LARGE* and *VLARGE* at 25% Cut-off Point for Foreign Ownership

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.914***	0.914***	0.914***	0.914***	0.914***	0.914***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$TFP^{LP}_{i(t-1)}$	0.032***	0.032***				
	(0.012)	(0.012)				
$TFP^{BUETTNER}_{i(t-1)}$			0.030*	0.030*		
			(0.016)	(0.016)		
$TFP^{LABPROD}_{i(t-1)}$					0.037***	0.036***
					(0.013)	(0.013)
$SMALL_{i(t-1)}$	-0.102***	-0.102***	-0.099***	-0.099***	-0.110***	-0.110***
	(0.023)	(0.023)	(0.025)	(0.025)	(0.022)	(0.022)
$LARGE_{i(t-1)}$	0.107***	0.108***	0.106***	0.106***	0.115***	0.115***
	(0.030)	(0.030)	(0.031)	(0.030)	(0.029)	(0.028)
$VLARGE_{i(t-1)}$	0.153***	0.154***	0.151***	0.151***	0.169***	0.170***
	(0.037)	(0.037)	(0.040)	(0.040)	(0.032)	(0.032)
$wage_{i(t-1)}$	0.042	0.042	0.040	0.040	0.033	0.033
	(0.030)	(0.030)	(0.029)	(0.029)	(0.028)	(0.028)
$SKILL_{i(t-1)}$	0.023	0.022	0.025	0.024	0.023	0.022
	(0.036)	(0.036)	(0.035)	(0.036)	(0.036)	(0.036)
$TRAIN_{i(t-1)}$	0.015	0.015	0.014	0.014	0.015	0.015
	(0.036)	(0.036)	(0.037)	(0.037)	(0.037)	(0.037)
$RDPRODUCT_{i(t-1)}$	0.068*		0.065*		0.067*	
	(0.038)		(0.037)		(0.037)	
$RDPROCESS_{i(t-1)}$		0.073		0.070		0.071
		(0.057)		(0.056)		(0.058)
$CHINA_{i(t-1)}$	0.081	0.080	0.080	0.079	0.079	0.079
	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)
$EU_{i(t-1)}$	0.059	0.062	0.058	0.060	0.056	0.058
	(0.096)	(0.096)	(0.096)	(0.096)	(0.095)	(0.095)
$JAPAN_{i(t-1)}$	0.105*	0.106*	0.104*	0.105*	0.104*	0.104*
	(0.055)	(0.055)	(0.055)	(0.054)	(0.055)	(0.054)
$KOREA_{i(t-1)}$	-0.046	-0.045	-0.052	-0.050	-0.046	-0.044
	(0.066)	(0.065)	(0.065)	(0.064)	(0.065)	(0.064)
$MALAYSIA_{i(t-1)}$	0.139*	0.138*	0.142*	0.140*	0.138*	0.136*
	(0.080)	(0.080)	(0.079)	(0.079)	(0.079)	(0.079)
$NONEU_{i(t-1)}$	0.082	0.083	0.085	0.086	0.085	0.086
	(0.133)	(0.133)	(0.131)	(0.132)	(0.131)	(0.131)
$OTHER_{i(t-1)}$	0.056	0.055	0.054	0.054	0.054	0.053
	(0.104)	(0.104)	(0.104)	(0.104)	(0.105)	(0.105)
$AUSCAN_{i(t-1)}$	0.150	0.149	0.147	0.146	0.150	0.150
	(0.102)	(0.103)	(0.101)	(0.101)	(0.101)	(0.101)
$SOUTHASIA_{i(t-1)}$	0.088	0.090	0.091	0.092	0.090	0.092
	(0.100)	(0.100)	(0.098)	(0.098)	(0.099)	(0.099)
$SEASIA_{i(t-1)}$	-0.192**	-0.188*	-0.193**	-0.188*	-0.192**	-0.188*
	(0.097)	(0.099)	(0.097)	(0.100)	(0.098)	(0.100)
$SINGAPORE_{i(t-1)}$	0.054	0.053	0.062	0.061	0.053	0.052
	(0.065)	(0.064)	(0.072)	(0.072)	(0.066)	(0.066)
$UK_{i(t-1)}$	0.126**	0.124**	0.124**	0.122**	0.123**	0.121**
	(0.060)	(0.060)	(0.061)	(0.061)	(0.060)	(0.060)
$US_{i(t-1)}$	0.176***	0.176***	0.176***	0.176***	0.177***	0.177***
	(0.046)	(0.046)	(0.047)	(0.046)	(0.047)	(0.046)
Observations	9049	9049	9049	9049	9049	9049

Notes: Robust clustered standard errors in parentheses. Region, time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

2E.2.2 Classified Size by Total Fixed Assets

Table 2E.7: The Model for Country of Origin and a Firm's Decision to Export with, $SMALL^A$, $LARGE^A$ and $VLARGE^A$ at 10% Cut-off Point for Foreign Ownership

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.916***	0.916***	0.916***	0.916***	0.917***	0.917***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$TFP^{LP}_{i(t-1)}$	0.047***	0.047***				
	(0.010)	(0.010)				
$TFP^{BUETTNER}_{i(t-1)}$			0.039**	0.039**		
			(0.017)	(0.017)		
$TFP^{LABPROD}_{i(t-1)}$					0.020	0.019
					(0.014)	(0.014)
$SMALL^A_{i(t-1)}$	-0.075***	-0.075***	-0.068**	-0.068**	-0.082***	-0.082***
	(0.026)	(0.026)	(0.027)	(0.027)	(0.026)	(0.026)
$LARGE^A_{i(t-1)}$	0.079**	0.081**	0.077**	0.078**	0.089***	0.090***
	(0.032)	(0.032)	(0.034)	(0.034)	(0.031)	(0.031)
$VLARGE^A_{i(t-1)}$	0.130***	0.131***	0.126**	0.127**	0.158***	0.159***
	(0.047)	(0.047)	(0.056)	(0.056)	(0.046)	(0.046)
$wage_{i(t-1)}$	0.009	0.009	0.014	0.014	0.031	0.032
	(0.029)	(0.029)	(0.028)	(0.028)	(0.029)	(0.029)
$SKILL_{i(t-1)}$	0.009	0.008	0.011	0.010	0.008	0.007
	(0.036)	(0.036)	(0.035)	(0.036)	(0.036)	(0.036)
$TRAIN_{i(t-1)}$	0.031	0.031	0.031	0.032	0.038	0.038
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
$RDPRODUCT_{i(t-1)}$	0.072*		0.070*		0.076**	
	(0.038)		(0.037)		(0.037)	
$RDPROCESS_{i(t-1)}$		0.077		0.076		0.083
		(0.058)		(0.057)		(0.057)
$CHINA_{i(t-1)}$	0.046	0.045	0.045	0.044	0.044	0.043
	(0.045)	(0.045)	(0.044)	(0.045)	(0.044)	(0.044)
$EU_{i(t-1)}$	0.022	0.022	0.018	0.019	0.022	0.022
	(0.074)	(0.073)	(0.074)	(0.074)	(0.072)	(0.072)
$JAPAN_{i(t-1)}$	0.096*	0.097*	0.097*	0.097*	0.098*	0.099**
	(0.053)	(0.052)	(0.052)	(0.052)	(0.051)	(0.050)
$KOREA_{i(t-1)}$	-0.113	-0.113	-0.114	-0.113*	-0.103	-0.103
	(0.075)	(0.074)	(0.069)	(0.069)	(0.071)	(0.070)
$MALAYSIA_{i(t-1)}$	0.196	0.195	0.199*	0.198	0.199	0.198
	(0.124)	(0.124)	(0.121)	(0.121)	(0.123)	(0.124)
$NONEU_{i(t-1)}$	0.085	0.087	0.094	0.095	0.107	0.108
	(0.129)	(0.129)	(0.127)	(0.127)	(0.130)	(0.130)
$OTHER_{i(t-1)}$	0.084	0.084	0.081	0.080	0.069	0.068
	(0.104)	(0.103)	(0.105)	(0.105)	(0.109)	(0.108)
$AUSCAN_{i(t-1)}$	0.172*	0.172*	0.167*	0.167*	0.168*	0.168*
	(0.090)	(0.090)	(0.088)	(0.088)	(0.086)	(0.086)
$SOUTHASIA_{i(t-1)}$	-0.023	-0.022	-0.010	-0.008	0.000	0.001
	(0.043)	(0.043)	(0.041)	(0.041)	(0.038)	(0.038)
$SEASIA_{i(t-1)}$	-0.175*	-0.170*	-0.175*	-0.171*	-0.183**	-0.179*
	(0.092)	(0.095)	(0.092)	(0.094)	(0.091)	(0.092)
$SINGAPORE_{i(t-1)}$	0.027	0.026	0.036	0.035	0.028	0.027
	(0.064)	(0.064)	(0.072)	(0.072)	(0.062)	(0.062)
$UK_{i(t-1)}$	0.113**	0.112**	0.113**	0.113**	0.121**	0.121**
	(0.053)	(0.053)	(0.054)	(0.054)	(0.051)	(0.051)
$US_{i(t-1)}$	0.124**	0.126**	0.122**	0.124**	0.126**	0.128**
	(0.053)	(0.053)	(0.054)	(0.053)	(0.055)	(0.054)
Observations	9049	9049	9049	9049	9049	9049

Notes: Robust clustered standard errors in parentheses. Region, time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2E.8: The Model for Country of Origin and a Firm's Decision to Export with, $SMALL^A$, $LARGE^A$ and $VLARGE^A$ at 25% Cut-off Point for Foreign Ownership

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.916***	0.916***	0.916***	0.916***	0.917***	0.917***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$TFP^{LP}_{i(t-1)}$	0.048***	0.047***				
	(0.011)	(0.011)				
$TFP^{BUETTNER}_{i(t-1)}$			0.040**	0.040**		
			(0.017)	(0.017)		
$TFP^{LABPROD}_{i(t-1)}$					0.020	0.020
					(0.014)	(0.014)
$SMALL^A_{i(t-1)}$	-0.077***	-0.077***	-0.070**	-0.070**	-0.085***	-0.085***
	(0.027)	(0.026)	(0.028)	(0.028)	(0.027)	(0.026)
$LARGE^A_{i(t-1)}$	0.080**	0.081**	0.077**	0.078**	0.089***	0.090***
	(0.032)	(0.032)	(0.035)	(0.035)	(0.031)	(0.031)
$VLARGE^A_{i(t-1)}$	0.129***	0.130***	0.125**	0.126**	0.157***	0.158***
	(0.048)	(0.048)	(0.057)	(0.057)	(0.047)	(0.047)
$wage_{i(t-1)}$	0.006	0.006	0.011	0.010	0.028	0.028
	(0.028)	(0.028)	(0.027)	(0.027)	(0.028)	(0.028)
$SKILL_{i(t-1)}$	0.011	0.010	0.012	0.011	0.010	0.009
	(0.035)	(0.035)	(0.035)	(0.035)	(0.036)	(0.036)
$TRAIN_{i(t-1)}$	0.032	0.032	0.032	0.032	0.038	0.039
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
$RDPRODUCT_{i(t-1)}$	0.071*		0.069*		0.075**	
	(0.038)		(0.037)		(0.037)	
$RDPROCESS_{i(t-1)}$		0.075		0.074		0.081
		(0.057)		(0.057)		(0.057)
$CHINA_{i(t-1)}$	0.075	0.074	0.073	0.073	0.072	0.071
	(0.052)	(0.052)	(0.052)	(0.052)	(0.051)	(0.051)
$EU_{i(t-1)}$	0.039	0.040	0.037	0.038	0.040	0.041
	(0.087)	(0.086)	(0.087)	(0.086)	(0.086)	(0.085)
$JAPAN_{i(t-1)}$	0.100*	0.101*	0.101*	0.101*	0.101**	0.101**
	(0.053)	(0.052)	(0.052)	(0.052)	(0.051)	(0.050)
$KOREA_{i(t-1)}$	-0.027	-0.026	-0.035	-0.034	-0.028	-0.028
	(0.065)	(0.064)	(0.064)	(0.063)	(0.064)	(0.063)
$MALAYSIA_{i(t-1)}$	0.120	0.118	0.127	0.125	0.121	0.119
	(0.087)	(0.087)	(0.088)	(0.087)	(0.085)	(0.085)
$NONEU_{i(t-1)}$	0.088	0.090	0.097	0.098	0.109	0.111
	(0.127)	(0.127)	(0.125)	(0.126)	(0.128)	(0.128)
$OTHER_{i(t-1)}$	0.085	0.084	0.081	0.081	0.067	0.066
	(0.102)	(0.102)	(0.104)	(0.104)	(0.108)	(0.107)
$AUSCAN_{i(t-1)}$	0.157*	0.157*	0.153*	0.153*	0.154*	0.154*
	(0.092)	(0.092)	(0.090)	(0.090)	(0.088)	(0.088)
$SOUTHASIA_{i(t-1)}$	0.116	0.118	0.121	0.122	0.124	0.126
	(0.094)	(0.094)	(0.092)	(0.092)	(0.089)	(0.089)
$SEASIA_{i(t-1)}$	-0.169*	-0.164*	-0.170*	-0.165*	-0.178*	-0.174*
	(0.095)	(0.097)	(0.095)	(0.097)	(0.093)	(0.095)
$SINGAPORE_{i(t-1)}$	0.040	0.039	0.050	0.050	0.040	0.039
	(0.066)	(0.065)	(0.075)	(0.075)	(0.064)	(0.064)
$UK_{i(t-1)}$	0.118**	0.116**	0.118**	0.117**	0.127**	0.125**
	(0.055)	(0.056)	(0.056)	(0.056)	(0.053)	(0.054)
$US_{i(t-1)}$	0.174***	0.175***	0.175***	0.175***	0.175***	0.175***
	(0.049)	(0.049)	(0.049)	(0.049)	(0.050)	(0.050)
Observations	9049	9049	9049	9049	9049	9049

Notes: Robust clustered standard errors in parentheses. Region, time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2E.9: The Model for Country of Origin and a Firm's Decision to Export with, $SMALL^A$, $LARGE^A$ and $VLARGE^A$ at 50% Cut-off Point for Foreign Ownership

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.916***	0.916***	0.916***	0.916***	0.917***	0.917***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$TFP^{LP}_{i(t-1)}$	0.051***	0.050***				
	(0.010)	(0.010)				
$TFP^{BUETTNER}_{i(t-1)}$			0.045***	0.044***		
			(0.016)	(0.016)		
$TFP^{LABPROD}_{i(t-1)}$					0.024*	0.023
					(0.014)	(0.014)
$SMALL^A_{i(t-1)}$	-0.077***	-0.077***	-0.069**	-0.069**	-0.085***	-0.085***
	(0.026)	(0.026)	(0.027)	(0.027)	(0.026)	(0.026)
$LARGE^A_{i(t-1)}$	0.076**	0.078**	0.073**	0.074**	0.086***	0.088***
	(0.032)	(0.032)	(0.034)	(0.034)	(0.031)	(0.031)
$VLARGE^A_{i(t-1)}$	0.126***	0.127***	0.120**	0.121**	0.155***	0.157***
	(0.048)	(0.048)	(0.056)	(0.056)	(0.047)	(0.047)
$wage_{i(t-1)}$	0.010	0.010	0.013	0.013	0.032	0.033
	(0.029)	(0.030)	(0.027)	(0.027)	(0.029)	(0.029)
$SKILL_{i(t-1)}$	0.015	0.014	0.016	0.015	0.013	0.012
	(0.036)	(0.036)	(0.035)	(0.036)	(0.036)	(0.036)
$TRAIN_{i(t-1)}$	0.033	0.033	0.033	0.033	0.040	0.040
	(0.034)	(0.034)	(0.035)	(0.035)	(0.035)	(0.035)
$RDPRODUCT_{i(t-1)}$	0.079**		0.076**		0.083**	
	(0.038)		(0.037)		(0.037)	
$RDPROCESS_{i(t-1)}$		0.083		0.082		0.089
		(0.058)		(0.057)		(0.057)
$CHINA_{i(t-1)}$	0.177**	0.177**	0.174**	0.174**	0.171**	0.171**
	(0.076)	(0.076)	(0.075)	(0.075)	(0.075)	(0.076)
$EU_{i(t-1)}$	0.110	0.111	0.109	0.110	0.110	0.112
	(0.113)	(0.112)	(0.112)	(0.111)	(0.111)	(0.111)
$JAPAN_{i(t-1)}$	0.139***	0.139***	0.141***	0.140***	0.138***	0.138***
	(0.040)	(0.039)	(0.039)	(0.039)	(0.039)	(0.038)
$KOREA_{i(t-1)}$	-0.030	-0.029	-0.041	-0.040	-0.037	-0.036
	(0.077)	(0.076)	(0.074)	(0.073)	(0.073)	(0.072)
$MALAYSIA_{i(t-1)}$	-0.092	-0.094	-0.084	-0.085	-0.094	-0.096
	(0.082)	(0.081)	(0.078)	(0.077)	(0.083)	(0.082)
$NONEU_{i(t-1)}$	-0.016	-0.013	-0.007	-0.004	0.002	0.005
	(0.078)	(0.079)	(0.075)	(0.077)	(0.075)	(0.076)
$OTHER_{i(t-1)}$	-0.028	-0.029	-0.034	-0.035	-0.057	-0.058
	(0.080)	(0.081)	(0.081)	(0.081)	(0.084)	(0.085)
$AUSCAN_{i(t-1)}$						
$SOUTHASIA_{i(t-1)}$	0.002	0.002	0.004	0.004	0.010	0.010
	(0.077)	(0.077)	(0.077)	(0.077)	(0.076)	(0.075)
$SEASIA_{i(t-1)}$						
$SINGAPORE_{i(t-1)}$	0.198***	0.195***	0.237***	0.235***	0.188***	0.186***
	(0.047)	(0.047)	(0.063)	(0.064)	(0.049)	(0.049)
$UK_{i(t-1)}$	0.101	0.099	0.102	0.100	0.102	0.099
	(0.075)	(0.075)	(0.075)	(0.076)	(0.075)	(0.076)
$US_{i(t-1)}$	0.152***	0.152***	0.150***	0.150***	0.148***	0.149***
	(0.054)	(0.054)	(0.053)	(0.053)	(0.057)	(0.057)
Observations	9049	9049	9049	9049	9049	9049

Notes: Robust clustered standard errors in parentheses. Region, time and three-digit industry dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

3

Exporting and Financial Health

3.1 Introduction

Export promotion policies are adapted by both developed and developing countries as a means to encourage growth through trade. Many studies have tried to investigate and answer the question of whether firms should self-select into export markets or not. However, in practice we observe that not every firm exports, perhaps because firms have different specific characteristics and performances. As a result, it can be concluded that the entry decision to export is determined by various factors (see e.g. Roberts and Tybout 1997, Bernard and Jensen 1999, 2004, Kimura and Kiyota 2006). The majority of studies have concentrated on developed rather than developing countries. Recently, developing countries, especially the NICs, have managed to grow rapidly through an openness to trade strategy (World Bank 1993, and Edwards 1993 and 1998). It is therefore interesting to focus on the factors that influence the export strategies of developing countries.

For the new Asian Tigers (Malaysia, Thailand, the Philippines, and Indonesia), there are a limited number of studies that examine export activities and the probability of exporting (see e.g. Hallward-Driemeier *et al.* 2002 for East Asia, Sjöholm 2003, Blalock and Gertler 2004, Blalock and Roy 2007 for Indonesia). Some studies try to answer whether exporters become good firms by investigating the effect on productivity after firms export. For evidence of learning-by-exporting, productivity or output or both should increase after firms export (see for example Clerides *et al.* 1998, Van Biesebroeck 2005, Alvarez and López 2005, Kimura and Kiyota 2006).

Apart from firm-specific characteristics, sunk entry costs are considered to be one of the important factors that determine the decision to enter export markets due to the fact that sunk entry costs are arguably a barrier to the entry (Cabral and Ross, 2008). Melitz (2003) also argues that firms must pay the variable and sunk entry costs of exporting in order to enter export markets. Such costs that are faced by firms prior to export are considered as a form of investment. However, because of imperfect capital markets, firms are likely to face credit constraints. Therefore, the investment decision arguably depends upon internal finance. Thus, one may argue that the financial balance sheet and financial variables will have a significant impact on the capability of firms' investment.

From a developed countries perspective, Greenaway *et al.* (2007) investigate the relationship between financial factors and firms' investment in the UK. However, the nature of developed countries is different from developing countries, for example they may have different stages of financial market development or financial sector reform. Since financial markets are the sources to obtain external funding for investment, we can therefore assume that the investment behaviour of firms and the factors affecting the probably of exporting are likely to be different in countries with different levels of development. In addition, if we consider the relationship between the structure of ownership and access to funding, domestic firms may face some

obstacles to obtain external funding as they rely only on borrowing from domestic financial markets. In contrast, foreign-owned firms are less likely to face a credit constraint problem because they are typically large and tend to receive support from their parent company.

This chapter is an extension of Chapter two where we emphasise on how the financial health of a firm relates to its export decision. We re-examine the factors that affect a firm's entry decision into export markets using the same data set. The model in Chapter two is extended by including financial variables in our estimations because they indicate a firm's ability to invest in order to enter and operate in export markets. We assume that the financial balance sheet and investment are linked. Different specific characteristics such as the structure of ownership, productivity, wage, firm size, etc. are also included in our estimations. In addition, we investigate factors affecting the entry decision into export markets of different sub-samples according to the structure of ownership. Once a firm participates in exporting, we further examine how various factors affect the export intensity.

We find that the entry decision into export markets depends upon various factors that are consistent with results in Chapter two. Foreign ownership positively affects a firm's decision to enter export markets. Large firms are more likely to export compared to small firms. Productivity also increases the probability of exporting. Most importantly for this chapter, the financial health of a firm is found to have a significant effect on the decision to export. Firms that have a high liquidity ratio are more likely to become exporters. In contrast, if we measure firm's financial health by the leverage ratio, high leveraged firms are less likely to export. After firms export, we find some evidence that financial health affects their export intensity. Other firm characteristics also determine the elasticity of export sales. These findings for Thailand are potentially important for government policy not only in the implementation of entry-promotion

and export promotion policies but also in signalling about the financial market development and the importance of financial sector reform.

The remainder of this chapter is organised as follows. Section 3.2 summarises the theoretical and empirical literature. Section 3.3 outlines and discusses the empirical model, variables and data. Section 3.4 provides the discussion of the estimated results. Section 3.5 concludes.

3.2 Literature Review

3.2.1 Firm Characteristics and the Decision to Export

As discussed in Chapter two, a firm's decision to export is determined by a number of factors. Theoretically, Roberts and Tybout (1997) explain the model of export market participation as firstly each firm *i* has to maximise its revenue subject to the current information available to firm *i*. The current profit function $(\hat{\pi}_{it})$ therefore is a combination of the current revenue (R_{it}) and the difference in the expected value of maximise revenue if a firm exports and if not.

Once a firm is able to indentify its expected profit and revenue then a firm can decide whether or not to enter the export market or even decide to exit conditional upon Equation (2.4) in Chapter two where firm *i* at time *t* chooses to export if the expected gross profit and revenue $(\hat{\pi}_{it})$ is greater than the current period cost (c_{it}) together with sunk entry costs (S_i). Roberts and Tybout (1997) point out that a firm's export decision not only depends upon its profit and revenue but also depends upon differences in firm characteristics (Z_{it}). Therefore, the estimated model can be specified as Equation (2.5) in Chapter two.

In the empirical analysis, Roberts and Tybout (1997) use data for Columbian firms from 1981 to 1989. They include sunk entry costs and firm characteristics such as wage, firm size, age, etc. in a vector Z. Sunk entry costs are positive and significantly determine a firm's decision to export in Columbia. Large firms and old firms are more likely to become exporters. Such findings lead to the implication of entry-promotion policies which reduce the entry costs faced by firms.

Many empirical studies are based on the framework of Roberts and Tybout (1997) and extend the model to investigate firm-level characteristics and other factors that would influence the export decision in both developed and developing countries (see for instance, the US (Bernard and Jensen 1999, 2004); the UK (Greenaway and Kneller 2004, Kneller and Pisu 2004); Germany (Bernard and Wagner 2001); Spain (Fariñas and Martín-Marcos 2007); Taiwan (Aw *et al.* 2000, 2007); Japan (Kimura and Kiyota 2006)). López (2005), Wagner (2007), and Greenaway and Kneller (2007) present detailed surveys of the empirical literature on exporting and firm heterogeneity.

Bernard and Jensen (1999 and 2004) try to identify factors that affect the probability of becoming an exporter using US manufacturing firm-level data. Various firm characteristics such as firm size, productivity, wage, etc. are included. All independent variables are lagged by one year in order to avoid possible simultaneity problems. One and two years lagged are used as proxies for sunk entry costs. Both studies found that past export experience or sunk entry costs have positive and significant effects on a firm's entry decision. Similar positive and significant results are also found for the coefficients of firm size, productivity wage and product changed. Bernard and Jensen (2004) include additional factors such as structure of ownership (foreign owned or domestic owned), government subsidies and spillovers. Being foreign owned increases the probability of exporting. Spillover effects from export activities are negligible. Export promotion subsidies have no impact on the probability of exporting.

Greenaway and Kneller (2004) also perform an empirical analysis of the determinant of a firm's decision to export in the UK. Other than firm characteristics, they include additional factors capturing industrial and geographical agglomeration in the model. The results for sunk entry costs, firm size, productivity and wage are consistent with the findings of the US with positive and significant coefficients. Industrial and geographical agglomerations also influence the entry decision. Kneller and Pisu (2004) extend the decision to export model by emphasising the importance of structure of ownership and origin of ownership. Foreign-owned firms are more likely to export. The positive significance of some origins suggests that the findings are consistent with the export-platform FDI hypothesis.

Another UK study by Girma *et al.* (2004) applies matching and difference-in-differences techniques to investigate the link between exporting and firm performances. Girma *et al.* (2004) find that exporters and non-exporters typically differ in size and productivity. Exporters are larger and more productive than non-exporters. They also find evidence to support the hypothesis that firms self-select into export markets and learn by exporting whereas productive firms are more likely to export and their productivity tends to be further increased after firms export. Greenaway *et al.* (2005), and Arnold and Hussinger (2005) also employ similar techniques to Girma *et al.* (2004) to examine exporting and firm performance in Sweden and Germany, respectively. For Sweden, there is no evidence of learning-by-exporting since productivity pre- and post-entry do not differ. For Germany, Arnold and Hussinger (2005) find that more productive firms self-select into export markets. This evidence supports the self-selection hypothesis which is consistent with the findings in the previous studies of German firms by Bernard and Wagner (1997 and 2001). However, firm productivity does not improve after the entry into export markets (Arnold and Hussinger, 2005).

Kimura and Kiyota (2006) employ a random probit model to identify factors that affect the decision to export and to engage in FDI in Japan between 1994 and 2000. They find that the coefficient for sunk entry costs, FDI dummy, foreign ownership dummy, TFP, firm size and R&D are all positive and significant. These findings support the statement that good firms become exporters.

Delgado *et al.* (2002) examine firm productivity and exporting of the Spanish manufacturing firms. Their results support the hypothesis that highly-productive firms self-select into export markets. A recent study of Spanish firms by Fariñas and Martín-Marcos (2007) find that exporters differ from non-exporters in size, productivity, wages and innovation. They find evidence of firms self-selecting into, and out of, export markets.

Campa (2004) investigates the relationship between the fluctuation of exchange rates and a country's trade balances. The rise and fall in exchange rates affect a country's trade balance through the export and import behaviour of individual firms. Campa (2004) examines Spanish manufacturing firms to explain the relationship between the changes in exchange rates and the export participation of each firm for the entry decision and the level of output exported. Sunk costs are found to be one of the important factors determining the entry into or exit from export markets. However, the results show that sunk costs are not related to the exchange rate. As the exchange rate changes, only the volume of output alters, meaning firms respond to the changes by adjusting quantities of exports rather than number of exporting firms (Campa, 2004).

For studies on developing countries, Alvarez and López (2005) test the existence of both the self-selection and the learning-by-exporting hypothesis using Chilean plants. Productivity, firm size, foreign capital, foreign licences, ratio of skill labours, age and investment are significant factors that affect the probability of beginning to export. Apart from age, all variables are more likely to increase the probability of beginning to export. Such findings support the self-selection

hypothesis. In addition, Alvarez and López (2005) also find the evidence of learning-by-exporting for the new entrants where productivity is further increased after firms export.

Blalock and Roy (2007) emphasise the effect of the financial crisis on the export behaviour of Indonesian firms. They find that the rate of entry into and exit from export markets increased significantly. The financial crisis and the devaluation of the Indonesian currency had an effect on firms' liquidity constraints so some exporters may have chosen to exit the market. In the mean time, some firms may find the depreciation of the exchange rate to be profitable and therefore decide to enter the export markets. Foreign-owned firms in the pre-crisis that invested in R&D and training were more likely to continue exporting. Surprisingly, the productivity in the pre-crisis period has no impact on the decision to continue exporting.

In summary, heterogeneous firms have different specific characteristics hence the decision of each firm to enter export markets is different. Various factors are used to examine a firm's entry decision into export markets. The results for both developed and developing countries are broadly consistent with sunk entry costs, productivity, structure of ownership, size, etc. being important factors in determining the entry decision. Next, we provide a summary of the literature emphasising financial factors and explain how they are linked to investment and exporting.

3.2.2 Firm-Level Investment and Financial Constraints

A numbers of financial constraints or financial variables have been studied and investigated with regard to their links with different types of a firm's investment such as fixed investment and inventory investment. In the case of imperfect capital markets, it is difficult for financially constrained firms to obtain external sources of funds. Therefore, investment should depend

positively on internal finance especially liquid assets such as cash flow. Inventory investment is arguably more sensitive to financial variables than fixed investment because of its high liquidity and can be adjusted more easily at low costs (Carpenter *et al.* 1994 and Guariglia and Mateut 2005). For that reason, recent studies place more emphasis on the relationship between inventory investment and financial constraints.

Bond and Meghir (1994) investigate the importance of a firm's investment that relates to the accessibility of internal funds in the UK. The assumption of the hierarchy of the finance model is different from the standard neoclassical model because it assumes that an investment funded by internal finance costs less than using external sources of funds. An empirical result from an estimation of dynamic investment models using GMM estimation technique reveals that a firm's investment in the UK is sensitive to internal funds (Bond and Meghir 1994).

Many empirical studies have found that cash flow only proxies the shift in demand for investment but does not sufficiently capture financial constraints. Fazzari and Petersen (1993) try to fill in the gap by emphasising the role of working capital as a measure of liquidity in order to investigate the effect of financial constraints on fixed investment. They found evidence that working capital investment is sensitive to fluctuations in cash flow. Therefore, when firms face financial constraints, they tend to use working capital as a source of funds to smooth fixed investment relative to cash-flow shocks (Fazzari and Petersen 1993).

Rather than focus only on the explanation of fixed investment, a few studies have tried to examine the effect of internal finance on inventory investment. Kashyap *et al.* (1994) try to explain the movement of inventory investment particularly during the tight monetary policy period (1981-1982) in the US. They found evidence that financial factors affected the change in inventory investment within firms.

Similar results are found in the study of Carpenter *et al.* (1994) using quarterly panel data of US manufacturing firms. They explain that the fluctuation of internal finance has a direct impact on inventory investment. Because of imperfect capital markets, the shock in internal finance leads to an adjustment in investment (Carpenter *et al.* 1994 and Hubbard 1998). Carpenter *et al.* (1994) found that fixed investment of financially constrained firms decreases proportionally less than a reduction in inventory investment because inventory investment can be adjusted at lower cost relative to others.

Guariglia (1999) also finds a significant relationship between internal finance and inventory investment in the UK. During recessions, financial constrained firms tend to suffer more and therefore reduce their inventory investment especially of work-in-process and raw material inventories. In addition, Guariglia and Mateut (2005) employ augmented error-correction inventory investment equations to examine the evidence of financial constraints, firm's investment and global engagement status in the UK using micro-level panel data between 1993 and 2003. They found that inventory investment is significantly affected by financial variables of which the level of the effect depends upon the possibility of facing financial constraints. If firms participate in global activities, they are less likely to face financial constraints problems as they have greater access to both domestic and international financial markets. Therefore, the inventory investment of those firms is less sensitive to financial variables than is the case for domestic firms. The findings from the study of Guariglia and Mateut (2005) suggest that trade openness is good for a country because trade helps to reduce the level of financial constraints faced by firms and stimulates investment.

In other European countries, Vermeulen (2002) investigates the relationship of financial accelerator and investment using data for Germany, France, Italy and Spain between 1983 and 1997. The evidence shows that a financial accelerator affects a firm's investment spending.

Financial health and firm size also matter such that the investment spending of small firms that have a weak balance sheet is affected the most. Another European study by Konings *et al.* (2003) examines the link between investment and financial constraints in transition economies, Poland, the Czech Republic, Bulgaria and Romania from 1994 to 1999. Firms' investment decisions in Poland and the Czech Republic are more sensitive to internal finance constraints than in Bulgaria and Romania. This can be explained by the soft budget constraints that occur in the two least advanced transition economies, Bulgaria and Romania, which means that firms in these two countries cannot operate under liquidity constraints conditions (Konings *et al.* 2003).

Bond *et al.* (2003) use financial factors to explain a firm's investment behaviour in Belgium, France, Germany and the UK with the aim to distinguish whether different financial systems in each country have different impacts on financial constraints and investment. For UK firms, internal finance seems to be an important source of investment. If the desired investment could not be funded by internal finance, firms are likely to face investment constraints. Such a finding is clearly explained by the structure of the market-oriented financial system in the UK, which does not perform very well in channelling investment funds compared to the continental European financial system.

Harrison and McMillan (2003) examine the Ivory Coast's direct foreign investment and domestic credit constraints by using an augmented Euler investment model that includes the proxies for financial distress, i.e. debt to asset ratio and the interest coverage ratio. Since domestic credit constraints are one of the obstacles for future investment of firms, the inflow of direct foreign investment would alleviate domestic credit constraints. The finding from the Ivory Coast suggests that overall domestic firms suffer more from the domestic credit constraints than foreign firms. In addition, Harrison and McMillan (2003) split the sample into

public and private firms. For domestic public firms, the investment decisions do not depend upon the debt to asset ratio and interest coverage. However, for domestic private firms, their investment decisions are more likely to be affected by credit constraints compared to foreign firms.

In summary, there are a growing number of studies that examine the impact of financial factors on investment decisions. Based on the assumption of imperfect capital markets, some firms may face obstacles to external finance. Therefore, their investment decision depends upon the internal finance or financial health of firms. Empirical results from the literature support the hypothesis that investment such as inventory and fixed investment is sensitive to internal finance. In the next sub-section, we summarise the literature that studies the relationship between financial factors and a firm's investment in sunk entry costs and variable costs in order to start exporting and to remain in the export markets.

3.2.3 Financial Factors and Firm's Export Behaviour

In order to enter export markets, a firm faces a form of investment known as sunk entry costs (Melitz 2003, Roberts and Tybout 1997, Bernard and Jensen 2001, 2004 and Chaney 2005). Such investment will be influenced by the financial health or financial constraints of a firm. Many studies have considered both directly and indirectly the relationship between financial factors and the decision to export.

A study by Campa and Shaver (2002) considers the indirect link and focuses on the liquidity constraint and capital investment of exporters and non-exporters. They expected that multi-nation exporters should receive more stable income through the diversification of export destinations than single nation exporters. Using Spanish manufacturing sector data for 9 years,

they show that exporters receive more stable cash flows and have more stable capital investment compared to non-exporters. In addition, exporters are likely to have fewer liquidity constraint problems. In contrast, non-exporters seem to suffer more than exporters during the domestic business cycle.

Chaney (2005) emphasises the effect of currency devaluation on the trade balance and develops a model of international trade where liquidity constraints are one of the essential determinants of being an exporter. In international trade, firms need to pay fixed costs including sunk entry costs in order to enter export markets. This indicates that firms' financial health is very important in determining export behaviour. Firms that are able to generate sufficient liquidity seem to enter export markets while liquidity constrained firms are unable to export as they do not have adequate funds to cover sunk entry costs. However, when the exchange rate appreciates, it means there is an increase in domestic assets in terms of foreign price so some of those firms that have liquidity constraints are able to start exporting during that period.

More recent studies consider the impact of financial factors on the decision to export. Greenaway *et al.* (2007) find evidence for the UK that the financial health of exporters is better than non-exporters. Among exporters, continuous exporters have a healthier financial balance sheet than starters. The results also show that financial factors of firms such as liquidity and leverage determine firms' likelihood to export. Greenaway *et al.* (2007) find that liquidity has a positive and significant effect on the decision to export while leverage has a negative and significant effect. In addition, once a firm participates in export markets, it helps to improve the firm's financial health. For other firm characteristics, foreign ownership and subsidiaries have positive and significant effects on the decision to export. Firm sizes that are very small, small, medium and large have negative and significant coefficients. The results of TFP are mixed with insignificant coefficients.

Another recent study by Garcia-Veg and Guariglia (2007) focuses on the explanation of income volatility on financial constraints that affects the probability of exporting. Garcia-Veg and Guariglia (2007) build a model by assuming that each firm has to borrow from external sources in order to operate in the market. In addition, the model also assumes that each particular firm faces a normally distributed income shock. Garcia-Veg and Guariglia (2007) try to link firms' productivity and volatility to the ability of firms to access external sources of borrowing. They explain that more productive and less volatile firms are able to acquire cheaper loans while less productive and more volatile firms are more likely to face a higher cost of borrowing. It can be concluded that the cost to obtain external funds depends positively upon the degree of volatility.

When a country is open to trade, exporting firms are likely to face two possible contrasting effects. First, if firms are able to pay sunk entry costs and enter export markets, their financial constraints are likely to decrease. Second, an increase in competition in export markets causes an increase in the probability to exit or to go bankrupt for some firms, which therefore raises the difficulty to gain access to external sources of funds. Using UK data, Garcia-Veg and Guariglia (2007) find empirical evidence that more volatile firms are more likely to go bankrupt so in order to continue to operate in the market they have to be more productive, and therefore are more likely to become exporters.

From these empirical studies, we found that financial factors and investment in the entry decision to export are linked as each firm faces sunk entry costs prior to export. If firms can afford to pay such costs, they thus enter the export markets. In the next section, we build a model to investigate whether financial factors and firm characteristics actually affect a firm's export decision.

3.3 Methodology and Data

In this chapter, we follow the economic methodology as previously discussed in Chapter two. We extend the empirical model in Chapter two by including measures of a firm's financial health in order to explain how financial health affect the export participation. We discuss our model and briefly about methodology in the first sub-section. We then describe variables included in the model and finally about data.

3.3.1 Model

Our empirical model includes factors based on guidance from the previous theoretical and empirical literature. We extend the empirical model (Equation 2.8) in Chapter two where we include different measures of a firm's financial health in the model. Since a firm's financial status or financial health is considered to be an indicator of a firm's ability to pay sunk entry costs in order to enter export markets and also the capacity to export for the existing exporters, we exclude the lag of export status from the model. Similarly to Chapter two, we lag all independent variables by one year to avoid possible simultaneity problems. Thus, our model is given by:

$$\begin{aligned} EX_{it} = {} & \alpha + \beta_1 FINANCE_{i(t-1)} + \beta_2 FOREIGN_{i(t-1)} + \beta_3 TFP_{i(t-1)} \\ & + \beta_4 SMALL^{A}_{i(t-1)} + \beta_5 LARGE^{A}_{i(t-1)} + \beta_6 VLARGE^{A}_{i(t-1)} \\ & + \beta_7 wage_{i(t-1)} + \beta_8 SKILL_{i(t-1)} + \beta_9 TRAIN_{i(t-1)} + \beta_{10} RD \\ & + \sum_{r=1}^{5} \beta_r REGION_r + \varepsilon_{it} \end{aligned} \tag{3.1}$$

where EX is a dummy for export status of firm i.

$FINANCE$ is a firm's financial variable or financial ratio.

$FOREIGN$ is a dummy variable to indicate the structure of ownership whether it is foreign or domestic owned.

TFP is total factor productivity of a firm.

$SMALL^A$ is a dummy variable to represent a small firm.

$LARGE^A$ is a dummy variable to represent a large firm.

$VLARGE^A$ is a dummy variable to represent a very large firm.

$wage$ is the log of wages per employee.

$SKILL$ is a ratio of skilled labour to total labour.

$TRAIN$ is a dummy variable for both in-house and outside training.

RD is a dummy variable of whether a firm engages in R&D.

$REGION$ is a vector of five regional dummies which indicate the regional location of a firm.

ε is the error term.

Our model is estimated using pooled probit estimation even though there are several alternative estimation techniques suggested by the previous empirical literature such as fixed and random effects probit, a linear probability model and a GMM first differences estimator. Due to our relatively short panel compared to other studies, the implementation of these alternative estimation techniques is not possible.

Apart from region dummies, we also include twenty-two two-digit industry and two year dummies to control for unobserved industry and time varying effects. Additionally, we allow for robust clustering at two-digit industry level. The robust variance estimation alleviates the

problem of heteroscedasticity in the error terms and the clustering helps to relax the independence assumption and requires only that the observations are independent across industries.

3.3.2 Variables

For financial variable ($FINANCE_{i(t-1)}$), which represent the financial health of a firm, we use different proxies with different definitions of the financial ratio, i.e. liquidity and leverage, based on previous studies of financial constraints (see e.g. Fazzari and Petersen 1993, Chaney 2005, Greenaway *et al.* 2007). First, liquidity is used to measure a firm's ability to invest as a proxy of the capacity of a firm to pay sunk entry costs in order to start exporting. In this chapter, we define liquidity ratio ($LIQUIDITY_{i(t-1)}$) follow Greenaway *et al.* (2007) and measured as the current assets less liabilities divided by total assets. Second, two alternative definitions are used to classify the financial leverage ratio. Our first definition ($LEVERAGE1_{i(t-1)}$) represents short-term debt to asset ratio defined as the current liabilities divided by current assets while our second definition ($LEVERAGE2_{i(t-1)}$) represents the long-term debt to asset ratio and is defined as total liabilities divided by total assets. We expect that the liquidity ratio will have a positive effect on a firm's decision to export. Firms that have a high liquidity ratio are more likely to export. In contrast, the leverage ratio would be expected to have a negative effect on the export decision.

Foreign ownership ($FOREIGN_{i(t-1)}$) captures the structure of a firm's ownership. We define a firm as foreign owned if at least 10% of its shares belong to foreigners. Therefore, we generate a dummy equal to 1 if a firm is foreign owned and 0 otherwise. We also define our foreign ownership dummy at 25% and 50% levels ($FOREIGN25_{i(t-1)}$ and $FOREIGN50_{i(t-1)}$) in our

sensitivity analysis. Foreign firms invest in a host country for different reasons, for example as an export-platform or resource seeking or market seeking. The estimated sign of coefficient for this variable would reveal the incentive for investment. Since we know that foreign firms tend to have more advanced technologies and a higher ratio of skilled labour than domestic firms, such advantages would therefore enhance the productivity of foreign-owned firms. We therefore expect a positive relationship between foreign ownership and the export decision.

Total factor productivity ($TFP_{i(t-1)}$) is an indicator of a firm's efficiency in the production process. We use a semi-parametric approach following Levinsohn and Petrin (2003) that takes account of unobserved firm-specific productivity shock ($TFP^{LP}_{i(t-1)}$). We also use other alternative techniques to measure TFP in the sensitivity analysis. First, an R&D estimator of TFP ($TFP^{BUETTNER}_{i(t-1)}$) by Buettner (2003) is the estimation of a semi-parametric and nonlinear least square regression that accounts for endogenous R&D. Second, $TFP^{LABPROD}_{i(t-1)}$ is the simple labour productivity which is defined as the log of value added divided by total labour. The existing empirical evidence suggests that highly productive firms are more likely to enter export markets (Bernard and Jensen 1999, 2004, Greenaway and Kneller 2004, Kneller and Pisu 2004, Fariñas and Martín-Marcos 2007). Therefore, we expect TFP to have a positive effect on a firm's decision to export.

Firm size is considered as one of the important factors that determine export decisions because it is a measure of firm's success. We believe that large firms are more likely to export than small firms because large firms tend to have higher production capacity. In this chapter, we classify firm size slightly different from Chapter two. Since this chapter relates to the financial status of a firm, we classify firm size into different groups according to total fixed assets rather than total

employment.[1] For small firm ($SMALL^{A}_{i(t-1)}$), a dummy variable equals 1 if the total fixed assets in firm i at time $t-1$ falls in the first quartile distribution of the capital stock for all firms operating in the same two-digit ISIC level (Revision 3) as firm i at time $t-1$. For medium ($MEDIUM^{A}_{i(t-1)}$), large ($LARGE^{A}_{i(t-1)}$) and very large firm ($VLARGE^{A}_{i(t-1)}$), we use the same method as we classify small firm, total fixed assets of firm i at time $t-1$ falls in the second, third and forth quartile of the total fixed assets distribution respectively. In the analysis, we omit *MEDIUM* firms.

Wage ($wage_{i(t-1)}$) is an indicator of the quality of the workforce. Wage is defined as the log of wages per employee where wages per employee are the ratio of total wage payments to total workers less owners who do not receive wages. Employees who receive high wages tend to be the skilled and professional workers whereas low wage employees tend to be unskilled workers. It can be concluded that the quality of the workforce has a positive effect on wage income. Therefore, firms that pay high wages, which means firms have high quality of labour, are expected to have higher probability of exporting. Another indicator for the quality of workforce is ratio of skilled labour ($SKILL_{i(t-1)}$) which is defined as the ratio of professional and skilled worker to total worker.

For training ($TRAIN_{i(t-1)}$), a dummy is equal to 1 if employees within a firm receive formal training either in-house or outside training or both at least once, and 0 otherwise. Workers who receive training tend to have had an increase in their working expertise and competence. Training is expected to be positively correlated with the probability of exporting.

[1] A previous empirical study on financial factors and exporting by Greenaway *et al* (2007) also uses assets to classify different categories of firm size.

In terms of R&D ($RD_{i(t-1)}$), we distinguish R&D activities into different types. First, product R&D ($RDPRODUCT_{i(t-1)}$) represents an enhancement in the quality of existing products and new product lines. A dummy equals 1 if a firm carries out R&D in products and 0 otherwise. Firms that invest in product R&D are more likely to export as such investment is expected to improve the quality of products to meet the qualify standard of exporting. Second, production process R&D ($RDPROCESS_{i(t-1)}$) is an improvement in production technology to produce a higher quality of product at a lower cost of production. A dummy equals 1 if a firm carries out R&D in the production process and 0 otherwise. Firms that perform production process R&D are also more likely to export as they are assumed to have lower costs of production.

3.3.3 Data

We use the same data set as Chapter two which is an unbalanced panel of firm-level data during the period 2001 and 2004 from the Annual Survey of Thailand's manufacturing industry by the OIE. The data includes information on standard firm characteristics for example exports, output, productivity, structure of ownership, R&D, employment, training as well as financial balance sheet information that allows us to generate our financial ratio variables.

Details of definitions and descriptive statistics are presented in Tables 3A.1 and 3A.2 of the Appendix 3A. The raw correlations presented in Table 3A.3 show that export status is positively correlated with liquidity ratio whilst negatively correlated with leverage ratio.

Table 3.1 provides summary statistics of a firm's characteristics including financial ratio variables that proxy the financial health in the firm's balance sheet. We report the means and standard deviations for different groups; total sample, non-exporting firms and exporting firms. For exporting firms, we divide the sample into two sub-samples. The first sub-sample is firms that

export in the current year. The second sub-sample is firms that export in the current period but did not export in the previous year.

In terms of output, sales, assets, capital stock and employment, exporting firms are larger than non-exporting firms. However, exporting firms that do not export in the previous year are slightly smaller than firms that export in the current period ($EX_{it} = 1$). These findings and figures are consistent with the stylised facts from developed countries such as the US (Bernard and Jensen 1999, 2004), the UK (Greenaway and Kneller 2004 and Greenaway *et al.* 2007) and Germany (Arnold and Hussinger 2005) and developing countries such as Indonesia (Blalock and Gertler 2004).

For productivity using Levinsohn and Petrin (2003)'s method, exporting firms are more productive than non-exporting firms. In addition, employees who work in exporting firms receive higher wages compared to those working in non-exporting firms. The number of foreign-owned exporters is also greater relative to foreign non-exporters.

If we look at the financial variables, we find that exporters have a slightly higher liquidity ratio compared to non-exporters. A higher liquidity ratio indicates a greater ability to invest. If we proxy financial health using the leverage ratio, different definitions of leverage reveal similar results. Exporters seem to have a lower leverage ratio than non-exporters. This indicates that non-exporters are relatively illiquid and are more likely to face a high debt to asset ratio.

Different groups of sample have different characteristics. Large, highly productive firms with high liquidity or low leverage ratio seem to enter export markets. Such specific characteristics including a firm's financial health may influence a firm's decision to participate in export markets. We now econometrically investigate this link and present results in the next section.

Table 3.1: Summary Statistics

	Total Sample	Non-Exporting Firms	Exporting Firms	
		$EX_{it} = 0$	$EX_{it} = 1$	$EX_{it} = 1$ and $EX_{i(t-1)} = 0$
Output	184.427	80.714	252.876	133.042
	(534.93)	(335.61)	(623.63)	(394.12)
Sales	225.100	103.614	305.281	172.416
	(628.46)	(402.76)	(729.70)	(504.66)
Assets	206.514	99.936	276.854	178.211
	(701.417	(397.51)	(836.75)	(500.18)
Capital stock	91.816	37.253	127.828	105.375
	(421.73)	(166.67)	(523.13)	(366.11)
Labour	454.638	174.025	639.839	372.725
	(884.72)	(333.94)	(1067.49)	(899.45)
Productivity	9.512	9.259	9.679	9.757
	(1.92)	(1.84)	(1.95)	(1.78)
Wage	30.508	27.606	32.424	36.254
	(47.45)	(58.19)	(38.65)	(31.63)
Foreign	0.335	0.150	0.457	0.261
	(0.47)	(0.36)	(0.50)	(0.44)
Liquidity	0.080	0.077	0.082	0.043
	(0.52)	(0.66)	(0.40)	(0.48)
Leverage1	1.187	1.385	1.057	1.197
	(4.34)	(6.51)	(1.82)	(1.92)
Leverage2	0.778	0.838	0.738	0.771
	(2.56)	(1.05)	(3.18)	(0.77)
Observation	9,945	3,954	5,991	138

Notes: Standard deviations are reported in parentheses. Capital stock is a firm's total fixed assets. Labour is total employment including owners. Productivity is obtained from the estimation technique of Levinsohn and Petrin (2003). Wage is the ratio of total labour costs to total employment less owners who do not receive wage. Liquidity is the ratio of a firm's current asset less current liabilities over total assets. Two definitions of leverage ratio are used; leverage1 is defined as the ratio of current liabilities over current assets, and leverage2 is defined as the ratio of total liabilities to total assets. Output, sales and capital stock are measured in hundreds of thousands of US Dollars while wage is measured in hundred of US Dollars.

3.4 Results

The summary statistics in the previous section suggest a link between financial variables and export status. Before providing our econometric results, Table 3.2 presents the mean values of financial variables for non-exporters and exporters in the full sample and different sub-samples according to the quartile distribution of capital stock. We also provide the test statistics for whether there is any difference in the financial variables between non-exporters and exporters within each individual group.

In Table 3.2, the mean values show that exporters overall have higher liquidity ratio and lower leverage than non-exporters. For the liquidity ratio of small, large and very large firms, the t-statistic results suggest that exporters are significantly different from non-exporters. If we consider the leverage ratio rather than liquidity, we also find the differences between dissimilar groups in all samples especially in the definition of leverage1.

We now report the empirical results that affect the entry of a firm into export market in Tables 3.3 and 3.4. Finally, we present the estimated results of factors that affect the elasticity of a firm's export sales in Tables 3.5 and 3.6. Results reported in Table 3.3 are from the marginal effect estimations calculated at the mean of each continuous independent variable (except for the dummy variable). Three different financial variables are included for the purpose of our sensitivity analysis. Columns (1) and (2) include a measurement of liquidity based on the definition of Greenaway *et al.* (2007). Other columns use different definitions of leverage denoted by $LEVERAGE1$ and $LEVEAGE2$.

Table 3.2: Mean of the Financial Ratios for Different Groups of Sample

	Liquidity	Leverage1	Leverage2	Observation
Entire Sample				
Non-Exporters	0.076	1.383	0.839	4,153
Exporters	0.082	1.055	0.737	6,250
Coefficient	0.007	-0.332***	-0.128**	
t-statistic	(0.67)	(-3.63)	(-2.39)	
Small Firms				
Non-Exporters	0.183	0.942	0.908	1,162
Exporters	0.210	0.852	0.805	451
Coefficient	0.097**	-0.268)**	-0.148**	
t-statistic	(2.08)	(-2.13	(-2.24)	
Medium Firms				
Non-Exporters	0.114	1.272	0.825	1,264
Exporters	0.124	0.957	0.776	1,190
Coefficient	0.021	-0.490**	-0.045	
t-statistic	(0.84)	(-2.18)	(-1.05)	
Large Firms				
Non-Exporters	-0.024	1.479	0.870	1,041
Exporters	0.096	1.017	0.688	1,897
Coefficient	0.109***	-0.409***	-0.167***	
t-statistic	(5.52)	(-4.95)	(-4.50)	
Very Large Firms				
Non-Exporters	-0.043	2.302	0.712	638
Exporters	0.030	1.168	0.747	2,627
Coefficient	0.053	-0.904	0.080	
t-statistic	(2.75)***	(-3.31)***	(0.40)	

Notes: Tables reports the mean values of liquidity and leverage ratios for non-exporters $(EX_{it} = 0)$ and exporters $(EX_{it} = 1)$ in different groups according to the quartile distribution of capital stock for all firms operating in the same two-digit industry. Small firms is defined as if the observations fall in the first size quartile while medium, large and very large firms are defined as if the observations fall in the second, third and forth quartile, respectively. The row labelled *coefficient* and *t-statistic* present the coefficient and t-statistic of export status (EX_{it}) in a regression of financial ratio on export status, region, two-digit industry and time dummies, i.e.

$LIQUIDITY_{it} \,/\, LEVEARGE_{it} = \alpha_0 + \alpha_1 EX_{it} + \sum_{r=1}^{5} \alpha_r REGION_r + \sum_{j=1}^{22} \alpha_j INDUS_j + \sum_{t=1}^{3} \alpha_t T_t + \varepsilon_{it}$. * significant at 10%; ** significant at 5%; *** significant at 1%.

The results show that the financial health of a firm has a significant influence on a firm's export decision. When we use liquidity to measure a firm's financial health, the positive and significant coefficient indicates that adding one unit to the liquidity ratio will add to the probability of exporting around 3.7 percentage points. In contrast to liquidity, the coefficient for the leverage ratio has a negative and significant effect for both measures. In Columns (3) and (4) and Columns (5) and (6), the results mean that adding one unit to the liquidity ratio will decrease the probability of exporting by 1.4 and 1.9 percentage points respectively.

Considering our other independent variables, we observe that foreign ownership has a positive and significant effect on the decision to export across all specifications. Being a foreign-owned firm increases the probability of exporting by 24 percentage points relative to a domestically-owned firm. As expected, the results for TFP are positive and significant. This means the higher the TFP, the higher the probability of a firm to become an exporter. In Columns (1) to (6), increasing TFP by one unit increases the probability of exporting on average by 5.5 percentage points.

Another important factor that determines a firm's decision to export is the size of a firm. We classify size into different groups and the results show that different groupings have different outcomes. The coefficient for small firms is negative and significant while large and very large firms have positive and significant results. Small firms are less likely to export. However, as firm size increases so does the likelihood of becoming an exporter.

Wage and the ratio of skilled labour have negative coefficients but neither is significant.[2] Because both variables are proxies of the quality of labour, the negative outcome may imply that firms in Thailand specialises in exporting mass-produced products or intermediate inputs that

[2] Greenaway *et al.* (2007) also find a negative result on wage variable. They explain that this puzzle may arise from the fact that wages are correlated with productivity and firm size.

are produced using cheap labour costs. In addition, we find that the training variable is positive and significant. This significant result indicates that the probability of exporting will be on average about 10.3 percentage points higher for firms that provide training to their employees compared to firms that do not provide any. It is known that Thailand is abundant with unskilled labour so training becomes another important factor that determines the export entry decision.

In Columns (1), (3) and (5), product R&D has a positive and significant impact on a firm's decision to export. Firms that invest in product R&D to develop and improve quality of goods are more likely to export. Production process R&D also has positive and significant coefficient in Columns (2), (4) and (6). The investment in production process R&D helps firms to develop advanced technology that permits efficiency in the production process and results in a reduction in production costs.

For further analysis, we split our sample according to structure of ownership using 10% of foreign-owned shares as a cut-off point between foreign and domestic.[3] The marginal effect estimations from the pooled probit are presented in Table 3.4.

The liquidity coefficient in both groups is positive but not significant. For our other financial ratios, leverage has a negative coefficient but only *LEVERAGE*1 in the domestic sample is significant. Hence, increasing leverage ratio of domestic firms by one unit decreases the probability of exporting by 1.3 percentage points. This finding implies that the entry decision of

[3] This breakdown sample into domestic and foreign sub-samples is verified via a likelihood ratio test. The likelihood ratio test involves estimating and comparing between two models by assuming that the model A (standard specification) is nested with model B (standard specification plus the interaction term between foreign and independent variables). The test statistic reports the chi-squared value for the test (48.70) and the p-value for a chi-square with nine degrees of freedom suggests that the difference between the two models is statistically significant. This means that the less restive model (model B) fits better than the more restrictive model (model A). The consequence of adding the interaction terms between the foreign and independent variables as predictor variables in the model result in statistically significant improvement of the model. Therefore, we can separately estimate models for domestic and foreign sub-samples.

domestic firms into export markets depends upon their financial health. Financially constrained firms especially those that are domestically owned may find it difficult to obtain external finance to invest in exporting. We find that the financial health of foreign-owned firms does not have any significant effect on the export entry decision. For foreign firms, their entry decisions typically depend on the incentive of investment such as export platform FDI.

The relationship between productivity and the decision to export is positive and significant across all specifications. For example, the coefficient in Column (1) show that increasing TFP of domestic firms by one unit raises the probability of exporting by 6.3 percentage points. In both samples, small firms are less likely to export whilst large and very large firms are more likely to export. Wage has a negative coefficient and significant only in foreign firms sample. This negative and significant result may possibly imply that foreign firms invest in Thailand to seek cheap labour that provides a low cost of production. Therefore, increasing wage rate of foreign firms by one unit decreases the probability of exporting by approximately 7 percentage points. The ratio of skilled labour in domestic and foreign firms also has a negative effect on a firm's decision to export but neither is significant.

Firms carry out training because it permits workers to improve their working skills and perform more efficient works. For both domestic and foreign firms, training has positive coefficient. For domestic firms, all six columns are significant meaning that the probability of exporting will be on average about 11 percentage points higher for domestic firms that provide training to their employees compared to domestic firms that do not provide any.

Table 3.3: The Determinants of a Firm's Decision to Export (Dep. Var. is EX_{it})

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.037*	0.037*				
	(0.019)	(0.019)				
$LEVERAGE1_{i(t-1)}$			-0.014***	-0.014***		
			(0.005)	(0.005)		
$LEVERAGE2_{i(t-1)}$					-0.019*	-0.019*
					(0.011)	(0.011)
$FOREIGN_{i(t-1)}$	0.239***	0.239***	0.239***	0.238***	0.240***	0.239***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
$TFP^{LP}_{i(t-1)}$	0.054***	0.055***	0.053***	0.054***	0.055***	0.056***
	(0.019)	(0.019)	(0.018)	(0.018)	(0.018)	(0.018)
$SMALL^{A}_{i(t-1)}$	-0.189***	-0.189***	-0.189***	-0.188***	-0.184***	-0.183***
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)
$LARGE^{A}_{i(t-1)}$	0.127***	0.128***	0.127***	0.129***	0.123***	0.125***
	(0.032)	(0.032)	(0.031)	(0.032)	(0.031)	(0.032)
$VLARGE^{A}_{i(t-1)}$	0.255***	0.256***	0.257***	0.258***	0.249***	0.250***
	(0.042)	(0.042)	(0.041)	(0.041)	(0.041)	(0.042)
$wage_{i(t-1)}$	-0.051	-0.052	-0.050	-0.051	-0.052	-0.053
	(0.053)	(0.055)	(0.053)	(0.055)	(0.053)	(0.055)
$SKILL_{i(t-1)}$	-0.018	-0.019	-0.018	-0.019	-0.018	-0.018
	(0.033)	(0.033)	(0.034)	(0.034)	(0.033)	(0.033)
$TRAIN_{i(t-1)}$	0.102***	0.105***	0.100***	0.103***	0.101***	0.104***
	(0.036)	(0.037)	(0.036)	(0.037)	(0.037)	(0.037)
$RDPRODUCT_{i(t-1)}$	0.130***		0.130***		0.130***	
	(0.012)		(0.012)		(0.012)	
$RDPROCESS_{i(t-1)}$		0.101***		0.101***		0.102***
		(0.027)		(0.027)		(0.027)
Observations	6961	6961	6961	6961	6961	6961

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.4: The Determinants of a Firm's Decision to Export for Domestic and Foreign Firms (Dep. Var. is EX_{it})

	Domestic Firms						Foreign Firms					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
$LIQUIDITY_{i(t-1)}$	0.039	0.040					0.023	0.023				
	(0.027)	(0.027)					(0.018)	(0.018)				
$LEVERAGE1_{i(t-1)}$			-0.013**	-0.013**					-0.012	-0.012		
			(0.005)	(0.005)					(0.007)	(0.007)		
$LEVERAGE2_{i(t-1)}$					-0.013	-0.013					-0.024	-0.024
					(0.015)	(0.015)					(0.017)	(0.017)
$TFP^{LP}_{i(t-1)}$	0.063***	0.064***	0.062***	0.062***	0.065***	0.065***	0.034**	0.035**	0.033**	0.034**	0.034**	0.035**
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
$SMALL^{A}_{i(t-1)}$	-0.184***	-0.183***	-0.183***	-0.182***	-0.178***	-0.177***	-0.109	-0.109	-0.105	-0.105	-0.101	-0.102
	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.067)	(0.067)	(0.065)	(0.066)	(0.062)	(0.062)
$LARGE^{A}_{i(t-1)}$	0.136***	0.139***	0.135***	0.139***	0.131***	0.134***	0.080***	0.080***	0.080***	0.080***	0.077***	0.077***
	(0.037)	(0.038)	(0.037)	(0.037)	(0.037)	(0.037)	(0.029)	(0.029)	(0.029)	(0.029)	(0.030)	(0.030)
$VLARGE^{A}_{i(t-1)}$	0.245***	0.248***	0.247***	0.250***	0.238***	0.240***	0.182***	0.182***	0.183***	0.183***	0.176***	0.176***
	(0.045)	(0.045)	(0.043)	(0.043)	(0.043)	(0.043)	(0.045)	(0.045)	(0.045)	(0.045)	(0.044)	(0.044)
$wage_{i(t-1)}$	-0.008	-0.008	-0.007	-0.007	-0.009	-0.009	-0.071**	-0.072**	-0.071**	-0.072**	-0.074**	-0.075**
	(0.071)	(0.075)	(0.071)	(0.075)	(0.072)	(0.075)	(0.031)	(0.030)	(0.030)	(0.030)	(0.031)	(0.031)
$SKILL_{i(t-1)}$	-0.007	-0.008	-0.006	-0.007	-0.006	-0.007	-0.016	-0.016	-0.015	-0.016	-0.015	-0.015
	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
$TRAIN_{i(t-1)}$	0.110***	0.113***	0.109***	0.112***	0.110***	0.113***	0.067	0.068	0.064	0.065	0.061	0.062
	(0.034)	(0.034)	(0.033)	(0.034)	(0.034)	(0.035)	(0.062)	(0.063)	(0.062)	(0.063)	(0.063)	(0.065)
$RDPRODUCT_{i(t-1)}$	0.187***		0.187***		0.189***		0.028		0.029		0.027	
	(0.020)		(0.019)		(0.019)		(0.025)		(0.024)		(0.025)	
$RDPROCESS_{i(t-1)}$		0.147***		0.146***		0.149***		0.015		0.016		0.014
		(0.031)		(0.032)		(0.031)		(0.029)		(0.029)		(0.030)
Observations	4626	4626	4626	4626	4626	4626	2335	2335	2335	2335	2335	2335

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

In terms of R&D, product R&D and production process R&D have positive coefficients and are significant only for domestic firms. The implication of such a finding is that domestic firms should invest in either product R&D or production process R&D or both. For example, domestic firms carry out product R&D in order to improve their product quality up to the standard level or expand their varieties to be able to enter export markets. R&D of foreign firms does not significantly affect the probability of exporting. One explanation is that R&D activities of foreign firms may be undertaken in the home country rather than the host country. Some foreign firms invest in Thailand in order to set up the production plants and use a country as an export platform.

The next stage was to investigate how various factors affect export intensity among exporters by replacing the export status dummy in Equation (3.1) with the log of export sales. Tables 3.5 and 3.6 present the estimated results obtained using a pooled OLS estimation technique.

Table 3.5 shows that the liquidity ratio has a positive and significant effect on a firm's export sales. This indicates that a higher liquidity ratio results in higher elasticity of export sales. In contrast, our leverage ratios have negative coefficients but only *LEVERAGE*1 is significant which indicates that if a firm face a short-term debt to asset ratio, its elasticity of export sales is likely to decrease. The long-term leverage (*LEVERAGE*2) does not have any significant effect. These results imply that a short-term debt to asset is significantly more important than the long-term one. Foreign ownership, productivity and size are consistent with the determinants of export status results in Table 3.3 where foreign-owned and high productive firms are more likely to increase their export sales. In addition, the elasticity of export sales increases further due to the increase in firm size.

Wage has a negative and significant impact on the elasticity of export sales. An increase in the wage rate means a firm's production costs are also increased. Thus, a firm may reduce the amount of goods exported which causes a decrease in a firm's export sales revenue. Training and product R&D positively influence a firm's export sales. If firms engage in product R&D, their elasticity of export sales is likely to increase. However, production process R&D has an insignificant effect.

Finally, we split our sample into domestic and foreign firms using the 10% of foreign-owned shares as a cut-off point.[4] Results are presented in Table 3.6. For our financial ratios, liquidity has positive coefficients whilst leverage has negative coefficients but only *LEVERAGE*1 in the foreign sample is significant. In both groups, productivity, training, large and very large firms have positive and significant effects on firms' export sales. In contrast, a dummy for small firm has a negative and significant coefficient that means being a small firm is likely to decrease their elasticity of export sales.

The negative and significant result of the wage variable in Table 3.6 is now explained by the dominant effect of foreign-owned firms rather than domestic firms. Product R&D of only domestic firms is also important in determining their elasticity of export sales. The magnitude of the effect means that the elasticity of export sales is about 24 percentage points higher for domestic firms that carry out product R&D compared to domestic firms that do not engage in any product R&D. The investment in product R&D helps domestic firms to develop and improve their product qualities or even continue to expand their product lines. R&D of foreign firms does not have any significant effect on their elasticity of export sales. This insignificant

[4] This breakdown sample into domestic and foreign sub-samples is verified via a likelihood ratio test. The test statistic reports the chi-squared value for the test (71.44) and the p-value for a chi-squared with nine degrees of freedom suggesting that the difference between the two models is statistically significant. This means that if we do allow for differences in the coefficients across ownership it results in the improvement of the model so we can separately estimate model for domestic and foreign sub-samples.

result is explained by the fact that R&D activities of foreign firms are perhaps undertaken in the home country rather than in the host country.

In a sensitivity analysis, we use different measures of TFP ($TFP^{BUETTNER}$ and $TFP^{LABPROD}$) and use alternative cut-off points for foreign ownership (25% and 50%). The results can be found in the Appendix 3B and are broadly consistent with the results discussed in Tables 3.3 and 3.5.

The evidence from our empirical results shows that financial ratios provide a partial explanation of a firm's investment ability to enter export markets. The liquidity ratio has positive and significant effect while the leverage ratio has negative impact on the probability of exporting. An illiquid firm may find it difficult to invest in sunk entry costs in order to export. This result leads to the suggestion that the Thai government should highlight on the entry promotion policies that help to reduce sunk entry costs. Such policies would encourage new entry and some financial constrained firms could afford to pay sunk costs to enter export markets. In addition, the government should develop financial markets and financial sectors. This would help firms and especially firms that face short-term debt to gain greater access to funding so some firms are able to enter export markets while some exporters would have sufficient funds to finance their production. The export promotion policies are also important as they facilitate the existing exporters to expand their export sales.

The government should stress on the policies that attract more FDI inflows because foreign ownership is one of the significant factors that determine the entry decision into export markets and the elasticity of export sales. The insignificant result from R&D of foreign firms implies that R&D activities may perhaps be undertaken in the home country rather than the host country. From technology and R&D spillovers perspective, government should encourage foreign firms to undertake R&D in the home country by granting investment promotion

because the R&D investment may generate positive spillovers to domestic firms. Training is also important because it helps to support Thai workforce to specialise in specific production technique and increase their competence. However, corporate institutes that provide special training to industry are limited to certain industries such as automotive and electrical industries. Government may support or set up institutes that provide special training to various industries.

Table 3.5: The Determinants of a Firm's Export Sales (Dep. Var. is $EXSALES_{it}$)

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.226*	0.229*				
	(0.131)	(0.131)				
$LEVERAGE1_{i(t-1)}$			-0.065*	-0.065*		
			(0.037)	(0.037)		
$LEVERAGE2_{i(t-1)}$					-0.102	-0.106
					(0.084)	(0.083)
$FOREIGN_{i(t-1)}$	0.426***	0.422***	0.425***	0.420***	0.426***	0.421***
	(0.094)	(0.093)	(0.094)	(0.093)	(0.092)	(0.092)
$TFP^{LP}_{i(t-1)}$	0.721***	0.725***	0.723***	0.726***	0.726***	0.729***
	(0.063)	(0.064)	(0.063)	(0.064)	(0.061)	(0.062)
$SMALL^{A}_{i(t-1)}$	-0.947***	-0.951***	-0.931***	-0.934***	-0.919***	-0.922***
	(0.183)	(0.185)	(0.181)	(0.183)	(0.181)	(0.183)
$LARGE^{A}_{i(t-1)}$	0.753***	0.757***	0.750***	0.755***	0.738***	0.742***
	(0.084)	(0.083)	(0.084)	(0.084)	(0.083)	(0.083)
$VLARGE^{A}_{i(t-1)}$	1.894***	1.901***	1.882***	1.889***	1.861***	1.868***
	(0.186)	(0.187)	(0.184)	(0.185)	(0.180)	(0.181)
$wage_{i(t-1)}$	-0.443***	-0.446***	-0.438***	-0.442***	-0.453***	-0.456***
	(0.150)	(0.150)	(0.153)	(0.153)	(0.151)	(0.151)
$SKILL_{i(t-1)}$	0.037	0.031	0.037	0.030	0.046	0.040
	(0.130)	(0.132)	(0.131)	(0.132)	(0.131)	(0.132)
$TRAIN_{i(t-1)}$	0.408**	0.423**	0.407**	0.422**	0.412**	0.426**
	(0.182)	(0.182)	(0.182)	(0.182)	(0.184)	(0.185)
$RDPRODUCT_{i(t-1)}$	0.168*		0.171*		0.165*	
	(0.096)		(0.096)		(0.093)	
$RDPROCESS_{i(t-1)}$		-0.044		-0.041		-0.044
		(0.097)		(0.097)		(0.097)
Constant	10.323***	10.309***	10.357***	10.342***	10.446***	10.439***
	(1.195)	(1.209)	(1.201)	(1.215)	(1.127)	(1.143)
Observations	4217	4217	4217	4217	4217	4217

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.6: The Determinants of a Firm's Export Sales for Domestic and Foreign Firms (Dep. Var. is $EXSALES_{it}$)

	Domestic Firms						Foreign Firms					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
$LIQUIDITY_{i(t-1)}$	0.073	0.082					0.333*	0.332*				
	(0.143)	(0.144)					(0.169)	(0.170)				
$LEVERAGE1_{i(t-1)}$			-0.030	-0.032					-0.130*	-0.128*		
			(0.036)	(0.037)					(0.065)	(0.065)		
$LEVERAGE2_{i(t-1)}$					-0.062	-0.071					-0.080	-0.080
					(0.113)	(0.114)					(0.084)	(0.084)
$TFP^{LP}_{i(t-1)}$	0.758***	0.761***	0.756***	0.758***	0.756***	0.758***	0.635***	0.639***	0.636***	0.641***	0.654***	0.658***
	(0.099)	(0.099)	(0.099)	(0.099)	(0.102)	(0.102)	(0.096)	(0.096)	(0.096)	(0.095)	(0.094)	(0.093)
$SMALL^{A}_{i(t-1)}$	-0.941***	-0.947***	-0.938***	-0.943***	-0.929***	-0.934***	-0.986***	-0.989***	-0.968***	-0.970***	-0.968***	-0.970***
	(0.219)	(0.222)	(0.222)	(0.226)	(0.228)	(0.231)	(0.274)	(0.275)	(0.273)	(0.274)	(0.280)	(0.281)
$LARGE^{A}_{i(t-1)}$	0.610***	0.624***	0.611***	0.624***	0.604***	0.617***	1.000***	0.999***	0.993***	0.993***	1.008***	1.007***
	(0.113)	(0.111)	(0.112)	(0.110)	(0.108)	(0.107)	(0.123)	(0.126)	(0.124)	(0.127)	(0.128)	(0.131)
$VLARGE^{A}_{i(t-1)}$	1.466***	1.485***	1.466***	1.484***	1.459***	1.477***	2.339***	2.337***	2.326***	2.324***	2.302***	2.299***
	(0.193)	(0.196)	(0.186)	(0.189)	(0.187)	(0.190)	(0.243)	(0.242)	(0.239)	(0.239)	(0.242)	(0.242)
$wage_{i(t-1)}$	-0.416	-0.418	-0.411	-0.413	-0.419	-0.422	-0.457***	-0.461***	-0.455***	-0.459***	-0.469***	-0.473***
	(0.285)	(0.288)	(0.286)	(0.289)	(0.284)	(0.287)	(0.114)	(0.113)	(0.115)	(0.114)	(0.114)	(0.114)
$SKILL_{i(t-1)}$	0.105	0.095	0.103	0.094	0.111	0.102	0.053	0.049	0.051	0.047	0.049	0.046
	(0.144)	(0.148)	(0.144)	(0.148)	(0.145)	(0.148)	(0.180)	(0.180)	(0.181)	(0.181)	(0.179)	(0.179)
$TRAIN_{i(t-1)}$	0.306	0.325	0.306	0.326	0.314	0.334*	0.683**	0.691**	0.662**	0.670**	0.676**	0.683**
	(0.193)	(0.192)	(0.194)	(0.193)	(0.191)	(0.190)	(0.295)	(0.297)	(0.280)	(0.282)	(0.295)	(0.297)
$RDPRODUCT_{i(t-1)}$	0.241**		0.241**		0.236**		0.148		0.158		0.144	
	(0.107)		(0.108)		(0.100)		(0.158)		(0.159)		(0.160)	
$RDPROCESS_{i(t-1)}$		-0.049		-0.049		-0.054		0.015		0.024		0.015
		(0.117)		(0.117)		(0.115)		(0.173)		(0.173)		(0.171)
Constant	10.501***	10.466***	10.516***	10.480***	10.573***	10.550***	10.765***	10.748***	10.907***	10.887***	10.829***	10.814***
	(1.688)	(1.723)	(1.692)	(1.729)	(1.569)	(1.604)	(1.016)	(1.025)	(0.996)	(1.005)	(1.072)	(1.083)
Observations	2296	2296	2296	2296	2296	2296	1921	1921	1921	1921	1921	1921

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

3.5 Conclusions

This chapter is an extension of Chapter two that emphasises the importance of financial variables that are used to proxy for a firm's financial health and links them with the decision to enter export markets using a firm-level data for Thailand between 2001 and 2004. We base our hypothesis on the assumption that investment and a firm's internal finance are related. Since exporting is also considered as a form of investment, i.e. investment in sunk entry costs and variable costs, the entry decision into export markets should be connected with a firm's financial health as well.

Financial variables are used to indicate firms' ability of investment to enter export market. We also include other firm specific characteristics in the regression and use different financial ratios to test for robustness. In general, liquidity is positive whilst leverage is negative and both ratios are significant. Firms that have high liquidity are more likely to export. In contrast, firms with high leverage are less likely to become exporters. For TFP, we find positive and significant results but this evidence from Thailand is in contrast with the findings of the UK by Greenaway *et al.* (2007). Other firm characteristics such as foreign ownership, firm size, training and R&D are also important in determining the entry decision into export markets. The significant results for the foreign ownership variable support the findings in Guariglia (1999) that if firms are involved in global activities, they are less likely to face financial constraints and are therefore more likely to enter export markets.

For export intensity, firm characteristics are used to test the effects on the size of exports. Financial health is found to be important as it reveals a firm's capability to produce goods for export. Foreign ownership, size differences, wage, training and R&D also have significant effects on the elasticity of firms' export sales.

In summary, the entry decision of a firm into export markets is determined by various firm characteristics and performance. Financial ratios provide a partial explanation for a firm's ability to invest in sunk entry costs in order to enter export markets. If firms face liquidity constraints, it means that firms have no sufficient funds to afford to pay sunk entry costs in order to enter export markets. Once firms enter export markets, financial health also affects the elasticity of export sales because firms' financial status indicates how much firms can actually afford to produce in order to supply the markets.

The finding for Thailand leads to the suggestion that government should develop financial markets and the financial sector so some currently constrained firms can gain greater access to external funding in order to invest and be able to enter export markets. The government should also highlight entry promotion as well as export promotion policies because the entry promotion policies help to reduce sunk entry costs faced by firms, so some financial constrained firms can afford the costs that would encourage new entry, while export promotion policies favour existing exporters to stimulate their export sales. In addition, the Thai government should promote policies that attract FDI inflows as foreign ownership is one of the significant factors that determine the entry decision into export markets and the elasticity of export sales.

Appendix 3A: Definition of Variables and Descriptive Statistics

Table 3A.1: Definition of Variables

Variable	Definition
EX_{it}	A dummy variable for export status where a dummy equals 1 if firm i at time t has positive export sales and 0 otherwise.
$EXSALES_{it}$	The log of export sales of firm i at time t.
$LIQUIDITY_{i(t-1)}$	A firm's liquidity ratio is defined as the ratio of current assets minus liabilities to total assets.
$LEVERAGE1_{i(t-1)}$	A firm's financial leverage ratio is defined as the ratio of current liabilities to current assets
$LEVERAGE2_{i(t-1)}$	Another definition of a firm's financial leverage ratio is defined as the ratio of total liabilities to total assets.
$FOREIGN_{i(t-1)}$	A dummy variable that indicates the structure of foreign ownership where a dummy equals 1 if shares of at least 10% are foreign owned.
$FOREIGN25_{i(t-1)}$	A dummy variable that indicates the structure of foreign ownership where a dummy equals 1 if shares of at least 25% are foreign owned.
$FOREIGN50_{i(t-1)}$	A dummy variable that indicates the structure of foreign ownership where a dummy equals 1 if shares of at least 50% are foreign owned.
$TFP^{LP}_{i(t-1)}$	Total factor productivity that is obtained from the estimation of the semi-parametric approach of Levinsohn and Petrin (2003).
$TFP^{BUETTNER}_{i(t-1)}$	Total factor productivity that is obtained from system estimation, a semi-parametric and nonlinear least square regression, of Buettner (2003).
$TFP^{LABPROD}_{i(t-1)}$	Labour productivity that is calculated from the log of value added divided by total labour.
$SMALL^{A}_{i(t-1)}$	For a small firm variable, a dummy variable is equal to 1 if the total fixed assets of the firm i at time $t-1$ is in the first quartile of the distribution of the total fixed assets of all firms operating in the same two-digit ISIC level (Revision 3) as firm i at time $t-1$.
$LARGE^{A}_{i(t-1)}$	For a large firm variable, a dummy variable equal to 1 if the total fixed assets of the firm i at time $t-1$ is in the third quartile of the distribution of the total fixed assets of all firms operating in the same two-digit ISIC level (Revision 3) as firm i at time $t-1$.
$VLARGE^{A}_{i(t-1)}$	A very large firm variable, a dummy variable equal to 1 if the total fixed assets of the firm i at time $t-1$ is in the forth quartile of the distribution of the total fixed assets of all firms operating in the same two-digit ISIC level (Revision 3) as firm i at time $t-1$.
$wage_{i(t-1)}$	The log of wage per employee where wage per employee is calculated from the ratio of total labour payments over total labour less owners.
$SKILL_{i(t-1)}$	The ratio of professional and skilled labour to total labour.
$TRAIN_{i(t-1)}$	A training dummy equals 1 if the workforce within a firm has received formal training either in-house training or outside training or both at least once, and 0 otherwise.
$RDPRODUCT_{i(t-1)}$	A dummy variable equals 1 if a firm carries out R&D in product development and 0 otherwise.

$RDPROCESS_{i(t-1)}$	A dummy variable equals 1 if a firm performs R&D in the development of production processes and 0 otherwise.
BKKM	A dummy variable identifies whether firm locates in Bangkok and Metropolitan Area or not.
CENTRAL	A dummy variable equals 1 if a firm locates in Central region excluding Bangkok and Metropolitan Area and 0 otherwise.
EAST	A dummy variable equals 1 if a firm locates in Eastern region and 0 otherwise.
NORTH	A dummy variable equals 1 if a firm locates in the North of Thailand and 0 otherwise.
SOUTH	A dummy variable equals 1 if a firm locates in the South of Thailand and 0 otherwise.

Table 3A.2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
EX_{it}	6961	0.61	0.49	0	1
$EXSALES_{it}$	4217	14.74	2.20	4.95	20.33
$LIQUIDITY_{i(t-1)}$	6961	0.08	0.51	-10.45	0.99
$LEVERAGE1_{i(t-1)}$	6961	1.19	4.91	0.01	239.68
$LEVERAGE2_{i(t-1)}$	6961	0.75	0.80	0.01	13.32
$FOREIGN_{i(t-1)}$	6961	0.34	0.47	0	1
$FOREIGN25_{i(t-1)}$	6961	0.30	0.46	0	1
$FOREIGN50_{i(t-1)}$	6961	0.18	0.38	0	1
$TFP^{LP}_{i(t-1)}$	6961	9.50	1.86	0.47	16.69
$TFP^{BUETTNER}_{i(t-1)}$	6690	10.51	1.20	1.21	15.31
$TFP^{LABPROD}_{i(t-1)}$	6961	9.17	1.02	1.45	14.00
$SMALL^{A}_{i(t-1)}$	6961	0.16	0.37	0	1
$LARGE^{A}_{i(t-1)}$	6961	0.29	0.45	0	1
$VLARGE^{A}_{i(t-1)}$	6961	0.32	0.46	0	1
$wage_{i(t-1)}$	6961	7.82	0.51	4.19	10.07
$SKILL_{i(t-1)}$	6961	0.53	0.32	0	1
$TRAIN_{i(t-1)}$	6961	0.92	0.28	0	1
$RDPRODUCT_{i(t-1)}$	6961	0.09	0.29	0	1
$RDPROCESS_{i(t-1)}$	6961	0.07	0.27	0	1

Table 3A.3: Correlation Matrix

	EX_{it}	*LIQUIDITY*	*LEVERAGE1*	*LEVERAGE2*	*FOREIGN*	*FOREIGN25*	*FOREIGN50*	TFP^{LP}	$TFP^{BUETTNER}$	$TFP^{LABPROD}$	$SMALL^{A}$	$LARGE^{A}$	$VLARGE^{A}$	*wage*	*SKILL*	*TRAIN*	*RDPRODUCT*	*RDPROCESS*
EX_{it}	1.00																	
LIQUIDITY	0.01	1.00																
LEVERAGE1	-0.04	-0.54	1.00															
LEVERAGE2	-0.09	-0.58	0.32	1.00														
FOREIGN	0.32	0.02	-0.03	-0.11	1.00													
FOREIGN25	0.32	0.02	-0.03	-0.10	0.92	1.00												
FOREIGN50	0.28	0.01	-0.02	-0.09	0.66	0.72	1.00											
TFP^{LP}	0.12	-0.02	0.01	-0.02	0.09	0.08	0.04	1.00										
$TFP^{BUETTNER}$	0.31	-0.01	-0.03	-0.14	0.34	0.32	0.28	0.58	1.00									
$TFP^{LABPROD}$	0.17	-0.01	-0.01	-0.11	0.32	0.31	0.25	0.57	0.92	1.00								
$SMALL^{A}$	-0.29	0.11	-0.03	0.07	-0.17	-0.16	-0.16	-0.18	-0.40	-0.27	1.00							
$LARGE^{A}$	0.07	-0.02	-0.01	-0.02	0.03	0.02	0.02	-0.00	0.02	0.01	-0.28	1.00						
$VLARGE^{A}$	0.29	-0.10	0.03	-0.06	0.23	0.22	0.22	0.26	0.53	0.38	-0.30	-0.43	1.00					
wage	0.17	-0.01	0.01	-0.09	0.38	0.38	0.32	0.35	0.61	0.68	-0.19	0.03	0.27	1.00				
SKILL	-0.02	0.01	0.01	0.01	-0.02	-0.01	-0.01	-0.03	-0.02	0.02	0.06	-0.03	-0.02	0.09	1.00			
TRAIN	0.16	-0.03	0.00	-0.05	0.10	0.09	0.08	0.11	0.22	0.15	-0.16	0.03	0.18	0.13	-0.02	1.00		
RDPRODUCT	0.11	0.01	-0.01	-0.04	0.03	0.03	0.02	0.06	0.12	0.07	-0.07	0.02	0.08	0.04	-0.05	0.07	1.00	
RDPROCESS	0.07	0.02	-0.01	-0.04	0.03	0.03	0.01	0.06	0.11	0.08	-0.07	0.00	0.08	0.06	-0.02	0.07	0.57	1.00

Appendix 3B: Sensitivity Analysis

In the Appendix 3B, we present a range of sensitivity checks on our independent variables in both models by using different definitions of foreign ownership and different techniques to measure TFP. For foreign ownership, 25% and 50% cut-off points of foreign-owned share are used instead of 10%. In terms of TFP, we use $TFP^{BUETTNER}$ and $TFP^{LABPROD}$. We only perform the sensitivity checks for the entire sample.

Tables 3B.1 to 3B.8 report the marginal effects of the pooled probit model for the determinants of a firm's decision to export using different cut-off points for foreign ownership and different measurement of TFP. In Tables 3B.1 and 3B.2, results are broadly consistent with those in Table 3.3. Liquidity has a positive whilst leverage has a negative effect on the entry of a firm into export markets. Other independent variables such as foreign ownership, firm size, training, and R&D are also significant. For TFP, only $TFP^{BUETTNER}$ has positive and significant coefficient. Results for $TFP^{LABPROD}$ are negative and insignificant. This puzzle may arise from the fact that $TFP^{LABPROD}$ is correlated with wage (see Table 3A.3).

Using 25% and 50% of foreign-owned share as our cut-off points, shown in Tables 3B.3 to 3B.8 are consistent with results from using 10% cut-off point. One interesting finding is that different percentage share used to classify foreign ownership shows that the higher the percentage, the greater the effect on the probability of exporting.

Tables 3B.9 to 3B.16 provide the estimated results from the pooled OLS model for the determinants of a firm's export sales. Results in Tables 3B.9 and 3B.10 are broadly similar to those in Table 3.5. Liquidity has a positive whilst leverage ratio has a negative coefficient. However, in Table 3B.9 only $LEVERAGE1$ is significant. When we use $TFP^{LABPROD}$ as a

measure of productivity in Table 3B.10, all of financial variables are significant. In Table 3B.10, wage is insignificant. Using different cut-off points of foreign-owned share in Tables 3B.11 to 3B.16, results also show that the higher the percentage, the greater the effect on the elasticity of export sales.

3B.1 The Determinants of a Firm's Decision to Export

3B.1.1 At the 10% Cut-Off Point for Foreign Ownership

Table 3B.1: The Determinants of a Firm's Decision to Export (Dep. Var. is EX_{it}) with $FOREIGN$ and $TFP^{BUETTNER}$

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.032*	0.032*				
	(0.019)	(0.019)				
$LEVERAGE1_{i(t-1)}$			-0.013***	-0.013***		
			(0.005)	(0.005)		
$LEVERAGE2_{i(t-1)}$					-0.013	-0.014
					(0.010)	(0.010)
$FOREIGN_{i(t-1)}$	0.247***	0.246***	0.246***	0.245***	0.247***	0.247***
	(0.022)	(0.021)	(0.022)	(0.021)	(0.021)	(0.021)
$TFP^{BUETTNER}_{i(t-1)}$	0.049**	0.050***	0.047**	0.048**	0.050***	0.051***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
$SMALL^{A}_{i(t-1)}$	-0.180***	-0.179***	-0.180***	-0.179***	-0.175***	-0.174***
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.040)
$LARGE^{A}_{i(t-1)}$	0.130***	0.133***	0.131***	0.133***	0.127***	0.130***
	(0.035)	(0.035)	(0.035)	(0.035)	(0.034)	(0.034)
$VLARGE^{A}_{i(t-1)}$	0.248***	0.250***	0.251***	0.253***	0.243***	0.245***
	(0.046)	(0.046)	(0.045)	(0.045)	(0.045)	(0.046)
$wage_{i(t-1)}$	-0.046	-0.048	-0.045	-0.047	-0.047	-0.049
	(0.052)	(0.054)	(0.052)	(0.054)	(0.052)	(0.054)
$SKILL_{i(t-1)}$	-0.011	-0.012	-0.010	-0.012	-0.010	-0.012
	(0.034)	(0.034)	(0.034)	(0.035)	(0.034)	(0.034)
$TRAIN_{i(t-1)}$	0.099***	0.101***	0.097***	0.100***	0.098***	0.101***
	(0.038)	(0.039)	(0.038)	(0.038)	(0.038)	(0.039)
$RDPRODUCT_{i(t-1)}$	0.135***		0.135***		0.135***	
	(0.020)		(0.020)		(0.020)	
$RDPROCESS_{i(t-1)}$		0.097***		0.097***		0.098***
		(0.029)		(0.029)		(0.029)
Observations	6690	6690	6690	6690	6690	6690

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3B.2: The Determinants of a Firm's Decision to Export (Dep. Var. is EX_{it}) with $FOREIGN$ and $TFP^{LABPROD}$

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.046**	0.047**				
	(0.019)	(0.019)				
$LEVERAGE1_{i(t-1)}$			-0.017***	-0.017***		
			(0.005)	(0.005)		
$LEVERAGE2_{i(t-1)}$					-0.024**	-0.025**
					(0.011)	(0.011)
$FOREIGN_{i(t-1)}$	0.240***	0.240***	0.240***	0.239***	0.241***	0.240***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
$TFP^{LABPROD}_{i(t-1)}$	-0.011	-0.011	-0.012	-0.012	-0.011	-0.011
	(0.026)	(0.026)	(0.026)	(0.026)	(0.025)	(0.025)
$SMALL^{A}_{i(t-1)}$	-0.206***	-0.206***	-0.204***	-0.204***	-0.199***	-0.199***
	(0.041)	(0.041)	(0.041)	(0.041)	(0.040)	(0.040)
$LARGE^{A}_{i(t-1)}$	0.144***	0.146***	0.144***	0.146***	0.140***	0.142***
	(0.032)	(0.032)	(0.031)	(0.032)	(0.031)	(0.031)
$VLARGE^{A}_{i(t-1)}$	0.298***	0.300***	0.299***	0.301***	0.291***	0.293***
	(0.040)	(0.041)	(0.040)	(0.040)	(0.040)	(0.040)
$wage_{i(t-1)}$	0.012	0.012	0.013	0.013	0.012	0.012
	(0.043)	(0.044)	(0.043)	(0.044)	(0.043)	(0.044)
$SKILL_{i(t-1)}$	-0.019	-0.020	-0.019	-0.020	-0.019	-0.020
	(0.033)	(0.033)	(0.034)	(0.033)	(0.033)	(0.033)
$TRAIN_{i(t-1)}$	0.112***	0.115***	0.109***	0.113***	0.111***	0.114***
	(0.036)	(0.037)	(0.036)	(0.037)	(0.037)	(0.037)
$RDPRODUCT_{i(t-1)}$	0.133***		0.133***		0.133***	
	(0.013)		(0.013)		(0.013)	
$RDPROCESS_{i(t-1)}$		0.104***		0.104***		0.105***
		(0.027)		(0.027)		(0.027)
Observations	6961	6961	6961	6961	6961	6961

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

3B.1.2 At the 25% Cut-Off Point for Foreign Ownership

Table 3B.3: The Determinants of a Firm's Decision to Export (Dep. Var. is EX_{it}) with $FOREIGN25$ and TFP^{LP}

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.039**	0.039**				
	(0.020)	(0.019)				
$LEVERAGE1_{i(t-1)}$			-0.015***	-0.015***		
			(0.005)	(0.005)		
$LEVERAGE2_{i(t-1)}$					-0.020*	-0.020*
					(0.011)	(0.011)
$FOREIGN25_{i(t-1)}$	0.248***	0.248***	0.248***	0.248***	0.248***	0.248***
	(0.021)	(0.020)	(0.021)	(0.020)	(0.020)	(0.020)
$TFP^{LP}_{i(t-1)}$	0.056***	0.057***	0.054***	0.055***	0.057***	0.058***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
$SMALL^{A}_{i(t-1)}$	-0.194***	-0.193***	-0.193***	-0.192***	-0.188***	-0.187***
	(0.041)	(0.040)	(0.041)	(0.040)	(0.040)	(0.040)
$LARGE^{A}_{i(t-1)}$	0.126***	0.128***	0.126***	0.128***	0.122***	0.124***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
$VLARGE^{A}_{i(t-1)}$	0.255***	0.256***	0.256***	0.257***	0.248***	0.249***
	(0.042)	(0.042)	(0.041)	(0.041)	(0.041)	(0.042)
$wage_{i(t-1)}$	-0.053	-0.055	-0.053	-0.054	-0.054	-0.056
	(0.053)	(0.055)	(0.053)	(0.054)	(0.053)	(0.055)
$SKILL_{i(t-1)}$	-0.020	-0.021	-0.020	-0.021	-0.020	-0.021
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
$TRAIN_{i(t-1)}$	0.100***	0.103***	0.098***	0.102***	0.099***	0.102***
	(0.035)	(0.036)	(0.035)	(0.036)	(0.035)	(0.036)
$RDPRODUCT_{i(t-1)}$	0.129***		0.129***		0.129***	
	(0.012)		(0.011)		(0.012)	
$RDPROCESS_{i(t-1)}$		0.101***		0.100***		0.101***
		(0.027)		(0.027)		(0.027)
Observations	6961	6961	6961	6961	6961	6961

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3B.4: The Determinants of a Firm's Decision to Export (Dep. Var. is EX_{it}) with $FOREIGN25$ and $TFP^{BUETTNER}$

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.034*	0.034*				
	(0.019)	(0.019)				
$LEVERAGE1_{i(t-1)}$			-0.013***	-0.013***		
			(0.005)	(0.005)		
$LEVERAGE2_{i(t-1)}$					-0.014	-0.015
					(0.011)	(0.011)
$FOREIGN25_{i(t-1)}$	0.255***	0.255***	0.255***	0.254***	0.256***	0.255***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
$TFP^{BUETTNER}_{i(t-1)}$	0.051***	0.052***	0.049**	0.050***	0.052***	0.053***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
$SMALL^{A}_{i(t-1)}$	-0.184***	-0.183***	-0.184***	-0.183***	-0.179***	-0.178***
	(0.042)	(0.041)	(0.042)	(0.041)	(0.041)	(0.041)
$LARGE^{A}_{i(t-1)}$	0.129***	0.131***	0.129***	0.132***	0.126***	0.128***
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.033)
$VLARGE^{A}_{i(t-1)}$	0.247***	0.249***	0.250***	0.252***	0.241***	0.243***
	(0.046)	(0.047)	(0.045)	(0.046)	(0.046)	(0.046)
$wage_{i(t-1)}$	-0.049	-0.051	-0.048	-0.050	-0.050	-0.052
	(0.052)	(0.053)	(0.051)	(0.053)	(0.052)	(0.053)
$SKILL_{i(t-1)}$	-0.014	-0.015	-0.013	-0.015	-0.013	-0.015
	(0.034)	(0.035)	(0.034)	(0.035)	(0.034)	(0.034)
$TRAIN_{i(t-1)}$	0.097***	0.100***	0.095***	0.098***	0.096***	0.099***
	(0.037)	(0.037)	(0.036)	(0.037)	(0.037)	(0.038)
$RDPRODUCT_{i(t-1)}$	0.134***		0.134***		0.134***	
	(0.019)		(0.019)		(0.019)	
$RDPROCESS_{i(t-1)}$		0.096***		0.096***		0.096***
		(0.030)		(0.030)		(0.030)
Observations	6690	6690	6690	6690	6690	6690

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3B.5: The Determinants of a Firm's Decision to Export (Dep. Var. is EX_{it}) with $FOREIGN25$ and $TFP^{LABPROD}$

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.049**	0.049**				
	(0.020)	(0.019)				
$LEVERAGE1_{i(t-1)}$			-0.017***	-0.017***		
			(0.005)	(0.005)		
$LEVERAGE2_{i(t-1)}$					-0.025**	-0.026**
					(0.011)	(0.011)
$FOREIGN25_{i(t-1)}$	0.248***	0.248***	0.247***	0.247***	0.248***	0.248***
	(0.020)	(0.019)	(0.020)	(0.019)	(0.019)	(0.019)
$TFP^{LABPROD}_{i(t-1)}$	-0.010	-0.010	-0.010	-0.011	-0.009	-0.010
	(0.026)	(0.026)	(0.026)	(0.026)	(0.025)	(0.026)
$SMALL^{A}_{i(t-1)}$	-0.210***	-0.210***	-0.209***	-0.208***	-0.203***	-0.203***
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.040)
$LARGE^{A}_{i(t-1)}$	0.144***	0.146***	0.144***	0.146***	0.140***	0.142***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
$VLARGE^{A}_{i(t-1)}$	0.299***	0.301***	0.300***	0.302***	0.292***	0.294***
	(0.041)	(0.041)	(0.040)	(0.040)	(0.040)	(0.040)
$wage_{i(t-1)}$	0.010	0.010	0.010	0.010	0.010	0.010
	(0.042)	(0.044)	(0.042)	(0.044)	(0.043)	(0.044)
$SKILL_{i(t-1)}$	-0.022	-0.023	-0.022	-0.022	-0.021	-0.022
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
$TRAIN_{i(t-1)}$	0.110***	0.114***	0.108***	0.111***	0.109***	0.112***
	(0.035)	(0.036)	(0.035)	(0.036)	(0.035)	(0.036)
$RDPRODUCT_{i(t-1)}$	0.132***		0.132***		0.132***	
	(0.012)		(0.012)		(0.012)	
$RDPROCESS_{i(t-1)}$		0.104***		0.103***		0.105***
		(0.027)		(0.027)		(0.027)
Observations	6961	6961	6961	6961	6961	6961

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

3B.1.3 At the 50% Cut-Off Point for Foreign Ownership

Table 3B.6: The Determinants of a Firm's Decision to Export (Dep. Var. is EX_{it}) with $FOREIGN50$ and TFP^{LP}

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.040**	0.040**				
	(0.019)	(0.019)				
$LEVERAGE1_{i(t-1)}$			-0.015***	-0.015***		
			(0.005)	(0.005)		
$LEVERAGE2_{i(t-1)}$					-0.021*	-0.021*
					(0.011)	(0.011)
$FOREIGN50_{i(t-1)}$	0.261***	0.260***	0.260***	0.260***	0.261***	0.261***
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
$TFP^{LP}_{i(t-1)}$	0.058***	0.059***	0.057***	0.058***	0.060***	0.060***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
$SMALL^{A}_{i(t-1)}$	-0.190***	-0.190***	-0.189***	-0.189***	-0.184***	-0.184***
	(0.042)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
$LARGE^{A}_{i(t-1)}$	0.125***	0.127***	0.125***	0.127***	0.121***	0.123***
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
$VLARGE^{A}_{i(t-1)}$	0.251***	0.252***	0.253***	0.254***	0.244***	0.245***
	(0.041)	(0.042)	(0.041)	(0.041)	(0.041)	(0.041)
$wage_{i(t-1)}$	-0.030	-0.032	-0.030	-0.032	-0.032	-0.034
	(0.053)	(0.054)	(0.053)	(0.054)	(0.053)	(0.055)
$SKILL_{i(t-1)}$	-0.021	-0.022	-0.021	-0.022	-0.020	-0.021
	(0.033)	(0.033)	(0.033)	(0.033)	(0.032)	(0.033)
$TRAIN_{i(t-1)}$	0.100***	0.103***	0.098***	0.101***	0.098***	0.101***
	(0.034)	(0.035)	(0.034)	(0.035)	(0.034)	(0.035)
$RDPRODUCT_{i(t-1)}$	0.133***		0.133***		0.133***	
	(0.012)		(0.012)		(0.012)	
$RDPROCESS_{i(t-1)}$		0.106***		0.106***		0.107***
		(0.024)		(0.024)		(0.024)
Observations	6961	6961	6961	6961	6961	6961

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3B.7: The Determinants of a Firm's Decision to Export (Dep. Var. is EX_{it}) with $FOREIGN50$ and $TFP^{BUETTNER}$

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.036*	0.036*				
	(0.019)	(0.019)				
$LEVERAGE1_{i(t-1)}$			-0.014***	-0.014***		
			(0.005)	(0.005)		
$LEVERAGE2_{i(t-1)}$					-0.016	-0.016
					(0.011)	(0.011)
$FOREIGN50_{i(t-1)}$	0.267***	0.266***	0.266***	0.266***	0.267***	0.267***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
$TFP^{BUETTNER}_{i(t-1)}$	0.054***	0.055***	0.053***	0.053***	0.055***	0.056***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.017)	(0.018)
$SMALL^{A}_{i(t-1)}$	-0.181***	-0.180***	-0.180***	-0.179***	-0.175***	-0.174***
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.041)
$LARGE^{A}_{i(t-1)}$	0.128***	0.130***	0.128***	0.131***	0.124***	0.127***
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
$VLARGE^{A}_{i(t-1)}$	0.242***	0.244***	0.244***	0.246***	0.236***	0.238***
	(0.046)	(0.046)	(0.045)	(0.045)	(0.045)	(0.045)
$wage_{i(t-1)}$	-0.026	-0.028	-0.025	-0.027	-0.027	-0.029
	(0.052)	(0.054)	(0.052)	(0.053)	(0.052)	(0.054)
$SKILL_{i(t-1)}$	-0.015	-0.016	-0.015	-0.016	-0.015	-0.016
	(0.033)	(0.034)	(0.033)	(0.034)	(0.033)	(0.034)
$TRAIN_{i(t-1)}$	0.096***	0.099***	0.095***	0.097***	0.095***	0.098***
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.037)
$RDPRODUCT_{i(t-1)}$	0.137***		0.137***		0.136***	
	(0.021)		(0.021)		(0.021)	
$RDPROCESS_{i(t-1)}$		0.103***		0.104***		0.104***
		(0.028)		(0.028)		(0.028)
Observations	6690	6690	6690	6690	6690	6690

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3B.8: The Determinants of a Firm's Decision to Export (Dep. Var. is EX_{it}) with $FOREIGN50$ and $TFP^{LABPROD}$

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.050**	0.050***				
	(0.019)	(0.019)				
$LEVERAGE1_{i(t-1)}$			-0.017***	-0.017***		
			(0.005)	(0.005)		
$LEVERAGE2_{i(t-1)}$					-0.026**	-0.027**
					(0.011)	(0.011)
$FOREIGN50_{i(t-1)}$	0.258***	0.257***	0.257***	0.257***	0.258***	0.258***
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
$TFP^{LABPROD}_{i(t-1)}$	-0.005	-0.006	-0.006	-0.007	-0.005	-0.006
	(0.025)	(0.025)	(0.025)	(0.025)	(0.024)	(0.024)
$SMALL^{A}_{i(t-1)}$	-0.207***	-0.207***	-0.205***	-0.205***	-0.200***	-0.200***
	(0.042)	(0.042)	(0.042)	(0.042)	(0.041)	(0.041)
$LARGE^{A}_{i(t-1)}$	0.143***	0.145***	0.143***	0.145***	0.139***	0.141***
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
$VLARGE^{A}_{i(t-1)}$	0.295***	0.297***	0.296***	0.298***	0.288***	0.290***
	(0.040)	(0.040)	(0.039)	(0.040)	(0.040)	(0.040)
$wage_{i(t-1)}$	0.031	0.031	0.032	0.032	0.031	0.031
	(0.042)	(0.043)	(0.041)	(0.043)	(0.042)	(0.043)
$SKILL_{i(t-1)}$	-0.023	-0.024	-0.022	-0.023	-0.022	-0.023
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
$TRAIN_{i(t-1)}$	0.110***	0.114***	0.108***	0.112***	0.109***	0.112***
	(0.034)	(0.035)	(0.034)	(0.035)	(0.034)	(0.035)
$RDPRODUCT_{i(t-1)}$	0.137***		0.137***		0.137***	
	(0.012)		(0.012)		(0.012)	
$RDPROCESS_{i(t-1)}$		0.110***		0.109***		0.110***
		(0.024)		(0.024)		(0.024)
Observations	6961	6961	6961	6961	6961	6961

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

3B.2 The Determinants of a Firm's Export Sales

3B.2.1 At the 10% Cut-Off Point for Foreign Ownership

Table 3B.9: The Determinants of a Firm's Export Sales (Dep. Var. is $EXSALES_{it}$) with $FOREIGN$ and $TFP^{BUETTNER}$

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.194	0.195				
	(0.115)	(0.114)				
$LEVERAGE1_{i(t-1)}$			-0.057*	-0.056*		
			(0.032)	(0.032)		
$LEVERAGE2_{i(t-1)}$					-0.069	-0.071
					(0.072)	(0.071)
$FOREIGN_{i(t-1)}$	0.756***	0.760***	0.757***	0.761***	0.761***	0.765***
	(0.061)	(0.062)	(0.061)	(0.062)	(0.059)	(0.061)
$TFP^{BUETTNER}_{i(t-1)}$	0.431***	0.427***	0.429***	0.426***	0.431***	0.428***
	(0.095)	(0.094)	(0.096)	(0.095)	(0.093)	(0.092)
$SMALL^{A}_{i(t-1)}$	-0.802***	-0.803***	-0.788***	-0.788***	-0.778***	-0.778***
	(0.169)	(0.171)	(0.167)	(0.169)	(0.167)	(0.169)
$LARGE^{A}_{i(t-1)}$	0.630***	0.636***	0.628***	0.634***	0.618***	0.623***
	(0.094)	(0.094)	(0.095)	(0.094)	(0.096)	(0.095)
$VLARGE^{A}_{i(t-1)}$	1.619***	1.626***	1.609***	1.616***	1.590***	1.597***
	(0.168)	(0.169)	(0.168)	(0.169)	(0.168)	(0.169)
$wage_{i(t-1)}$	-0.537***	-0.539***	-0.533***	-0.535***	-0.545***	-0.547***
	(0.127)	(0.128)	(0.130)	(0.131)	(0.128)	(0.130)
$SKILL_{i(t-1)}$	0.027	0.021	0.027	0.021	0.034	0.028
	(0.127)	(0.128)	(0.128)	(0.129)	(0.128)	(0.129)
$TRAIN_{i(t-1)}$	0.379**	0.390**	0.378**	0.389**	0.382**	0.393**
	(0.179)	(0.180)	(0.179)	(0.180)	(0.181)	(0.182)
$RDPRODUCT_{i(t-1)}$	0.179		0.183		0.178	
	(0.106)		(0.107)		(0.105)	
$RDPROCESS_{i(t-1)}$		-0.039		-0.034		-0.038
		(0.125)		(0.125)		(0.124)
Constant	7.692***	7.645***	7.719***	7.671***	7.742***	7.699***
	(1.338)	(1.356)	(1.344)	(1.363)	(1.276)	(1.295)
Observations	4032	4032	4032	4032	4032	4032

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3B.10: The Determinants of a Firm's Export Sales (Dep. Var. is $EXSALES_{it}$) with $FOREIGN$ and $TFP^{LABPROD}$

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.320**	0.324**				
	(0.131)	(0.130)				
$LEVERAGE1_{i(t-1)}$			-0.093**	-0.094**		
			(0.036)	(0.036)		
$LEVERAGE2_{i(t-1)}$					-0.154*	-0.160*
					(0.088)	(0.087)
$FOREIGN_{i(t-1)}$	0.307***	0.305***	0.311***	0.309***	0.308***	0.306***
	(0.095)	(0.097)	(0.095)	(0.098)	(0.093)	(0.095)
$TFP^{LABPROD}_{i(t-1)}$	0.470***	0.465***	0.468***	0.463***	0.469***	0.464***
	(0.103)	(0.102)	(0.103)	(0.103)	(0.102)	(0.101)
$SMALL^{A}_{i(t-1)}$	-1.032***	-1.036***	-1.009***	-1.013***	-0.992***	-0.996***
	(0.174)	(0.176)	(0.170)	(0.173)	(0.171)	(0.173)
$LARGE^{A}_{i(t-1)}$	0.876***	0.883***	0.872***	0.879***	0.855***	0.862***
	(0.087)	(0.086)	(0.088)	(0.087)	(0.091)	(0.090)
$VLARGE^{A}_{i(t-1)}$	2.264***	2.276***	2.247***	2.259***	2.221***	2.232***
	(0.137)	(0.138)	(0.136)	(0.137)	(0.134)	(0.136)
$wage_{i(t-1)}$	-0.172	-0.171	-0.168	-0.167	-0.183	-0.182
	(0.117)	(0.117)	(0.120)	(0.120)	(0.122)	(0.122)
$SKILL_{i(t-1)}$	0.009	0.001	0.007	0.000	0.020	0.013
	(0.136)	(0.137)	(0.137)	(0.138)	(0.136)	(0.137)
$TRAIN_{i(t-1)}$	0.533***	0.551***	0.531***	0.549***	0.538***	0.556***
	(0.186)	(0.186)	(0.186)	(0.186)	(0.190)	(0.190)
$RDPRODUCT_{i(t-1)}$	0.232**		0.237**		0.228**	
	(0.110)		(0.111)		(0.107)	
$RDPROCESS_{i(t-1)}$		-0.015		-0.010		-0.015
		(0.100)		(0.101)		(0.101)
Constant	9.761***	9.745***	9.804***	9.787***	9.951***	9.945***
	(1.361)	(1.384)	(1.374)	(1.398)	(1.294)	(1.318)
Observations	4217	4217	4217	4217	4217	4217

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

3B.2.2 At the 25% Cut-Off Point for Foreign Ownership

Table 3B.11: The Determinants of a Firm's Export Sales (Dep. Var. is $EXSALES_{it}$) with $FOREIGN25$ and TFP^{LP}

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.227*	0.230*				
	(0.129)	(0.128)				
$LEVERAGE1_{i(t-1)}$			-0.065*	-0.065*		
			(0.037)	(0.037)		
$LEVERAGE2_{i(t-1)}$					-0.102	-0.106
					(0.083)	(0.082)
$FOREIGN25_{i(t-1)}$	0.483***	0.479***	0.481***	0.478***	0.482***	0.478***
	(0.108)	(0.108)	(0.109)	(0.108)	(0.107)	(0.106)
$TFP^{LP}_{i(t-1)}$	0.729***	0.732***	0.730***	0.733***	0.733***	0.736***
	(0.063)	(0.063)	(0.063)	(0.064)	(0.061)	(0.062)
$SMALL^{A}_{i(t-1)}$	-0.940***	-0.943***	-0.923***	-0.926***	-0.911***	-0.914***
	(0.184)	(0.186)	(0.182)	(0.184)	(0.182)	(0.184)
$LARGE^{A}_{i(t-1)}$	0.757***	0.761***	0.754***	0.759***	0.742***	0.746***
	(0.086)	(0.085)	(0.086)	(0.086)	(0.085)	(0.085)
$VLARGE^{A}_{i(t-1)}$	1.895***	1.901***	1.882***	1.888***	1.862***	1.868***
	(0.183)	(0.183)	(0.180)	(0.181)	(0.177)	(0.177)
$wage_{i(t-1)}$	-0.462***	-0.466***	-0.458***	-0.461***	-0.472***	-0.476***
	(0.154)	(0.154)	(0.157)	(0.157)	(0.155)	(0.155)
$SKILL_{i(t-1)}$	0.027	0.021	0.027	0.021	0.035	0.030
	(0.131)	(0.133)	(0.132)	(0.133)	(0.132)	(0.133)
$TRAIN_{i(t-1)}$	0.406**	0.420**	0.405**	0.419**	0.410**	0.423**
	(0.176)	(0.177)	(0.177)	(0.177)	(0.179)	(0.180)
$RDPRODUCT_{i(t-1)}$	0.164*		0.167*		0.161*	
	(0.094)		(0.095)		(0.092)	
$RDPROCESS_{i(t-1)}$		-0.037		-0.034		-0.037
		(0.096)		(0.096)		(0.096)
Constant	10.405***	10.393***	10.439***	10.426***	10.527***	10.521***
	(1.226)	(1.236)	(1.230)	(1.240)	(1.157)	(1.169)
Observations	4217	4217	4217	4217	4217	4217

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3B.12: The Determinants of a Firm's Export Sales (Dep. Var. is $EXSALES_{it}$) with $FOREIGN25$ and $TFP^{BUETTNER}$

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.196*	0.196*				
	(0.113)	(0.112)				
$LEVERAGE1_{i(t-1)}$			-0.057*	-0.056*		
			(0.031)	(0.031)		
$LEVERAGE2_{i(t-1)}$					-0.069	-0.071
					(0.070)	(0.069)
$FOREIGN25_{i(t-1)}$	0.493***	0.490***	0.491***	0.488***	0.493***	0.490***
	(0.109)	(0.109)	(0.110)	(0.110)	(0.108)	(0.107)
$TFP^{BUETTNER}_{i(t-1)}$	0.762***	0.766***	0.763***	0.767***	0.768***	0.771***
	(0.060)	(0.061)	(0.061)	(0.062)	(0.059)	(0.060)
$SMALL^{A}_{i(t-1)}$	-0.792***	-0.793***	-0.778***	-0.779***	-0.768***	-0.768***
	(0.171)	(0.173)	(0.169)	(0.171)	(0.169)	(0.171)
$LARGE^{A}_{i(t-1)}$	0.632***	0.637***	0.630***	0.636***	0.620***	0.625***
	(0.096)	(0.095)	(0.097)	(0.096)	(0.097)	(0.097)
$VLARGE^{A}_{i(t-1)}$	1.618***	1.625***	1.608***	1.614***	1.589***	1.595***
	(0.166)	(0.167)	(0.166)	(0.167)	(0.166)	(0.167)
$wage_{i(t-1)}$	-0.558***	-0.560***	-0.554***	-0.556***	-0.566***	-0.568***
	(0.132)	(0.133)	(0.134)	(0.136)	(0.133)	(0.134)
$SKILL_{i(t-1)}$	0.017	0.011	0.017	0.011	0.023	0.017
	(0.128)	(0.130)	(0.129)	(0.130)	(0.129)	(0.130)
$TRAIN_{i(t-1)}$	0.377**	0.387**	0.375**	0.386**	0.380**	0.390**
	(0.174)	(0.175)	(0.174)	(0.175)	(0.176)	(0.177)
$RDPRODUCT_{i(t-1)}$	0.179		0.182*		0.177*	
	(0.104)		(0.104)		(0.103)	
$RDPROCESS_{i(t-1)}$		-0.030		-0.026		-0.030
		(0.120)		(0.120)		(0.119)
Constant	7.766***	7.722***	7.793***	7.747***	7.813***	7.773***
	(1.358)	(1.372)	(1.362)	(1.377)	(1.294)	(1.310)
Observations	4032	4032	4032	4032	4032	4032

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3B.13: The Determinants of a Firm's Export Sales (Dep. Var. is $EXSALES_{it}$) with $FOREIGN25$ and $TFP^{LABPROD}$

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.324**	0.328**				
	(0.128)	(0.128)				
$LEVERAGE1_{i(t-1)}$			-0.095**	-0.095**		
			(0.035)	(0.035)		
$LEVERAGE2_{i(t-1)}$					-0.157*	-0.162*
					(0.086)	(0.085)
$FOREIGN25_{i(t-1)}$	0.504***	0.501***	0.502***	0.499***	0.502***	0.499***
	(0.118)	(0.117)	(0.118)	(0.118)	(0.117)	(0.116)
$TFP^{LABPROD}_{i(t-1)}$	0.313***	0.311***	0.317***	0.315***	0.314***	0.312***
	(0.094)	(0.096)	(0.094)	(0.097)	(0.092)	(0.094)
$SMALL^{A}_{i(t-1)}$	-1.026***	-1.030***	-1.002***	-1.006***	-0.985***	-0.989***
	(0.177)	(0.180)	(0.173)	(0.176)	(0.174)	(0.176)
$LARGE^{A}_{i(t-1)}$	0.882***	0.889***	0.879***	0.886***	0.862***	0.868***
	(0.089)	(0.088)	(0.091)	(0.090)	(0.093)	(0.092)
$VLARGE^{A}_{i(t-1)}$	2.271***	2.282***	2.253***	2.264***	2.227***	2.238***
	(0.135)	(0.136)	(0.134)	(0.135)	(0.132)	(0.134)
$wage_{i(t-1)}$	-0.185	-0.185	-0.181	-0.181	-0.197	-0.196
	(0.124)	(0.124)	(0.126)	(0.126)	(0.129)	(0.129)
$SKILL_{i(t-1)}$	-0.004	-0.011	-0.005	-0.012	0.008	0.001
	(0.137)	(0.138)	(0.138)	(0.139)	(0.137)	(0.139)
$TRAIN_{i(t-1)}$	0.530***	0.548***	0.528***	0.546***	0.536***	0.553***
	(0.181)	(0.180)	(0.181)	(0.181)	(0.185)	(0.185)
$RDPRODUCT_{i(t-1)}$	0.228**		0.233**		0.224**	
	(0.107)		(0.108)		(0.105)	
$RDPROCESS_{i(t-1)}$		-0.008		-0.003		-0.008
		(0.101)		(0.101)		(0.101)
Constant	9.795***	9.782***	9.839***	9.824***	9.987***	9.983***
	(1.394)	(1.412)	(1.404)	(1.423)	(1.326)	(1.345)
Observations	4217	4217	4217	4217	4217	4217

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

3B.2.3 At the 50% Cut-Off Point for Foreign Ownership

Table 3B.14: The Determinants of a Firm's Export Sales (Dep. Var. is $EXSALES_{it}$) with $FOREIGN50$ and TFP^{LP}

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.219	0.222*				
	(0.127)	(0.127)				
$LEVERAGE1_{i(t-1)}$			-0.064*	-0.065*		
			(0.037)	(0.037)		
$LEVERAGE2_{i(t-1)}$					-0.094	-0.098
					(0.081)	(0.081)
$FOREIGN50_{i(t-1)}$	0.679***	0.674***	0.680***	0.675***	0.679***	0.674***
	(0.143)	(0.143)	(0.142)	(0.141)	(0.141)	(0.140)
$TFP^{LP}_{i(t-1)}$	0.733***	0.737***	0.734***	0.738***	0.738***	0.741***
	(0.063)	(0.063)	(0.063)	(0.064)	(0.063)	(0.063)
$SMALL^{A}_{i(t-1)}$	-0.917***	-0.921***	-0.901***	-0.904***	-0.890***	-0.893***
	(0.182)	(0.185)	(0.180)	(0.183)	(0.181)	(0.183)
$LARGE^{A}_{i(t-1)}$	0.734***	0.738***	0.731***	0.736***	0.720***	0.724***
	(0.089)	(0.089)	(0.090)	(0.089)	(0.089)	(0.089)
$VLARGE^{A}_{i(t-1)}$	1.862***	1.869***	1.850***	1.857***	1.830***	1.837***
	(0.186)	(0.186)	(0.184)	(0.184)	(0.180)	(0.181)
$wage_{i(t-1)}$	-0.467***	-0.470***	-0.463***	-0.466***	-0.476***	-0.480***
	(0.161)	(0.161)	(0.163)	(0.163)	(0.161)	(0.162)
$SKILL_{i(t-1)}$	0.028	0.022	0.027	0.022	0.036	0.030
	(0.124)	(0.125)	(0.124)	(0.126)	(0.125)	(0.126)
$TRAIN_{i(t-1)}$	0.418**	0.432**	0.417**	0.431**	0.421**	0.435**
	(0.176)	(0.177)	(0.176)	(0.177)	(0.179)	(0.180)
$RDPRODUCT_{i(t-1)}$	0.173*		0.177*		0.171*	
	(0.092)		(0.093)		(0.090)	
$RDPROCESS_{i(t-1)}$		-0.027		-0.024		-0.027
		(0.095)		(0.096)		(0.095)
Constant	10.332***	10.319***	10.370***	10.357***	10.442***	10.436***
	(1.261)	(1.271)	(1.263)	(1.274)	(1.193)	(1.206)
Observations	4217	4217	4217	4217	4217	4217

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3B.15: The Determinants of a Firm's Export Sales (Dep. Var. is $EXSALES_{it}$) with $FOREIGN50$ and $TFP^{BUETTNER}$

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.185	0.185				
	(0.111)	(0.111)				
$LEVERAGE1_{i(t-1)}$			-0.055*	-0.055		
			(0.032)	(0.032)		
$LEVERAGE2_{i(t-1)}$					-0.060	-0.061
					(0.069)	(0.067)
$FOREIGN50_{i(t-1)}$	0.696***	0.692***	0.696***	0.692***	0.697***	0.693***
	(0.138)	(0.137)	(0.137)	(0.137)	(0.135)	(0.135)
$TFP^{BUETTNER}_{i(t-1)}$	0.769***	0.772***	0.769***	0.773***	0.775***	0.778***
	(0.059)	(0.061)	(0.060)	(0.061)	(0.059)	(0.060)
$SMALL^{A}_{i(t-1)}$	-0.764***	-0.765***	-0.751***	-0.752***	-0.741***	-0.741***
	(0.176)	(0.178)	(0.175)	(0.177)	(0.175)	(0.177)
$LARGE^{A}_{i(t-1)}$	0.608***	0.613***	0.606***	0.612***	0.597***	0.602***
	(0.100)	(0.099)	(0.101)	(0.100)	(0.102)	(0.101)
$VLARGE^{A}_{i(t-1)}$	1.580***	1.587***	1.571***	1.577***	1.552***	1.559***
	(0.173)	(0.173)	(0.173)	(0.174)	(0.173)	(0.174)
$wage_{i(t-1)}$	-0.566***	-0.568***	-0.562***	-0.565***	-0.573***	-0.575***
	(0.140)	(0.141)	(0.142)	(0.144)	(0.141)	(0.142)
$SKILL_{i(t-1)}$	0.017	0.011	0.017	0.011	0.023	0.018
	(0.120)	(0.122)	(0.121)	(0.122)	(0.121)	(0.123)
$TRAIN_{i(t-1)}$	0.391**	0.401**	0.389**	0.400**	0.393**	0.404**
	(0.175)	(0.176)	(0.175)	(0.176)	(0.177)	(0.178)
$RDPRODUCT_{i(t-1)}$	0.185*		0.188*		0.183*	
	(0.102)		(0.102)		(0.101)	
$RDPROCESS_{i(t-1)}$		-0.018		-0.013		-0.017
		(0.125)		(0.125)		(0.124)
Constant	7.686***	7.645***	7.719***	7.676***	7.719***	7.681***
	(1.394)	(1.408)	(1.396)	(1.410)	(1.331)	(1.347)
Observations	4032	4032	4032	4032	4032	4032

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3B.16: The Determinants of a Firm's Export Sales (Dep. Var. is $EXSALES_{it}$) with $FOREIGN50$ and $TFP^{LABPROD}$

	(1)	(2)	(3)	(4)	(5)	(6)
$LIQUIDITY_{i(t-1)}$	0.315**	0.320**				
	(0.126)	(0.126)				
$LEVERAGE1_{i(t-1)}$			-0.094**	-0.094**		
			(0.036)	(0.036)		
$LEVERAGE2_{i(t-1)}$					-0.148*	-0.154*
					(0.084)	(0.083)
$FOREIGN50_{i(t-1)}$	0.698***	0.693***	0.699***	0.693***	0.697***	0.691***
	(0.151)	(0.150)	(0.148)	(0.147)	(0.147)	(0.146)
$TFP^{LABPROD}_{i(t-1)}$	0.325***	0.323***	0.328***	0.326***	0.327***	0.324***
	(0.091)	(0.093)	(0.092)	(0.094)	(0.090)	(0.092)
$SMALL^{A}_{i(t-1)}$	-1.003***	-1.007***	-0.980***	-0.984***	-0.964***	-0.967***
	(0.178)	(0.181)	(0.174)	(0.177)	(0.175)	(0.178)
$LARGE^{A}_{i(t-1)}$	0.858***	0.866***	0.855***	0.862***	0.839***	0.846***
	(0.094)	(0.093)	(0.095)	(0.094)	(0.098)	(0.097)
$VLARGE^{A}_{i(t-1)}$	2.236***	2.248***	2.219***	2.231***	2.194***	2.205***
	(0.138)	(0.138)	(0.136)	(0.137)	(0.135)	(0.136)
$wage_{i(t-1)}$	-0.197	-0.196	-0.193	-0.193	-0.207	-0.207
	(0.129)	(0.128)	(0.130)	(0.130)	(0.133)	(0.133)
$SKILL_{i(t-1)}$	-0.004	-0.011	-0.005	-0.012	0.008	0.001
	(0.130)	(0.132)	(0.131)	(0.133)	(0.131)	(0.132)
$TRAIN_{i(t-1)}$	0.542***	0.560***	0.540***	0.558***	0.548***	0.565***
	(0.181)	(0.181)	(0.181)	(0.181)	(0.185)	(0.185)
$RDPRODUCT_{i(t-1)}$	0.238**		0.243**		0.234**	
	(0.105)		(0.106)		(0.102)	
$RDPROCESS_{i(t-1)}$		0.002		0.007		0.002
		(0.101)		(0.102)		(0.101)
Constant	9.684***	9.670***	9.734***	9.720***	9.863***	9.859***
	(1.420)	(1.438)	(1.428)	(1.447)	(1.356)	(1.375)
Observations	4217	4217	4217	4217	4217	4217

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

4

Multi-Product Firms and Exporting

4.1 Introduction

The study of international trade has been transformed by the modelling of firm heterogeneity, productivity and exporting (see e.g. Hopenhayen 1992, Melitz 2003, Yeaple 2005, Melitz and Ottaviano 2005 and Bernard *et al.* 2007b).[1] What the early literature failed to take into account was that world production and trade is dominated by multi-product firms which has led to recent developments in both the theoretical and empirical literature (Baldwin and Gu 2005, Bernard *et al.* 2006a, Bernard *et al.* 2007a, Eckel and Neary 2006, Nocke and Yeaple 2006 and Iacovone and Javorcik 2008) although the empirics still has some way to go to catch up and is the literature to which this chapter contributes.

The importance of multi-product firms was first revealed for the US by Bernard *et al.* (2005) and (2006a) who show that 41 percent of firms produce more than one product but that multi-

[1] For a recent survey of the exporting and productivity literature see Tybout (2003) and Greenaway and Kneller (2007).

product firms account for 91 percent of total output while multi-product exporters account for more than 95 percent of total exports.[2] An important element of firm heterogeneity therefore is how firms cope with expanding or contracting their product range in response to changes in trading conditions.

However, detailed investigations of the multi-product firm phenomenon are limited and almost exclusively concentrated on developed countries. Yet, the role of foreign firms in developing countries is considered a crucial part of the development story with developing countries becoming increasingly aggressive in their approach to attracting FDI.[3] Thus, gaining an understanding of the dynamics of introducing new products at the firm level and how government policy can influence the export structure of firms is of direct policy relevance.

In this chapter, we examine the role of multi-product firms in a developing country, in this case Thailand. A first pass of the data suggests that there are both similarities and dissimilarities with the US. For Thailand, 43 percent of firms produce more than one product (compared to the 41 percent figure for the US). However, 57 percent of output is produced by multi-product firms and 52 percent of total exports are from firms that export multiple products (compared to the US figures of 91 and 95 percent respectively). The headline figures for the production and exporting share are clearly of a different magnitude to the figures that Bernard *et al.* (2006) find for the US. The smaller output percentage for Thailand hints at the differences in the behaviour

[2] These stylised facts have led to a renewed interest in the differentiated products and trade literature (see e.g. Linder 1961, Falvey 1981, Falvey and Kierzowski 1987, Flam and Helpman 1987 and Shaked and Sutton 1987) as evidenced by recent empirical work by Hummels and Klenow (2005), Hallak (2006) and Hallak and Schott (2008).
[3] Indeed, a growing literature examines the impact of FDI on developing countries and increasingly whether such policies are worthwhile (see e.g., Bergsman and Shen 1996, Blömstrom and Kokko, 1998, Aitkin and Harrison 1999 and Lall and Narula 2004).

of firms in developed and developing countries certainly in terms of the size distribution of firms.[4]

In the trade literature, the traditional approach to modelling the impact of trade liberalisation on an economy is to assume single-product firms with any intra-firm adjustment taking place in the scale of production with no role for multi-product production. Thus, the prediction of a positive relationship between firm size and the ratio between a firm's market value and its book value (Tobin's Q) contrary to a lot of the empirical evidence.[5] The industrial organisation (IO) literature on the other hand has been quicker to embrace the study of multi-product firms (see e.g. Brander and Eaton 1984, Baldwin and Ottaviano 2001, Johnson and Myatt 2003, and Allanson and Montagna 2005). However, the IO literature does not examine the export behaviour of firms and more specifically the export profile of firms.

So if we want to understand the dynamics of a newly industrialised country such as Thailand why is it important to make the distinction between single and multi-product firms? First, one of the arguments put forward to justify FDI subsidies and tax breaks for foreign firms is to enable governments of developing countries to attract firms and to subsequently benefit from technology and knowledge spillovers to local firms and workers. From a spillover perspective, multi-product firms are likely to be more attractive as logically the greater the number of

[4] We must be careful when making comparisons between our results and Bernard *et al.* (2005, 2006a) as the definition of whether a firm is multiple product or not depends crucially on what constitutes an individual product. The greater the level of disaggregation, the larger the number of multi-product firms. This is synonymous with the categorical aggregation problem that has plagued the intra-industry trade (IIT) literature (Caves 1981). In this chapter, we define a product according to the equivalent of the 5-digit ISIC compared to Bernard *et al.* (2006a) who use a 5-digit US SIC classification and Bernard *et al.* (2005) who use a 10-digit Harmonised System (HS) classification to measure their output and export statistics respectively and is probably one explanation for at least some of the difference in our headline figures. Indeed, given these numbers come from different aggregation levels one should not draw conclusions from their relative magnitudes. The SIC 5-digit data consists of around 1800 products whilst the HS 10-digit data contains 8500 products of which two thirds are from the manufacturing sector. The data reveal that firms produce across four and even two-digit industries and that the product distribution tends to be highly skewed where for example, exports of one product in a multi-product firm may account for considerably more than 50 percent of total exports. See Bernard *et al.* (2006a) for further discussion.

[5] See Nocke and Yeaple (2006) for further discussion on the relationship between Tobin's Q and firm size where firms with lower marginal costs have larger sales and have a higher Tobin's Q even though the empirical evidence suggests a negative relationship (see e.g. Lang and Stulz 1994).

products produced, the wider the range of technologies employed and thus the greater the likelihood that domestic firms will benefit from technology and knowledge spillovers. The process of a firm becoming multi-product is also associated with process and product R&D as firms seek to develop new products and methods of production. R&D is also strongly associated with positive spillovers from FDI.

Second, the growth through exporting route has proved to be particularly successful in the past as experienced by many East Asian countries over the last two decades. Thus, governments, if given a choice, are likely to prefer investment from foreign firms that produce more than one product, ideally for export. Finally, multi-product firms may be more attractive to host governments as such firms should exhibit less susceptibility to demand shocks as the risk from, for example, changes in fashion or advances in product specific technology, is spread over a variety of exports and possibly export markets. Hence, domestic employment change may benefit from being smoothed. Thus, an analysis of the structure of foreign firms and the characteristics of firms that produce multiple products provides a useful insight into the role played by MNEs in developing countries.

One result from the existing firms and exporting literature is that size matters, with large firms more likely to export. It is therefore important for a developing country to attract firms of a certain size.[6] Thus, in this chapter, we examine two specific aspects of the multi-product and development question. In the first stage, we examine the relationship between multi-product firms' extensive margins (number of products produced or exported) and intensive margins (output or export sales per product). Given that globalization or changes in trade barriers or

[6] Tybout (2003) in his survey of the firm-level literature concludes that whilst exporters are a minority, exporters tend to be larger and more productive although these firms still only export a small percentage of their total output. Eaton *et al.* (2004) in a firm-level study of export destinations for France concurred that there is significant heterogeneity across firms in the extent of their export participation with the number of firms selling to multiple markets declining with the number of destinations. Approximately 17 percent of French firms export with over 34 percent exporting to just one country.

trade costs will lead to intra-firm adjustment along firms' extensive and intensive margins we examine how this relationship affects the distribution in firm size. In addition, we examine the correlation between firms' extensive and intensive margins. Our first stage results show, in contrast to Bernard *et al.* (2006b), that in Thailand there is little variance between firms' extensive margins and total output or total export sales. In addition, the relationship between the intensive and extensive margins are mixed when different definitions of the two variables are used. We find a negative correlation in production but a positive correlation in exports.

In the second stage of the chapter, we examine the characteristics associated with multiple product producers making a distinction between domestic and foreign-owned firms. Our second stage results show that being a multi-product firm and the number of products produced are associated with various firm characteristics including export status, TFP and R&D status. Comparing domestic and foreign firms, we observe some systematic differences in both the factors that are related to being a multi-product firm and the number of products produced. Overall, a complex picture of the behaviour of MNEs in developing countries emerges where foreign-owned firms that export are strongly associated with being multi-product but foreign firms that only serve the domestic market show a strong negative partial correlation with being multi-product. These factors might explain, in part, why evidence for knowledge diffusion and productivity spillovers is less widespread that one might have imagined. Thus, our finding for a significant proportion of foreign-owned firms supplied only the domestic market and produced just a single product is an interesting new stylised fact not previously highlighted in the literature.

The structure of the remainder of this chapter is organised as follows. Section 4.2 presents an overview of the theoretical and empirical literature. Section 4.3 describes the data. In section 4.4, we discuss our empirical model and present the results of our intensive and extensive margins analysis while section 4.5 presents our results examining the characteristics of those

firms that produce multiple products and the factors related to the number of goods produced. Section 4.6 concludes.

4.2 Literature Review

Various models have been developed to explain trade at the firm level. A widely cited paper is Melitz (2003) who uses productivity differences across firms to develop a firm-level model of intra-industry trade and exporting where firms produce horizontally differentiated goods. The model assumes that the production function has a single factor of production and shows that trade liberalisation through a reduction in trade barriers would reduce the export productivity cut-off, increase benefits to exporting and persuade more productive firms to enter the market. Using a comparative advantage framework, Bernard *et al.* (2007b) point out that resource reallocation within and across industries leads to increases in industry productivity and sector outputs of the comparative advantage industries compared to industries with a comparative disadvantage because the former are more likely to become exporters. These two models however, says nothing about the role of multi-product firms.

One of the first papers to consider such a role was Baldwin and Ottaviano (2001) who develop a model to explain the behaviour of multi-product firms in intra-industry FDI and intra-industry trade. Because of trade costs, multi-product firms engage in FDI by producing some products abroad in order to reduce inter-variety competition. Although FDI and exports are substitutes they may also generate some reverse imports of those varieties manufactured abroad. In the heterogeneous firm model by Bernard *et al.* (2003) which is essentially an extension of the Ricardian model, a reduction in trade barriers or trade costs induces an increase in productivity

because of an expansion of high productivity firms with low-productivity firms exiting the market.

In contrast, Bernard *et al.* (2006b) present a general equilibrium model of firm dynamics with heterogeneous firms and endogenous entry and exit of firms. They assume the productivity of the firm for each single product to be fixed. When trade is liberalised, a reduction in trade costs leads to a reallocation of resources and therefore increases firm-level and industry-level productivity. Firms produce and export the most successful products (high-expertise products) rather than low-productivity products. The model predicts and the authors find a positive correlation between firms' intensive (the output per product) and extensive (the number of products) margins which indicates that the production for the export market is enlarged not only through an increase in the number of varieties sold abroad but also through an increase in exports per product.[7] This result is driven by the interaction between general competencies (ability) and product specific abilities (expertise). Thus, following trade liberalisation, exporting firms expand the range of the products to be exported whilst simultaneously contracting the range of products that they choose to produce.

In a recent paper, Eckel and Neary (2006) present a general equilibrium model of multi-product firms with oligopolist behaviour and address the role of the adjustment processes within multi-product firms and the relationship with factor and goods markets. Specifically, they analyse how firms react to shocks and the affect of these shocks not only on wages and labour demand but also on the number of products a firm produces highlighting the role of flexible manufacturing. Their results suggest that in a multi-product framework firms may adjust their scale of output and number of varieties produced instead of in the traditional trade literature that only allow entry and exit in response to shocks. One distinguishing feature of Eckel and Neary (2006) is

[7] In the model, the relationship between extensive and intensive margins can be negatively correlated if there are diseconomies of scope or inefficiency in monitoring various production process (Bernard *et al.*, 2006b).

the emphasis on "core competences" with one variety being able to be produced more efficiently than varieties that lie outside this core competency. This means firms are free to expand their production lines but the process is subject to diseconomies of scope and cost heterogeneities. Such costs differences allow cannibalisation to occur in response to shocks.

Similarly, Nocke and Yeaple (2006) develop a theoretical model with multi-product firms in order to analyse the effect of globalisation through trade liberalisation on firm scope assuming that the relationship between marginal costs of each product variety and the number of varieties of each firm are positively correlated. They find that globalisation and trade liberalisation affect firms' productivity because the marginal costs are endogenously determined. If new product lines are added, less of each good will be produced therefore firms face higher marginal costs of production that causes a reduction in the TFP of existing product lines. Hence, multilateral trade liberalisation should result in a less skewed firm size distribution with large firms shrinking and small firms increasing their product lines respectively. Crucially, in contrast to Bernard *et al.* (2006b) their model predicts a negative correlation between firms' intensive and extensive margins.

Feenstra and Ma (2007) develop a monopolistic competition model that emphasises the optimal choice of product scope for multi-product firms. Each firm chooses their product scope and, at the same time, has to be concerned about cannibalisation effects of their own sales. The model shows that when a country opens to trade, the less efficient firms exit the market while large and high productive firms remain and produce a greater variety of products.

In the majority of cases, models attempt to explain the stylised facts of the US international trade and to address the difference between exporters and non-exporters where exporters are assumed to have higher employment, output, value added per worker and productivity compared to non-exporters (Bernard *et al.,* 2007a). One of the first empirical papers was

Bernard *et al.* (2006b) who investigate the relationship between multi-product firms and exporting by testing firms' intensive and extensive margins using the US 1997 Manufacturing Census data. The empirical results show that exporters produce a greater variety of products than non-exporters. In addition, a positive and significant relationship between the intensive margin and an export dummy indicates that exporters produce more output per product more than non-exporters.

In Bernard *et al.* (2007a), a gravity equation framework is employed to examine the relationship between bilateral distance and firms' extensive or intensive margins. Using US data, the results show that distance to trading partner decreases both the number of exporting firms and number of exported products but increases the average export value.

In Bernard *et al.* (2006a), adjustment to firms' extensive margins suggests that the number of products can be changed through resource reallocation. The concept of adding and dropping particular products is based on productivity differences across products. Bernard *et al.* (2006a) find a positive relationship between a firm's productivity and the number of products. Productive firms self-select to produce additional products whereas firms are likely to drop later-birth products and the less-productive products, compared to other firms that produce similar products. In addition, they also find that multiple product firms are larger and more productive than single-product firms.

For developing countries there are four studies of interest. First, Brambilla (2006) presents a model of multi-product firms using a production function of the number of product varieties, a cost function of production technology and the maximisation of expected profits in order to explain how many varieties each firm decides to produce. The relationship between the structure of ownership and the number of product varieties among multi-product firms in China's manufacturing sector is then examined. Because foreign- and domestically-owned firms

face different costs of product development and have different technology and product efficiencies they show that the majority-owned foreign firms introduce more new varieties compared to private domestic firms.

Second, Eaton *et al.* (2007) investigate the variation in a country's exports using Colombian data. Total exports are a composition of the varieties sold (extensive margin) and average sales (intensive margin). They find that an increase in the total export value of Colombia affects over 50 percent more firms. They also examine the export dynamics of continuing firms, entrants and those that exit. Total export sales of new exporters are relatively small with most of the export revenue coming from a small number of very large stable exporters.

Third, Iacovone and Javorcik (2008) analyse the behaviour of multi-product exporters using Mexican data. The majority of firms in Mexico do not export while the exporting firms seem to concentrate on the export of only a few products. They find that a reduction in trade costs affects the adjustment of exporting at the product level. For new firms that enter export markets, they are likely to export on a small scale in terms of value and the number of products exported. They also found a positive correlation between extensive and intensive margins in exporting consistent with the Bernard *et al.* (2006b).

Finally, Goldberg *et al.* (2008) employ a detailed firm-level data from India to explain the characteristics of multi-product firms and importance of allocation of resources within firm-level adjustment by changing their product mix. Although India and the US are at different stages of development, the patterns and characteristics of multi-product firms in both countries appeared to be relatively similar. In regards to the extensive and intensive margins, the positive relationship is in line with the theoretical predictions and empirical evidence by Bernard *et al.* (2006b).

4.3 Data

In this chapter, we use the same data set as Chapters two and three which is the Annual Survey of Thailand's manufacturing industry by the OIE for the period between 2001 and 2004. One significant advantage of this data is that we are able to identify the number of products a firm produces. Our product classification is based loosely on ISIC classifications of what constitutes a product and are based on the question in the survey that asks the firms to "list the products that you produce". We believe this approximates to a 5-digit product classification.[8]

Tables 4A.1 and 4A.2 of the Appendix 4A provide details of definitions and descriptive statistics, respectively. The raw correlations presented in Table 4A.3 show that being a multi-product firm and the number of products produced have positive correlations with export status, foreign ownership, productivity, R&D wage and firm size.

Table 4.1 provides a summary of our two-digit ISIC data for the four years of our sample 2001 to 2004. The sectors that have a high percentage of exporting firms of more than 70 percent are ISIC 18 (Wearing Apparel; dressing and dying of fur), ISIC 32 (Radio, television and communication equipment) and ISIC 36 (Furniture). In 17 out of 22 two-digit ISIC sectors we observe an increase in the proportion of firms that export with ISIC 34 (Motor vehicles, trailers & semi-trailers) showing the largest increase in exports during this period.

In Table 4.2, we present the share of output and the share of firms that produce single and multiple products across various groupings. When we consider all firms, we see that the majority of firms produce only one product (57.12 percent) with 17.81 percent producing two

[8] Our method of product identification was to match the product lists with the ISIC 5-digit classification list by visual inspection.

products and only 9.15 percent producing five or more products.[9] However, those 57.12 percent of firms only produce around 43 percent of total output with the 9.15 percent of firms producing five or more products producing 15 percent of total output. If we compare foreign and domestic firms we observe that a larger proportion of domestic firms produce just one product. Thus, consistent with Bernard *et al.* (2006b) we find that foreign firms have a higher likelihood of being multi-product and a higher share of output with 17.25 percent of firms producing five or more products. Comparing exporters and non-exporters is also illuminating where we find an even greater difference with 61.16 percent of non-exporters and only 53.15 percent of exporters producing a single product.

Finally, we introduce a final complication by making a distinction between foreign-owned exporters and non-exporters. We find that 68 percent of foreign non-exporters produce a single product. The fact that approximately one fifth of foreign firms do not export is a stylised fact that we believe has not been previously highlighted in the literature where foreign firms are almost considered to be exporters almost by definition. This insight adds a layer of complexity to our analysis and hints at a more subtle relationship between foreign firms and the benefits accrued to the host country.

[9] Our figures are broadly consistent with a study by Goldberg *et al.* (2008) who find that in India the single product and multi-product firms account for 53 and 47 percent respectively of manufacturing firms.

Table 4.1: Share of Exporting Firms by two-digit ISIC

ISIC Rev. 3	Industry	2001	2002	2003	2004
15	Food products & beverages	49.96 (301)	48.82 (289)	51.39 (278)	54.44 (245)
16	Tobacco products	16.67 (1)	16.67 (1)	20.00 (1)	0.00 (0)
17	Textiles	34.55 (133)	35.81 (130)	38.06 (118)	38.13 (114)
18	Wearing apparel; dressing & dyeing of fur	76.33 (216)	76.63 (200)	77.73 (178)	72.82 (142)
19	Tanning & dressing of leather; manufacture of luggage, handbags, saddler, harness & footwear	64.91 (74)	63.89 (69)	67.65 (69)	65.17 (58)
20	Wood & products of wood and cork, except furniture; manufacture of articles of straw & plaiting materials	44.05 (37)	45.45 (35)	47.83 (33)	44.26 (27)
21	Paper and paper products	40.59 (41)	42.27 (41)	41.24 (40)	36.78 (32)
22	Publishing, printing & reproduction of recorded media	10.69 (14)	9.60 (12)	11.97 (14)	12.26 (13)
23	Coke, refined petroleum products & nuclear fuel	66.67 (8)	62.50 (5)	50.00 (3)	80.00 (4)
24	Chemicals & chemical products	52.87 (129)	53.78 (128)	57.14 (124)	57.92 (106)
25	Rubber & plastics products	45.92 (169)	46.94 (169)	49.26 (166)	51.68 (154)
26	Other non-metallic mineral products	32.31 (116)	33.64 (109)	32.54 (96)	37.60 (91)
27	Basic metals	34.34 (34)	33.33 (32)	33.33 (30)	40.26 (31)
28	Fabricated metal products, except machinery & equipment	42.36 (86)	43.62 (82)	44.69 (80)	43.40 (69)
29	Machinery & equipment n.e.c.	49.25 (99)	51.67 (93)	52.84 (93)	54.60 (89)
30	Office, accounting & computing machinery	63.41 (26)	62.50 (20)	60.87 (14)	52.17 (12)
31	Electrical machinery & apparatus n.e.c.	43.62 (65)	43.15 (63)	42.52 (54)	44.19 (57)
32	Radio, television & communication equipment & apparatus	75.95 (120)	79.08 (121)	78.08 (114)	74.26 (101)
33	Medical, precision and optical instruments, watches & clocks	47.76 (32)	50.85 (30)	47.27 (26)	50.00 (22)
34	Motor vehicles, trailers & semi-trailers	46.53 (47)	49.48 (48)	59.09 (78)	65.60 (82)
35	Other transport equipment	48.84 (21)	51.22 (21)	54.05 (20)	41.38 (12)
36	Furniture; manufacturing n.e.c.	74.43 (163)	73.43 (152)	77.83 (158)	77.27 (136)
37	Recycling	25.00 (4)	30.77 (4)	33.33 (4)	28.57 (4)
	Total industry	48.10 (1,936)	49.16 (1,854)	51.10 (1,791)	51.78 (1,601)

Note: Numbers of exporting observation are reported in parentheses.

Table 4.2: Share of Firms and Output for Different Groups by Product Distributions

Number products produced	All Firms		Domestic Firms		Foreign Firms		Non-Exporting Firms		Exporting Firms		Foreign Non-Exporting Firms		Foreign Exporting Firms	
	Share Firms	Share Output	Share Firms	Share Output	Share Firms	Share of Output	Share Firms	Share Output	Share Firms	Share of Output	Share Firms	Share of Output	Share Firms	Share of Output
1	57.12	43.02	58.17	42.49	54.37	43.31	61.16	52.63	53.15	40.54	68.29	48.34	50.85	42.75
	(5,438)		(4,001)		(1,437)		(2,883)		(2,555)		(364)		(1,073)	
2	17.81	19.79	16.89	20.19	20.20	19.58	16.31	20.79	19.28	19.57	16.70	22.76	21.09	19.21
	(1,696)		(1,162)		(534)		(769)		(927)		(89)		(445)	
3	9.16	13.74	9.57	16.91	8.10	11.42	8.59	17.14	9.71	12.95	6.38	21.99	8.53	10.25
	(872)		(658)		(241)		(405)		(467)		(34)		(180)	
4	6.76	8.66	6.54	8.87	7.34	8.44	5.11	4.59	8.38	9.60	3.75	3.51	8.25	9.01
	(644)		(450)		(194)		(241)		(403)		(20)		(174)	
5+	9.15	14.79	8.83	11.54	9.99	17.25	8.82	4.85	9.47	17.33	4.88	3.41	11.28	18.78
	(871)		(607)		(264)		(416)		(455)		(26)		(238)	
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	(9,521)		(6,878)		(2,643)		(4,714)		(4,807)		(533)		(2,110)	

Note: Numbers of observation are reported in parentheses.

4.4 Multi-Product Firms' Intensive and Extensive Margins

As previously noted, multi-product firms in Thailand produce 57 percent of total output while firms that export multiple products account for over 52 percent of total export sales. Bernard *et al.* (2006b) investigate this phenomenon for multi-product firms in the US by examining the contribution of firms' extensive margins to firm-size distribution. Similarly, Yeaple (2005) argues that large firms are responsible for much in the variation in sales across firms managing product lines much more actively than small firms. This line of thinking is matched by Berger and Ofek (1995) who find that single-product firms have large sales per product than multi-product firms. In this section we follow the methodology of Bernard *et al.* (2006b) to examine the relationship between intensive and extensive margins and size distribution for a newly industrialising country where the importance of attracting large MNEs is often part of government industrial policy.

Bernard *et al.* (2006b) begin with a cross-section estimation. The basic framework for firm-size distribution is to identify a firm's extensive (number of products) and intensive (output per product) margins. In this chapter, we have a panel estimation so the relationship is presented in Equation (4.1):

$$Y_{it} = n_{it}\overline{y}_{it} \tag{4.1}$$

where Y_i is firm size measured by total output of each individual firm.

n_i is the number of products produced by firm.

$\overline{y}_i$ is the average output per product that is defined as $\overline{y}_{it} \equiv \frac{1}{n_{it}} \sum_p y_{pit}$.

The subscripts i, t and p denote firm, time and product respectively. The relationship between firm size and multiple product firms requires a knowledge of how firm size varies. By taking the log of Equation (4.1), the model can be separated into two regressions for firms' intensive and extensive margins as a function of the log of total output,

$$\ln n_{it} = \delta_1 + \beta_1 \ln Y_{it} + \mu_{it} \tag{4.2}$$

$$\ln \overline{y}_{it} = \delta_2 + \beta_2 \ln Y_{it} + \varepsilon_{it} \tag{4.3}$$

where μ_{it} and ε_{it} denote stochastic errors and by using OLS estimation techniques, $\beta_1 + \beta_2 = 1$. Thus the coefficient of β_1 captures the partial correlation between total output and the extensive margin and β_2 captures the partial correlation between total output and the intensive margin (Bernard *et al.*, 2006b).

In addition, we examine the relationship between exporting and firms' intensive and extensive margins. In the case of an exporting firm, total exports is the number of products exported (n_i^e) multiplied by average exports per product $(\overline{y}_i^e)$. Thus, the estimated regression decompositions for exporting are presented as:

$$\ln n_{it}^e = \delta_3 + \beta_3 \ln Y_{it}^e + \mu_{it} \tag{4.4}$$

$$\ln \overline{y}_{it}^e = \delta_4 + \beta_4 \ln Y_{it}^e + \varepsilon_{it} \tag{4.5}$$

Since a firm's extensive and intensive margins are correlated, where $\beta_2 = 1 - \beta_1$ and $\beta_4 = 1 - \beta_3$ we simply report the estimated results of a firm's extensive margin (β_1 and β_3). A robust variance estimation corrects for the problem of heteroscedastic errors. The results from OLS

estimations with and without region, industry and time fixed effects are presented in Table 4.3 and are based on a sample of multi-product firms only.

In Columns (1) and (2), we find that the number of products produced accounts for approximately one percent of the variation in total firm output. This means that an increase in the number of products (extensive margin) accounts for only one percent of the increase in total output. On the other hand, this result indicates that the variation of total firm output in Thailand is mainly due to changes in average output per product (intensive margin).[10]

A slightly higher variation is observed if we consider the number of products exported and total export sales (Columns (3) and (4)). The coefficient shows that the number of products exported causes a variation in total export sales of 7.4 percent. This means that the number of products exported raises total export sales by 7.4 percent by keeping average export sales per product constant.

Table 4.3: OLS Regression Decomposition of Firm Size and Firms' Extensive Margins

	Production		**Exporting**	
	(1)	**(2)**	**(3)**	**(4)**
$\ln Y_{it}$	0.009***	0.012***		
	(4.17)	(5.20)		
$\ln Y_{it}^{e}$			0.074***	0.074***
			(21.87)	(20.48)
Observations	6042	6042	3331	3331
R-squared	0.003	0.057	0.118	0.189
Additional Covariates	None	Region, Industry and Time Fixed Effects	None	Region, Industry and Time Fixed Effects

Notes: Sample includes multi-product firms only. Dependent variable in Column (1) and (2) is the log of number of products produced ($\ln n_{it}$), and Column (3) and (4) is the log of number of product exported ($\ln n_{it}^{e}$). Robust *t* statistics in parentheses. *** significant at 1%.

[10] As Bernard *et al.* (2006a) point out, our use of the equivalent of 5-digit ISIC data will have the effect of masking unobserved changes within 5-digit categories thus our results are likely to underestimate the importance of firm adjustments to the extensive margins.

Next we examine the relationship between intensive and extensive margins by regressing firms' output or exports per product on the number of products produced or exported by firm. The estimated regressions are presented as follows:

$$\ln \bar{y}_{it} = \sigma_1 + \gamma_1 \ln n_{it} + \xi_{it} \tag{4.6}$$

$$\ln \bar{y}^{e}_{it} = \sigma_2 + \gamma_2 \ln n^{e}_{it} + \omega_{it} \tag{4.7}$$

In Table 4.4 we observe a positive correlation between the extensive and intensive margins in Columns (3) and (4) only. This positive relationship indicates that the number of products exported increases export sales per product by between 50.1 percent and 58.4 percent. We can conclude therefore that multi-product firms only marginally increase the number of products exported but for each product, multi-product firms export a larger volume of each. However, in contrast to Bernard *et al.* (2006b), Iacovone and Javorcik (2008) and Goldberg *et al.* (2008), we find a negative and significant correlation for firms' extensive and intensive margins when we consider production data. Thus, in Columns (1) and (2), we find that an increase in the number of products produced decreases the amount of output per product by between 64.1 percent and 69.2 percent. This negative correlation is consistent with the relationship predicted by the models of Nocke and Yeaple (2006), and Eckel and Neary (2006). The empirical result suggests that in Thailand, the more products a firm develops, the less of each one produced. This can be explained by diseconomies of scope in the production unit of multi-product firms in Thailand. Assuming that the marginal costs and the number of products are positively correlated, when the new product lines are added, a firm faces higher marginal costs of production and therefore causes a reduction in the productivity of the existing product line. In addition, the negative result implies that there is inefficiency in monitoring various production processes.

Another explanation is that there may be advantages associated with the production of a number of products and that by using the same production unit, distributing products through the same channels and managing production within the same organisation there is no discernible difference in cost. Multi-product firms in Thailand may be trying to expand their market potential by increasing the number of products produced rather than merely increasing sales of existing products. If firms produce a greater number of products it may help to reduce future risk resulting from the product life cycle at any given period. More importantly, it suggests that the behaviour of MNEs differs by location between developed and developing countries. It will be interesting to see whether these results hold for other developing countries.

Table 4.4: OLS Regression of Firms' Extensive and Intensive Margins

	Production		**Exporting**	
	(1)	**(2)**	**(3)**	**(4)**
$\ln n_{it}$	-0.692***	-0.641***		
	(9.32)	(9.22)		
$\ln n^{e}_{it}$			0.584***	0.501***
			(7.49)	(6.33)
Observations	6042	6042	3331	3331
R-squared	0.014	0.200	0.018	0.139
Additional Covariates	None	Region, Industry and Time Fixed Effects	None	Region, Industry and Time Fixed Effects

Notes: Sample includes multi-product firms only. Dependent variable in Column (1) and (2) is log of output per product ($\ln \overline{y}_{it}$), and Column (3) and (4) is the log of export sales product per product ($\ln \overline{y}^{e}_{it}$). Region, industry and time dummies are included. Robust t statistics in parentheses. *** significant at 1%.

From the decomposition of the firm-size distribution and firms' extensive margins, we found that intra-firm adjustment on the number of products produced and exported by multi-product firms positively and significantly affects the variation in firm size. The effect on the variation in firm size is mainly due to changes in output and export sales per product. When we consider the relationship between firms' extensive and intensive margins, our results show that extensive

and intensive margins are negatively correlated in production but positively correlated in exporting.

We now know that multi-product firms also play a significant but complex role in Thailand's economy. Although there are a larger number of single-product firms, approximately 57 percent of total output is accounted for by multi-product firms. Given the importance of multi-product firms we now investigate which factors, in addition to size, are associated with a firm's decision to produce multiple products. By identifying these characteristics the results may enable policymakers to refine the selection criteria for targeting FDI attraction policies to encourage those firms that are most likely to benefit the domestic economy.

4.5 The Characteristics of Multi-Product Firms

This section presents empirical analyses on the characteristics associated with multiple product producers making a distinction between domestic and foreign firms. First, we examine the characteristics associated with being a multi-product firm using a binary dependent variable. We follow the economic methodology as previously discussed in Chapters two and three. Second, we examine the characteristics associated with the number of products produced using a count data so the methodology used is the negative binomial regression. In each sub-section, we discuss about our model, methodology, variables and finally our estimated results.

4.5.1 Being a Multi-Product Firm

Recent stylised facts have shown that, in both domestic and international markets, multi-product firms have become increasingly important. We now investigate the characteristics of those firm's that produce multiple products.

We estimate a pooled probit model for the binary dependent variable, which indicates the status of a firm.[11] All independent variables are lagged by one year in order to avoid possible simultaneity problems. Unfortunately the data does not provide a set of instruments to control for possible exogeneity between multi-product production and our dependent variables. For example, being multi-product may cause TFP to rise or make it more likely that a firm will export. We believe this is less of a problem than with the traditional determinants of exporting regressions. However, we acknowledge that lagging by one year is not ideal and hence in our results section we refer to associations and partial correlations instead of determinants and effects. Thus, our probit model is as follows,

$$\Pr(MULTIDUM_{it} = 1 \mid Z_{i(t-1)}) = \Phi(\beta' Z_{i(t-1)}) \tag{4.8}$$

where, $MULTIDUM_{it}$ is a dummy variable that is 1 if the firm is multi-product and 0 otherwise.

Z is a vector of firm characteristics.

Φ is the cumulative distribution function of the normal distribution function.

We include five region, twenty-two two-digit industry and two year dummies in order to control for unobserved effects. In addition, we allow for robust clustering at the two-digit industry level (clustering at the regional level made little difference to the results). This relaxes the independence assumption and requires only that the observations are independent across sectors.

[11] Since our data has a short panel structure, we are not able to use alternative estimation methods (e.g. a fixed effects estimator or a GMM first difference estimator). For example, Arellano and Bond (1991) explain that the GMM first difference estimator requires two or more lags of all the right-hand-side variables as instruments.

In Equation (4.8), the vector of firm characteristics (Z) includes the following,

EX is an export dummy which equals 1 if the firm has positive export sales and 0 otherwise.

$FOREIGN$ is a dummy, which equals 1 if at least 10% of shares are foreign owned, and 0 otherwise. Cut-offs of 25% and 50% were used in a sensitivity analysis.

*EX*FOREIGN* is an interaction term that measures the effect of being both foreign and an exporter over and above the individual effects.

TFP^{LP} is a measure of total factor productivity. The calculation of the parameter is obtained from the semi-parametric approach of Levinsohn and Petrin (2003) which takes account of unobserved firm-specific productivity shocks. In a sensitivity analysis, we use two alternative measures of TFP. The R&D estimator of TFP ($TFP^{BUETTNER}$) is obtained from a semi-parametric and nonlinear least square regression of Buettner (2003) that allows for endogenous R&D.[12] The standard labour productivity ($TFP^{LABPROD}$) is calculated from the log of value added over total labour.

$size$ is measured as the log of total employment. As a robustness check we also categorise firm size into small ($SMALL$), medium ($MEDIUM$), large ($LARGE$) and very large ($VLARGE$) by following the quartile distribution of the total employment for all firms operating in the same two-digit ISIC (Rev.3).

$wage$ is the log of wage per employee. Wage is an indicator of labour quality. It is expected that the higher the wages, the more superior the quality of labour and the more likely that a firm will be able to produce multiple products.

[12] See Appendices 2B and 2C for the methodology underlying our Levinsohn and Petrin (2003) and Buettner (2003) TFP calculations.

RDPRODUCT and *RDPROCESS* are dummy variables for R&D to capture those firms that undertake R&D in product development and production processes respectively. R&D activity is an important mechanism for firms to introduce new products (Brander and Eaton, 1984). R&D is also an important procedure for enhancing the quality of existing products and for developing new products as well as highlighting cost savings in the production process. It is expected that firms that carry out R&D especially product R&D are more likely to be a multi-product firms.

The results reported in Tables 4.5 and 4.6 are marginal effect estimations that are calculated at the mean of each independent variable except for the dummy variable. Each coefficient indicates the change in the probability of the outcome.

In Table 4.5, the results of our preferred specification in Columns (3) and (4) show a complex relationship between export status and the probability of a firm to be a multi-product producer. The results suggest that it is not export status itself that is important. We also have to consider the interaction term between the export status of the firm and our ownership variable. For domestic firms, the export status has a negative but insignificant association on the probability of being a multi-product firm. For foreign firms, being an exporter is associated with an increase in the probability of being a multi-product firm by 1.9 percentage points relative to being a non-exporter.[13]

Foreign ownership appears therefore to have an important association with multi-product production although it is not a straightforward relationship. The individual partial correlation for foreign ownership is negative and significant for all specifications. This suggests that for non-exporters being a foreign-owned firm is negatively associated with being a multi-product

[13] The mean of ownership status is approximately 0.28 so the export effect conditional upon being a foreign-owned firm is calculated as [-0.023+(0.146*0.28)]=0.019.

firm. If we compare the magnitude of the effect for non-exporter and exporters, the ownership effect for exporters (-0.086) is relatively lower than for non-exporters (-0.159).[14] One plausible explanation for a negative result might be overseas firms setting up single product assembly plants that specialise in the production of one single product for sale either domestically in Thailand or for export (possibly to Thailand's ASEAN neighbours). This would also fit with the Baldwin and Ottaviano (2001) hypothesis that MNEs locate the production of different varieties in different countries. However, as noted earlier, foreign-owned firms that also export are positively and significantly correlated with firms that produce multiple products. Thus it is clear that foreign firms cannot be considered one homogenous group.

For TFP, as expected we observe that highly productive firms are positively associated with multi-product firms. The positive and significant coefficients for product R&D and process R&D suggests that firms that carry out R&D in either product development or production processes, or both, are positively related to the probability that a firm will be a multi-product producer. The product R&D activities facilitate a firm to improve product quality and develop new products. The R&D in the production process helps a firm to generate cost savings in the production process that make possible for a firm to produce more products. When we examine our proxy for the quality of labour, we see that the coefficient on wage is positive but generally insignificant.

As expected, the relationship between size and being a multi-product firm is positive and significant at the one percent level. Increasing firm size by one unit is associated with an increase in the probability of producing multiple products of approximately 6 percentage points. If we categorise firm size into small, large and very large firms, the coefficients are also significant at the one percent level with small firms being negatively correlated with being multi-

[14] The mean of export status is approximately 0.50 so the ownership effect conditional upon being an exporter is calculated as [-0.159+(0.146*0.50)]=-0.086.

product producers. As firm sizes increases, we observe increasingly positive results so that the larger the size, the greater the probability of producing multiple products.

To further investigate the results from Table 4.5 we split the sample into domestic firms and foreign firms.[15] Approximately one quarter of our firm sample are foreign-owned firms. We retain the 10 percent foreign-owned definition.[16] The results are presented in Table 4.6. Observe that the export status of domestic firms has no relationship with the probability of a firm producing multiple products. In contrast, exporting has a significant and positive partial correlation with the probability of a foreign firm being a multi-product producer. This suggests a systemic difference between the behaviour of foreign and domestic firms with foreign exporters producing more than one product and domestic exporters tending to concentrate on the export of a single product.

For productivity, the coefficients for both domestic and foreign firms are positive and significant for only four of our twelve specifications. For process R&D, the positive significant coefficients for the domestic sample indicate that for domestic firms, R&D in production processes is associated with a higher probability of a firm becoming multi-product producer. In contrast, the insignificant coefficient for our foreign firm sample suggests that neither R&D process development nor wages are associated with an increase in the probability of being a multi-product producer. However, R&D product development is positive and significant at the

[15] This breakdown sample into domestic and foreign sub-samples is verified via a likelihood ratio test by testing the two models that we do not allow for differences in the coefficients across ownership (model A) versus the one that we do (model B). The test statistic reports the chi-squared value for the test (44.13) and the p-value for a chi-square with seven degrees of freedom suggests that the difference between the two models is statistically significant. This means that the less restive model (model B) fits better than the more restrictive model (model A). The consequence of adding the interaction terms between the foreign and independent variables as predictor variables in the model result in statistically significant improvement of model. Therefore, we can separately estimate model for domestic and foreign sub-samples.

[16] In a sensitivity analysis we tested 25 percent and 50 percent cut-off points with broadly similar results that are available in Appendix 4B.

one percent level for domestic firms and five percent for foreign firms except in Column (9). Firm size for both domestic and foreign firms is positive and significant.

Our results suggest therefore that the relationship between export status, ownership and multiple products production are complex. We observe that individually foreign-owned firms and exporters have a negative partial correlation with the likelihood of being a multi-product producer but that the interaction term between being a foreign-owned firm and an exporter has a positive partial correlation with the production of multiple products.

Table 4.5: The Characteristics Associated with Multiple Product Producers (Dep. Var. is $MULTIDUM_{it}$)

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.031	0.033	-0.029	-0.030	-0.024	-0.023
	(0.031)	(0.032)	(0.034)	(0.034)	(0.035)	(0.035)
$FOREIGN_{i(t-1)}$	-0.139***	-0.139***	-0.159***	-0.160***	-0.158***	-0.159***
	(0.031)	(0.031)	(0.032)	(0.032)	(0.032)	(0.032)
$(EX * FOREIGN)_{i(t-1)}$	0.127***	0.127***	0.144***	0.145***	0.145***	0.146***
	(0.047)	(0.047)	(0.045)	(0.045)	(0.047)	(0.047)
$TFP^{LP}_{i(t-1)}$	0.056***	0.057***	0.019*	0.019*	0.023**	0.024**
	(0.012)	(0.012)	(0.010)	(0.010)	(0.011)	(0.011)
$RDPRODUCT_{i(t-1)}$	0.093***		0.067***		0.076***	
	(0.017)		(0.015)		(0.015)	
$RDPROCESS_{i(t-1)}$		0.102***		0.083***		0.088***
		(0.022)		(0.021)		(0.022)
$wage_{i(t-1)}$	0.000	-0.001	0.023	0.023	0.019	0.019
	(0.022)	(0.022)	(0.019)	(0.019)	(0.020)	(0.020)
$size_{i(t-1)}$			0.058***	0.059***		
			(0.009)	(0.009)		
$SMALL_{i(t-1)}$					-0.078***	-0.078***
					(0.016)	(0.016)
$LARGE_{i(t-1)}$					0.072***	0.071***
					(0.024)	(0.024)
$VLARGE_{i(t-1)}$					0.132***	0.133***
					(0.028)	(0.028)
Observations	9521	9521	9521	9521	9521	9521

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4.6: The Characteristics Associated with Multiple Product Producers by Ownership Structure (Dep. Var. is $MULTIDUM_{it}$)

	Domestic Firms						Foreign Firms					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
$EX_{i(t-1)}$	0.027	0.027	-0.027	-0.028	-0.025	-0.026	0.159***	0.161***	0.115***	0.116***	0.124***	0.126***
	(0.029)	(0.030)	(0.033)	(0.033)	(0.033)	(0.034)	(0.035)	(0.035)	(0.036)	(0.036)	(0.037)	(0.037)
$TFP^{LP}_{i(t-1)}$	0.051***	0.051***	0.017	0.016	0.020	0.019	0.070***	0.071***	0.020	0.021	0.032	0.033
	(0.014)	(0.014)	(0.011)	(0.011)	(0.012)	(0.012)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
$RDPRODUCT_{i(t-1)}$	0.106***		0.077***		0.083***		0.060**		0.042		0.052**	
	(0.031)		(0.029)		(0.029)		(0.027)		(0.028)		(0.026)	
$RDPROCESS_{i(t-1)}$		0.145***		0.126***		0.129***		0.022		0.007		0.012
		(0.030)		(0.028)		(0.029)		(0.040)		(0.040)		(0.040)
$wage_{i(t-1)}$	0.020	0.020	0.032*	0.032*	0.029	0.029	-0.039	-0.040	0.010	0.010	-0.001	-0.002
	(0.022)	(0.022)	(0.018)	(0.018)	(0.018)	(0.018)	(0.048)	(0.048)	(0.050)	(0.050)	(0.050)	(0.050)
$size_{i(t-1)}$			0.054***	0.055***					0.067***	0.067***		
			(0.009)	(0.009)					(0.013)	(0.013)		
$SMALL_{i(t-1)}$					-0.068***	-0.068***					-0.120***	-0.120***
					(0.022)	(0.022)					(0.039)	(0.039)
$LARGE_{i(t-1)}$					0.087***	0.088***					0.023	0.022
					(0.030)	(0.030)					(0.036)	(0.037)
$VLARGE_{i(t-1)}$					0.135***	0.136***					0.103***	0.105***
					(0.037)	(0.038)					(0.033)	(0.034)
Observations	6878	6878	6878	6878	6878	6878	2643	2643	2643	2643	2643	2643

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

4.5.2 The Number of Products Produced

In the previous sub-section, we examined the characteristics of being a multi-product firm. In this sub-section, we aim to identify a firm's performance by investigate the characteristics associated with the number of products produced. Thus, our dependent variable is now a count of the number of products produced.

Since count data is used as our dependent variable, there are two alternative regression models for counts which are poisson regression model and negative binomial regression model.[17] In this chapter, we estimate count data using a negative binomial regression model. Additionally, we also estimated a simple poisson count model for a sensitivity check.[18] We lag all independent variables by one year to avoid possible simultaneity problems. As this is not ideal we continue to avoid direct causal language in discussing our results. Our negative binomial regression model can be specified as follows:

$$\Pr(NPRODUCT|Z) = \frac{\Gamma(NPRODUCT + \alpha^{-1})}{NPRODUCT!\Gamma(\alpha^{-1})}\left(\frac{\alpha^{-1}}{\alpha^{-1}+\mu}\right)\left(\frac{\mu}{\alpha^{-1}+\mu}\right)^{NPRODUCT} \quad (4.9)$$

where $NPRODUCT$ is a count for the number of products produced by each firm.

Z is a vector of firm-level characteristics.

$\Gamma()$ is the gamma function.

α is the degree of overdispersion which equals to zero when negative binomial and poisson has the same distribution.

---

[17] Poisson regression estimation assumes that the observed count is drawn from a poisson distribution of which the mean and variance are equal. In practice, the poisson regression model maybe inappropriate due to overdispersion. Therefore, the negative binomial regression model which is an extension of poisson regression alleviate an overdispersion problem by including a parameter that captures unobserved heterogeneity amongst observations.

[18] The estimated results from Poisson regression are identical to the negative binomial regression. From the negative binomial regression, the likelihood ratio test of $\alpha = 0$ fails to reject H0: $\alpha = 0$. This indicates that we do not experience an overdispersion problem in our data.

μ is known as the observed heterogeneity and is estimated from the observed firm characteristic where $\mu = \exp(\beta' Z + \varepsilon)$.[19]

In Equation (4.9), the independent variables included in a vector of firm-level characteristics (Z) are the same as before. Five region, twenty-two two-digit industry and two year dummies are included in order to control for unobserved effects. A robust variance estimation corrects for possible heteroscedasticity in the error term and we allow for clustering at the two-digit industry level. Tables 4.7 and 4.8 present the coefficients obtained from the estimation of marginal effects for our negative binomial regressions calculated at the mean of each independent variable except for the dummy variable.

In general, the sign and significant level of results in Tables 4.7 and 4.8 are consistent with those presented in Tables 4.5 and 4.6. Table 4.7 shows that for domestically-owned firms, being an exporter does not have any significant association with the number of products produced. For foreign firms, being an exporter is positively associated with the number of products produced by 1.3 percentage points relative to being a non-exporter.[20] For ownership effect, the relationship of foreign ownership and the product count is not so simple. The negative and significant coefficient of *FOREIGN* indicates that for non-exporters being a foreign-owned firm is negatively associated with the number of products produced. If we consider the ownership status and the interaction term, for exporters, being a foreign-owned firm leads to a proportional decrease in the expected change in the number of products produced of approximately 0.22 relative to being a domestically-owned firm.[21]

---

[19] According to Long (1997) and Cameron and Trivedi (1998), $\exp(\varepsilon)$ is unknown but it can be drawn from a gamma distribution of which mean equals 1 and variance equals α.

[20] The mean of ownership status is approximately 0.28 so the export effect conditional upon being a foreign-owned firm is calculated as [-0.117+(0.464*0.28)]=0.013.

[21] The mean of export status is approximately 0.50 so the ownership effect conditional upon being an exporter is calculated as [-0.451+(0.464*0.50)]=-0.22.

TFP has a significant positive impact on the number of products produced in two of the six columns. For example, the TFP coefficient in Column (1) indicates that increasing TFP by one unit is associated with 10.8 percentage points increase in the expected change in the product count. Other variables such as R&D of both product and production process, wage, size have positive and significant effect on the number of products produced as expected.

In Table 4.8, we split the sample into domestic and foreign firms.[22] The insignificant results for export status in Table 4.7 are now explained. This is also picked up by the positive and significant results for the interaction term reported in Table 4.7. The export status of domestic firms has no significant association with the product count. In contrast, the export status of foreign firms has a positive and significant impact on the number of products produced. For example, the EX coefficient in Column (12) indicates that being a foreign exporters is associated with 30.8 percentage points increase in the expected change in the number of product count relative to being a foreign non-exporters.

When we consider the productivity of domestic firms, the coefficient is positive and significant when size is excluded from the model. In the foreign firms' sample, the coefficients of TFP are generally positive and significantly associated with the number of products produced. In both samples, product R&D and process R&D have positive coefficients but are only significant in the sample of domestic firms. Wage of only domestically-owned firms is associated with an increase in the expected change in the number of products produced. As expected, firm size of both domestic and foreign firms is positive and significant. A one unit change in firm size is

[22] This breakdown sample into domestic and foreign sub-samples is verified via a likelihood ratio test. The test statistic reports the chi-squared value for the test (26.94) and the p-value for a chi-square with seven degrees of freedom suggests that the difference between the two models is statistically significant. This means that if we do allow for differences in the coefficients across ownership results in the improvement of the model so we can separately estimate model for domestic and foreign sub-samples.

associated with a proportional increase in the expected change in the number of products by 16 percentage points for domestic firms and 18 percentage points for foreign firms.

Finally, it is worth pointing out that we performed a series of sensitivity checks. For ownership structure, we tested 25 percent and 50 percent foreign owned as the cut-off point. For productivity, the Buettner (2003) approach and standard labour productivity were employed instead of our Levinsohn and Petrin (2003) approach.[23] The results presented in Appendix 4B are broadly consistent with results shown in Tables 4.5 and 4.7.

[23] With the Buettner (2003) measure of TFP we lose approximately four percent of our observations.

Table 4.7: The Characteristics Associated with the Number of Products Produced (Dep. Var. is $NPRODUCT_{it}$)

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.035	0.039	-0.144	-0.144	-0.120	-0.117
	(0.090)	(0.090)	(0.092)	(0.092)	(0.094)	(0.094)
$FOREIGN_{i(t-1)}$	-0.404***	-0.405***	-0.454***	-0.455***	-0.449***	-0.451***
	(0.067)	(0.068)	(0.066)	(0.066)	(0.066)	(0.067)
$(EX * FOREIGN)_{i(t-1)}$	0.411***	0.410***	0.462***	0.463***	0.464***	0.464***
	(0.119)	(0.118)	(0.104)	(0.103)	(0.112)	(0.111)
$TFP^{LP}_{i(t-1)}$	0.108***	0.109***	-0.001	-0.001	0.018	0.019
	(0.023)	(0.023)	(0.021)	(0.021)	(0.023)	(0.024)
$RDPRODUCT_{i(t-1)}$	0.288***		0.202***		0.233***	
	(0.046)		(0.037)		(0.039)	
$RDPROCESS_{i(t-1)}$		0.302***		0.238***		0.255***
		(0.063)		(0.056)		(0.061)
$wage_{i(t-1)}$	0.037	0.035	0.106**	0.105**	0.088*	0.087*
	(0.054)	(0.055)	(0.045)	(0.045)	(0.049)	(0.049)
$size_{i(t-1)}$			0.167***	0.169***		
			(0.021)	(0.021)		
$SMALL_{i(t-1)}$					-0.213***	-0.213***
					(0.046)	(0.047)
$LARGE_{i(t-1)}$					0.210***	0.210***
					(0.074)	(0.075)
$VLARGE_{i(t-1)}$					0.373***	0.379***
					(0.064)	(0.065)
Observations	9521	9521	9521	9521	9521	9521

Notes: Standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4.8: The Characteristics Associated with the Number of Products Produced by Ownership Structure (Dep. Var. is $NPRODUCT_{it}$)

	Domestic Firms						Foreign Firms					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
$EX_{i(t-1)}$	0.034	0.035	-0.127	-0.131	-0.117	-0.119	0.385***	0.390***	0.261***	0.264***	0.304***	0.308***
	(0.083)	(0.083)	(0.082)	(0.083)	(0.084)	(0.085)	(0.085)	(0.084)	(0.086)	(0.086)	(0.088)	(0.087)
$TFP^{LP}_{i(t-1)}$	0.098***	0.098***	-0.006	-0.007	0.005	0.004	0.168***	0.173***	0.036	0.039	0.085*	0.089*
	(0.032)	(0.032)	(0.027)	(0.026)	(0.029)	(0.029)	(0.046)	(0.047)	(0.045)	(0.047)	(0.044)	(0.046)
$RDPRODUCT_{i(t-1)}$	0.325***		0.230***		0.252***		0.170		0.119		0.151	
	(0.094)		(0.088)		(0.087)		(0.109)		(0.117)		(0.112)	
$RDPROCESS_{i(t-1)}$		0.433***		0.364***		0.376***		0.037		0.001		0.017
		(0.095)		(0.086)		(0.089)		(0.106)		(0.109)		(0.107)
$wage_{i(t-1)}$	0.066	0.065	0.102**	0.102**	0.091**	0.091**	-0.024	-0.029	0.111	0.110	0.059	0.059
	(0.055)	(0.056)	(0.047)	(0.046)	(0.046)	(0.046)	(0.096)	(0.098)	(0.105)	(0.107)	(0.100)	(0.102)
$size_{i(t-1)}$			0.160***	0.161***					0.176***	0.179***		
			(0.018)	(0.018)					(0.033)	(0.032)		
$SMALL_{i(t-1)}$					-0.201***	-0.202***					-0.268*	-0.268*
					(0.059)	(0.059)					(0.139)	(0.140)
$LARGE_{i(t-1)}$					0.259***	0.260***					0.040	0.036
					(0.96)	(0.096)					(0.110)	(0.111)
$VLARGE_{i(t-1)}$					0.401***	0.403***					0.230***	0.2334**
					(0.072)	(0.073)					(0.088)	(0.089)
Observations	6878	6878	6878	6878	6878	6878	2643	2643	2643	2643	2643	2643

Notes: Standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

4.6 Conclusions

In this chapter, we investigate different aspects of multi-product firms in international trade using the firm-level data from Thailand for the period 2001 to 2004. The empirical analysis comprises two sections. First, we examine the relationship between multi-product firm's extensive margin (number of products) on output or exporting. Second, we investigate the characteristics associated with being a multi-product firm using binary data and the number of products produced using count data. The use of the former allowed us to analyse the characteristics of those multi-product firms while the latter is used to explain factors that affect the number of products produced. We also examine the systematic differences in the between domestic and foreign firms by estimating each sample separately.

Our results show that little variation is observed for firms' extensive margins in both total output and export sales. However, firms' extensive margins seem to have a higher variation in export sales than in total output. We suspect a partial explanation for these low variations, at least relative to the findings in Bernard *et al.* (2006b), is because of the level of aggregation we use when we classify the number of products. Another explanation arises from the fact that multi-product firms in Thailand do not dominate domestic production and exporting. In Thailand, there is an evidence of diseconomy of scope and inefficiency in monitoring production process. If firms want to produce more products, they should be cautious when introducing new products and try to minimise the negative relationship between the extensive and intensive margins.

Various factors such as export status, foreign ownership, TFP, R&D both in product and in the production processes and firm size are important correlates with both multi-product firms and the number of products produced. Productive and large firms and those that carry out R&D

also have a strong association with being a multiple product firm. Similarly, the effects of different factors on the expected number of products produced by firms are generally consistent with the factors associated with the probability of becoming a multi-product firm.

We did however find that there are systematic differences in the factors correlated with multi-product production between different groups in our sample. The differences in the significance and sign of factors indicate that domestic firms perform differently to foreign firms. Perhaps more importantly from a development policy perspective is that R&D has a weak association with the propensity of a foreign firm to be multi-product or the number of products produced. Assuming that potential benefits from spillovers increase with the number of varieties this may partially explain the lack of evidence for spillovers found in many studies of developing countries. In contrast, it could be argued that a technologically advanced single-product firm could offer greater potential spillovers than a less technologically advanced multi-product firm. The government should therefore carefully consider targeting investment promotion activities that attract technologically advanced single-product firms or multi-product firms that provide various technologies in their production.

In summary, for Thailand we show therefore that the relationship between MNEs and development is complex. We show that multi-products firms have played a significant role in international trade especially though exporting and FDI. The results from the empirical analysis also confirm that being foreign owned and an exporter is an important characteristics associated with the emergence of multi-product firms and number of products produced. There appears however to be differences in the behaviour of foreign firms in developing and developed countries. In future research it would be useful to break down foreign ownership into country of origin to see whether there is a difference between the behaviour of firms from developing and developed countries. A further extension that would require a longer time period would be

to examine the behaviour of firms in response to a shock to see whether product adjustment occurs at the intensive or extensive margin.

Appendix 4A: Definition of Variables and Descriptive Statistics

Table 4A.1: Definition of Variables

Variable	Definition
Y_{it}	Total output of the firm
Y_{it}^{e}	Total firm export sales
n_{it}	Number of products produced by firm
n_{it}^{e}	Number of products exported by firm
$\overline{y}_{it}$	Average output per product that is calculated from the aggregation of output of individual products divides by the number of product.
$\overline{y}_{it}^{e}$	Average export sales per product calculated as the aggregation of output of individual products divided by the number of products exported.
$MULTIDUM_{it}$	A dummy variable for a multi-product firm which equals 1 if a firm produces multiple products and 0 if a firm produces a single product.
$NPRODUCT_{it}$	Count data for the number of products produced by each firm.
$EX_{i(t-1)}$	A dummy variable for export status where a dummy equals 1 if firm i has positive export sales and 0 otherwise.
$FOREIGN_{i(t-1)}$	A dummy variable that indicates the structure of foreign ownership where a dummy equals 1 if shares of at least 10% are foreign owned.
$FOREIGN25_{i(t-1)}$	A dummy variable that indicates the structure of foreign ownership where a dummy equals 1 if shares of at least 25% are foreign owned.
$FOREIGN50_{i(t-1)}$	A dummy variable that indicates the structure of foreign ownership where a dummy equals 1 if shares of at least 50% are foreign owned.
$TFP_{i(t-1)}^{LP}$	Total factor productivity that is obtained from the estimation of the semi-parametric approach of Levinsohn and Petrin (2003).
$TFP_{i(t-1)}^{BUETTNER}$	Total factor productivity obtained from the system estimation (a semi-parametric and nonlinear least square regression) by Buettner (2003).
$TFP_{i(t-1)}^{LABPROD}$	Labour productivity calculated as the log of value added divided by total labour.
$size_{i(t-1)}$	Size is measured as the log of total employees.
$SMALL_{i(t-1)}$	A dummy variable equal to 1 if the total labour of firm i at time $t-1$ is in the first quartile of the distribution of the total labour of all firms operating in the same two-digit ISIC level (Rev. 3) as firm i at time $t-1$.
$LARGE_{i(t-1)}$	A dummy variable equal to 1 if the total labour of firm i at time $t-1$ is in the third quartile of the distribution of the total labour of all firms operating in the same two-digit ISIC level (Rev. 3) as firm i at time $t-1$.
$VLARGE_{i(t-1)}$	A dummy variable equal to 1 if the total labour of the firm i at time $t-1$ is in the forth quartile of the distribution of the total labour of all firms operating in the same two-digit ISIC level (Rev. 3) as firm i at time $t-1$.
$wage_{i(t-1)}$	The log of wage per employee calculated as the ratio of total labour

	payments over total labour less owner's wage.
$RDPRODUCT_{i(t-1)}$	A dummy variable equals 1 if a firm carries out R&D in product development and 0 otherwise.
$RDPROCESS_{i(t-1)}$	A dummy variable equals 1 if a firm performs R&D in the development of production processes and 0 otherwise.
BKKM	A dummy variable identifies whether firm locates in Bangkok and Metropolitan Area or not.
CENTRAL	A dummy variable equals 1 if a firm locates in Central region excluding Bangkok and Metropolitan Area and 0 otherwise.
EAST	A dummy variable equals 1 if a firm locates in Eastern region and 0 otherwise.
NORTH	A dummy variable equals 1 if a firm locates in the North of Thailand and 0 otherwise.
SOUTH	A dummy variable equals 1 if a firm locates in the South of Thailand and 0 otherwise.

Table 4A.2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
$\ln Y_{it}$	6042	14.81	2.21	6.31	20.61
$\ln \overline{y}_{it}$	6042	13.73	2.22	5.21	19.80
$\ln n_{it}$	6042	1.08	0.38	0.69	2.30
$\ln Y_{it}^{e}$	3331	14.70	2.36	3.86	20.37
$\ln \overline{y}_{it}^{e}$	3331	13.87	2.23	3.86	19.21
$\ln n_{it}^{e}$	3331	0.83	0.51	0	2.08
$MULTIDUM_{it}$	9521	0.43	0.49	0	1
$NPRODUCT_{it}$	9521	1.95	1.38	1	10.00
$EX_{i(t-1)}$	9521	0.50	0.50	0	1
$FOREIGN_{i(t-1)}$	9521	0.28	0.45	0	1
$FOREIGN25_{i(t-1)}$	9521	0.25	0.43	0	1
$FOREIGN50_{i(t-1)}$	9521	0.14	0.35	0	1
$TFP_{i(t-1)}^{LP}$	9521	9.22	1.84	0.47	16.69
$TFP_{i(t-1)}^{BUETTNER}$	9195	10.19	1.28	1.21	15.31
$TFP_{i(t-1)}^{LABPROD}$	9554	8.98	1.05	1.45	14.00
$RDPRODUCT_{i(t-1)}$	9521	0.08	0.27	0	1
$RDPROCESS_{i(t-1)}$	9521	0.06	0.24	0	1
$wage_{i(t-1)}$	9521	7.71	0.53	4.19	10.29
$size_{i(t-1)}$	9521	4.79	1.50	1.10	9.00
$SMALL_{i(t-1)}$	9521	0.26	0.44	0	1
$LARGE_{i(t-1)}$	9521	0.25	0.43	0	1
$VLARGE_{i(t-1)}$	9521	0.25	0.43	0	1

Table 4A.3: Correlation Matrix

	MULTIDUM	*NPRODUCT*	*EX*	*FOREIGN*	*FOREIGN25*	*FOREIGN50*	*EX*FOREIGN*	*TFP^{LP}*	*TFP^{BUETTNER}*	*TFP^{LABPROD}*	*RDPRODUCT*	*RDPROCESS*	*wage*	*size*	*SMALL*	*LARGE*	*VLARGE*
MULTIDUM	1.00																
NPRODUCT	0.80	1.00															
EX	0.08	0.06	1.00														
FOREIGN	0.04	0.03	0.37	1.00													
FOREIGN25	0.04	0.03	0.37	0.92	1.00												
FOREIGN50	0.04	0.04	0.32	0.66	0.72	1.00											
*EX*FOREIGN*	0.07	0.06	0.53	0.86	0.82	0.67	1.00										
TFP^{LP}	0.08	0.07	0.20	0.14	0.14	0.08	0.13	1.00									
TFP^{BUETTNER}	0.15	00.12	0.39	0.38	0.36	0.31	0.38	0.63	1.00								
TFP^{LABPROD}	0.11	0.09	0.26	0.35	0.33	0.27	0.32	0.61	0.93	1.00							
RDPRODUCT	0.08	0.08	0.13	0.05	0.05	0.03	0.07	0.08	0.15	0.11	1.00						
RDPROCESS	0.07	0.07	0.10	0.04	0.04	0.02	0.06	0.08	0.13	0.10	0.57	1.00					
wage	0.09	0.09	0.27	0.41	0.40	0.34	0.35	0.43	0.66	0.70	0.08	0.08	1.00				
size	0.16	0.15	0.53	0.29	0.27	0.27	0.33	0.34	0.60	0.31	0.18	0.12	0.28	1.00			
SMALL	-0.13	-0.12	-0.36	-0.18	-0.17	-0.17	-0.21	-0.26	-0.45	-0.25	-0.10	-0.08	-0.23	-0.70	1.00		
LARGE	0.05	0.05	0.13	0.02	0.02	0.02	0.03	0.07	0.13	0.08	0.01	0.02	0.08	0.19	-0.34	1.00	
VLARGE	0.13	0.11	0.35	0.22	0.21	0.20	0.25	0.25	0.43	0.22	0.15	0.11	0.18	0.72	-0.34	-0.33	1.00

Appendix 4B: Sensitivity Analysis

We perform a range of sensitivity checks for the entire sample on our independent variables in the models presented in Sections 4.5.1 and 4.5.2 by using different definitions of foreign ownership and different techniques to measure TFP. For foreign ownership, 25% and 50% cut-off points of foreign-owned share are used instead of 10%. In terms of TFP, we use $TFP^{BUETTNER}$ and $TFP^{LABPROD}$.

Tables 4B.1 to 4B.8 report the marginal effect estimations obtained from the pooled probit model on the characteristics associated with multiple product producers by including different cut-off points for foreign ownership and different measurements of TFP. In Tables 4B.1 and 4B.2, we retain the 10% cut-off point. The results are broadly consistent with those in Table 4.5. Both TFP have positive coefficients but the level of significance is decreased when size and different category of size are included in the model. Using 25% of foreign-owned share as a cut-off point, results in Tables 4B.3 to 4B.5 are generally unchanged. However, when we use 50% cut-off point the interaction term of $EX*FOREIGN50$ becomes insignificant.

Tables 4B.9 to 4B.16 report the estimated coefficients of the negative binomial regression on the characteristics associated with the number of products produced.[24] Using different definition of TFP, results in Tables 4B.9 and 4B.10 are broadly consistent with those presented in Table 4.7. In addition, the results remain generally unchanged when we use 25% and 50% cut-off points of foreign-owned share.

[24] In the main text, we report the marginal effect results.

4B.1 The Characteristics Associated with Multiple Product Producers

4B.1.1 At the 10% Cut-Off Point for Foreign Ownership

Table 4B.1: The Characteristics Associated with Multiple Product Producers (Dep. Var. is $MULTIDUM_{it}$) with $FOREIGN$ and $TFP^{BUETTNER}$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.019	0.020	-0.034	-0.034	-0.030	-0.030
	(0.032)	(0.033)	(0.034)	(0.034)	(0.034)	(0.035)
$FOREIGN_{i(t-1)}$	-0.143***	-0.143***	-0.161***	-0.161***	-0.161***	-0.161***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
$(EX * FOREIGN)_{i(t-1)}$	0.132***	0.132***	0.151***	0.151***	0.152***	0.152***
	(0.046)	(0.047)	(0.044)	(0.044)	(0.045)	(0.045)
$TFP^{BUETTNER}_{i(t-1)}$	0.058***	0.059***	0.018	0.018	0.024*	0.023*
	(0.012)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)
$RDPRODUCT_{i(t-1)}$	0.085***		0.063***		0.072***	
	(0.022)		(0.024)		(0.022)	
$RDPROCESS_{i(t-1)}$		0.108***		0.095***		0.097***
		(0.025)		(0.024)		(0.024)
$wage_{i(t-1)}$	-0.010	-0.010	0.024	0.024	0.018	0.018
	(0.024)	(0.023)	(0.024)	(0.024)	(0.025)	(0.025)
$size_{i(t-1)}$			0.056***	0.056***		
			(0.010)	(0.010)		
$SMALL_{i(t-1)}$					-0.074***	-0.074***
					(0.016)	(0.016)
$LARGE_{i(t-1)}$					0.070***	0.070***
					(0.023)	(0.023)
$VLARGE_{i(t-1)}$					0.128***	0.129***
					(0.032)	(0.032)
Observations	9195	9195	9195	9195	9195	9195

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4B.2: The Characteristics Associated with Multiple Product Producers (Dep. Var. is $MULTIDUM_{it}$) with $FOREIGN$ and $TFP^{LABPROD}$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.054	0.056	-0.028	-0.028	-0.021	-0.021
	(0.035)	(0.035)	(0.034)	(0.034)	(0.035)	(0.035)
$FOREIGN_{i(t-1)}$	-0.129***	-0.130***	-0.158***	-0.158***	-0.156***	-0.157***
	(0.031)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
$(EX * FOREIGN)_{i(t-1)}$	0.119**	0.119**	0.143***	0.143***	0.143***	0.144***
	(0.050)	(0.050)	(0.046)	(0.046)	(0.048)	(0.048)
$TFP^{LABPROD}_{i(t-1)}$	0.029**	0.029**	0.016	0.016	0.018	0.018
	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)
$RDPRODUCT_{i(t-1)}$	0.103***		0.067***		0.078***	
	(0.018)		(0.015)		(0.015)	
$RDPROCESS_{i(t-1)}$		0.110***		0.084***		0.089***
		(0.021)		(0.020)		(0.022)
$wage_{i(t-1)}$	0.030	0.030	0.024	0.024	0.023	0.023
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
$size_{i(t-1)}$			0.062***	0.063***		
			(0.009)	(0.009)		
$SMALL_{i(t-1)}$					-0.085***	-0.085***
					(0.016)	(0.016)
$LARGE_{i(t-1)}$					0.077***	0.077***
					(0.024)	(0.024)
$VLARGE_{i(t-1)}$					0.144***	0.146***
					(0.028)	(0.028)
Observations	9554	9554	9554	9554	9554	9554

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

4B.1.2 At the 25% Cut-Off Point for Foreign Ownership

Table 4B.3: The Characteristics Associated with Multiple Product Producers (Dep. Var. is $MULTIDUM_{it}$) with $FOREIGN25$ and TFP^{LP}

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.034	0.034	-0.026	-0.027	-0.021	-0.021
	(0.032)	(0.032)	(0.034)	(0.034)	(0.035)	(0.035)
$FOREIGN25_{i(t-1)}$	-0.145***	-0.145***	-0.162***	-0.163***	-0.162***	-0.163***
	(0.042)	(0.043)	(0.042)	(0.042)	(0.043)	(0.043)
$(EX * FOREIGN25)_{i(t-1)}$	0.135**	0.137**	0.151**	0.153**	0.153**	0.154**
	(0.065)	(0.066)	(0.061)	(0.061)	(0.063)	(0.063)
$TFP^{LP}_{i(t-1)}$	0.056***	0.056***	0.019*	0.019*	0.023**	0.023**
	(0.012)	(0.012)	(0.010)	(0.010)	(0.011)	(0.011)
$RDPRODUCT_{i(t-1)}$	0.093***		0.068***		0.076***	
	(0.017)		(0.015)		(0.015)	
$RDPROCESS_{i(t-1)}$		0.103***		0.084***		0.088***
		(0.022)		(0.020)		(0.022)
$wage_{i(t-1)}$	-0.001	-0.001	0.022	0.021	0.018	0.018
	(0.022)	(0.023)	(0.019)	(0.019)	(0.020)	(0.020)
$size_{i(t-1)}$			0.057***	0.058***		
			(0.009)	(0.009)		
$SMALL_{i(t-1)}$					-0.076***	-0.076***
					(0.016)	(0.016)
$LARGE_{i(t-1)}$					0.071***	0.071***
					(0.024)	(0.024)
$VLARGE_{i(t-1)}$					0.132***	0.133***
					(0.028)	(0.028)
Observations	9521	9521	9521	9521	9521	9521

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4B.4: The Characteristics Associated with Multiple Product Producers (Dep. Var. is $MULTIDUM_{it}$) with $FOREIGN25$ and $TFP^{BUETTNER}$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.022	0.023	-0.029	-0.030	-0.026	-0.025
	(0.032)	(0.033)	(0.034)	(0.034)	(0.034)	(0.035)
$FOREIGN25_{i(t-1)}$	-0.146***	-0.147***	-0.163***	-0.164***	-0.163***	-0.164***
	(0.042)	(0.043)	(0.041)	(0.041)	(0.041)	(0.042)
$(EX * FOREIGN25)_{i(t-1)}$	0.135**	0.136**	0.154***	0.155***	0.155**	0.156**
	(0.064)	(0.064)	(0.060)	(0.060)	(0.062)	(0.062)
$TFP^{BUETTNER}_{i(t-1)}$	0.058***	0.058***	0.018	0.017	0.023*	0.023*
	(0.012)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)
$RDPRODUCT_{i(t-1)}$	0.086***		0.064***		0.073***	
	(0.023)		(0.024)		(0.022)	
$RDPROCESS_{i(t-1)}$		0.109***		0.096***		0.098***
		(0.025)		(0.024)		(0.024)
$wage_{i(t-1)}$	-0.010	-0.011	0.023	0.023	0.017	0.017
	(0.023)	(0.023)	(0.024)	(0.024)	(0.024)	(0.024)
$size_{i(t-1)}$			0.055***	0.056***		
			(0.010)	(0.010)		
$SMALL_{i(t-1)}$					-0.072***	-0.072***
					(0.016)	(0.016)
$LARGE_{i(t-1)}$					0.070***	0.070***
					(0.022)	(0.022)
$VLARGE_{i(t-1)}$					0.128***	0.129***
					(0.032)	(0.032)
Observations	9195	9195	9195	9195	9195	9195

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4B.5: The Characteristics Associated with Multiple Product Producers (Dep. Var. is $MULTIDUM_{it}$) with $FOREIGN25$ and $TFP^{LABPROD}$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.057	0.058*	-0.025	-0.025	-0.018	-0.018
	(0.035)	(0.035)	(0.034)	(0.034)	(0.035)	(0.035)
$FOREIGN25_{i(t-1)}$	-0.135***	-0.136***	-0.161***	-0.162***	-0.160***	-0.161***
	(0.042)	(0.043)	(0.041)	(0.042)	(0.043)	(0.043)
$(EX * FOREIGN25)_{i(t-1)}$	0.125*	0.127*	0.149**	0.151**	0.150**	0.151**
	(0.068)	(0.068)	(0.061)	(0.061)	(0.064)	(0.064)
$TFP^{LABPROD}_{i(t-1)}$	0.029*	0.029*	0.015	0.015	0.017	0.017
	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)
$RDPRODUCT_{i(t-1)}$	0.103***		0.068***		0.078***	
	(0.018)		(0.015)		(0.015)	
$RDPROCESS_{i(t-1)}$		0.111***		0.084***		0.089***
		(0.021)		(0.020)		(0.022)
$wage_{i(t-1)}$	0.030	0.030	0.023	0.023	0.022	0.023
	(0.025)	(0.025)	(0.024)	(0.024)	(0.025)	(0.025)
$size_{i(t-1)}$			0.062***	0.062***		
			(0.008)	(0.009)		
$SMALL_{i(t-1)}$					-0.083***	-0.083***
					(0.016)	(0.016)
$LARGE_{i(t-1)}$					0.077***	0.077***
					(0.023)	(0.023)
$VLARGE_{i(t-1)}$					0.144***	0.145***
					(0.028)	(0.028)
Observations	9554	9554	9554	9554	9554	9554

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

4B.1.3 At the 50% Cut-Off Point for Foreign Ownership

Table 4B.6: The Characteristics Associated with Multiple Product Producers (Dep. Var. is $MULTIDUM_{it}$) with $FOREIGN50$ and TFP^{LP}

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.050*	0.051*	-0.007	-0.007	-0.002	-0.001
	(0.029)	(0.029)	(0.031)	(0.032)	(0.032)	(0.032)
$FOREIGN50_{i(t-1)}$	-0.071	-0.072	-0.102**	-0.103**	-0.101**	-0.102**
	(0.045)	(0.046)	(0.045)	(0.045)	(0.044)	(0.045)
$(EX * FOREIGN50)_{i(t-1)}$	0.042	0.044	0.063	0.064	0.065	0.066
	(0.072)	(0.072)	(0.067)	(0.067)	(0.068)	(0.068)
$TFP^{LP}_{i(t-1)}$	0.054***	0.055***	0.018*	0.018*	0.022**	0.023**
	(0.011)	(0.011)	(0.010)	(0.010)	(0.011)	(0.011)
$RDPRODUCT_{i(t-1)}$	0.092***		0.065***		0.074***	
	(0.017)		(0.015)		(0.015)	
$RDPROCESS_{i(t-1)}$		0.100***		0.081***		0.085***
		(0.022)		(0.021)		(0.022)
$wage_{i(t-1)}$	-0.008	-0.008	0.015	0.015	0.011	0.011
	(0.024)	(0.024)	(0.020)	(0.020)	(0.021)	(0.021)
$size_{i(t-1)}$			0.057***	0.058***		
			(0.009)	(0.009)		
$SMALL_{i(t-1)}$					-0.076***	-0.076***
					(0.017)	(0.017)
$LARGE_{i(t-1)}$					0.070***	0.070***
					(0.024)	(0.024)
$VLARGE_{i(t-1)}$					0.129***	0.131***
					(0.028)	(0.028)
Observations	9521	9521	9521	9521	9521	9521

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4B.7: The Characteristics Associated with Multiple Product Producers (Dep. Var. is $MULTIDUM_{it}$) with $FOREIGN50$ and $TFP^{BUETTNER}$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.039	0.039	-0.010	-0.010	-0.007	-0.006
	(0.029)	(0.030)	(0.031)	(0.032)	(0.031)	(0.032)
$FOREIGN50_{i(t-1)}$	-0.072	-0.071	-0.105**	-0.104**	-0.104**	-0.104**
	(0.047)	(0.048)	(0.046)	(0.046)	(0.045)	(0.046)
$(EX * FOREIGN50)_{i(t-1)}$	0.039	0.039	0.065	0.065	0.067	0.067
	(0.074)	(0.075)	(0.069)	(0.069)	(0.071)	(0.071)
$TFP^{BUETTNER}_{i(t-1)}$	0.057***	0.057***	0.018	0.017	0.023*	0.023*
	(0.011)	(0.011)	(0.013)	(0.013)	(0.013)	(0.013)
$RDPRODUCT_{i(t-1)}$	0.084***		0.063***		0.071***	
	(0.022)		(0.023)		(0.021)	
$RDPROCESS_{i(t-1)}$		0.107***		0.093***		0.095***
		(0.025)		(0.024)		(0.025)
$wage_{i(t-1)}$	-0.018	-0.019	0.016	0.016	0.010	0.010
	(0.025)	(0.025)	(0.025)	(0.025)	(0.026)	(0.026)
$size_{i(t-1)}$			0.054***	0.055***		
			(0.010)	(0.010)		
$SMALL_{i(t-1)}$					-0.072***	-0.072***
					(0.016)	(0.016)
$LARGE_{i(t-1)}$					0.068***	0.068***
					(0.022)	(0.023)
$VLARGE_{i(t-1)}$					0.126***	0.126***
					(0.032)	(0.032)
Observations	9195	9195	9195	9195	9195	9195

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4B.8: The Characteristics Associated with Multiple Product Producers (Dep. Var. is $MULTIDUM_{it}$) with $FOREIGN50$ and $TFP^{LABPROD}$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.072**	0.074**	-0.006	-0.006	0.001	0.001
	(0.031)	(0.031)	(0.031)	(0.032)	(0.032)	(0.032)
$FOREIGN50_{i(t-1)}$	-0.059	-0.061	-0.101**	-0.101**	-0.099**	-0.100**
	(0.047)	(0.047)	(0.045)	(0.046)	(0.045)	(0.045)
$(EX * FOREIGN50)_{i(t-1)}$	0.030	0.032	0.060	0.061	0.061	0.062
	(0.074)	(0.074)	(0.067)	(0.068)	(0.069)	(0.069)
$TFP^{LABPROD}_{i(t-1)}$	0.028*	0.028*	0.015	0.015	0.017	0.017
	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)
$RDPRODUCT_{i(t-1)}$	0.101***		0.066***		0.076***	
	(0.018)		(0.015)		(0.015)	
$RDPROCESS_{i(t-1)}$		0.108***		0.081***		0.086***
		(0.022)		(0.021)		(0.022)
$wage_{i(t-1)}$	0.022	0.022	0.016	0.016	0.015	0.015
	(0.026)	(0.026)	(0.025)	(0.025)	(0.025)	(0.025)
$size_{i(t-1)}$			0.061***	0.062***		
			(0.009)	(0.009)		
$SMALL_{i(t-1)}$					-0.083***	-0.083***
					(0.016)	(0.016)
$LARGE_{i(t-1)}$					0.075***	0.075***
					(0.023)	(0.023)
$VLARGE_{i(t-1)}$					0.141***	0.143***
					(0.028)	(0.028)
Observations	9554	9554	9554	9554	9554	9554

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

4B.2 The Characteristics Associated with the Number of Products Produced

4B.2.1 At the 10% Cut-Off Point for Foreign Ownership

Table 4B.9: The Characteristics Associated with the Number of Products Produced (Dep. Var. is $NPRODUCT_{it}$) with $FOREIGN$ and $TFP^{BUETTNER}$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.004	0.007	-0.083*	-0.083*	-0.071	-0.070
	(0.047)	(0.048)	(0.047)	(0.047)	(0.048)	(0.048)
$FOREIGN_{i(t-1)}$	-0.226***	-0.226***	-0.255***	-0.255***	-0.252***	-0.252***
	(0.035)	(0.036)	(0.034)	(0.035)	(0.035)	(0.035)
$(EX * FOREIGN)_{i(t-1)}$	0.208***	0.206***	0.237***	0.237***	0.237***	0.236***
	(0.050)	(0.051)	(0.043)	(0.043)	(0.046)	(0.046)
$TFP^{BUETTNER}_{i(t-1)}$	0.058***	0.058***	-0.008	-0.008	0.006	0.006
	(0.012)	(0.012)	(0.014)	(0.014)	(0.014)	(0.014)
$RDPRODUCT_{i(t-1)}$	0.118***		0.083***		0.098***	
	(0.027)		(0.028)		(0.026)	
$RDPROCESS_{i(t-1)}$		0.131***		0.110***		0.115***
		(0.038)		(0.038)		(0.039)
$wage_{i(t-1)}$	0.009	0.008	0.066**	0.066**	0.051*	0.050*
	(0.029)	(0.029)	(0.029)	(0.029)	(0.030)	(0.030)
$size_{i(t-1)}$			0.090***	0.091***		
			(0.012)	(0.012)		
$SMALL_{i(t-1)}$					-0.115***	-0.115***
					(0.027)	(0.028)
$LARGE_{i(t-1)}$					0.109***	0.109***
					(0.035)	(0.036)
$VLARGE_{i(t-1)}$					0.188***	0.190***
					(0.032)	(0.032)
Constant	-0.473***	-0.473***	-0.457***	-0.454***	-0.244	-0.242
	(0.136)	(0.139)	(0.138)	(0.138)	(0.151)	(0.153)
Observations	9195	9195	9195	9195	9195	9195

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4B.10: The Characteristics Associated with the Number of Products Produced (Dep. Var. is $NPRODUCT_{it}$) with $FOREIGN$ and $TFP^{LABPROD}$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.044	0.047	-0.074	-0.074	-0.060	-0.059
	(0.051)	(0.051)	(0.048)	(0.048)	(0.049)	(0.049)
$FOREIGN_{i(t-1)}$	-0.211***	-0.211***	-0.250***	-0.251***	-0.247***	-0.248***
	(0.039)	(0.039)	(0.038)	(0.038)	(0.039)	(0.039)
$(EX * FOREIGN)_{i(t-1)}$	0.197***	0.196***	0.227***	0.228***	0.228***	0.228***
	(0.059)	(0.059)	(0.049)	(0.048)	(0.052)	(0.052)
$TFP^{LABPROD}_{i(t-1)}$	0.013	0.013	-0.008	-0.008	-0.004	-0.004
	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)
$RDPRODUCT_{i(t-1)}$	0.152***		0.102***		0.118***	
	(0.021)		(0.018)		(0.019)	
$RDPROCESS_{i(t-1)}$		0.157***		0.119***		0.128***
		(0.027)		(0.026)		(0.028)
$wage_{i(t-1)}$	0.071**	0.071**	0.065**	0.065**	0.062**	0.062**
	(0.030)	(0.031)	(0.030)	(0.030)	(0.030)	(0.030)
$size_{i(t-1)}$			0.088***	0.089***		
			(0.010)	(0.010)		
$SMALL_{i(t-1)}$					-0.119***	-0.120***
					(0.026)	(0.026)
$LARGE_{i(t-1)}$					0.111***	0.111***
					(0.037)	(0.037)
$VLARGE_{i(t-1)}$					0.193***	0.196***
					(0.028)	(0.028)
Constant	-0.479***	-0.487***	-0.446***	-0.449***	-0.233	-0.237
	(0.126)	(0.129)	(0.144)	(0.146)	(0.157)	(0.160)
Observations	9554	9554	9554	9554	9554	9554

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

4B.2.2 At the 25% Cut-Off Point for Foreign Ownership

Table 4B.11: The Characteristics Associated with the Number of Products Produced (Dep. Var. is $NPRODUCT_{it}$) with $FOREIGN25$ and TFP^{LP}

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.016	0.018	-0.076	-0.077	-0.064	-0.063
	(0.047)	(0.047)	(0.047)	(0.047)	(0.049)	(0.049)
$FOREIGN25_{i(t-1)}$	-0.247***	-0.248***	-0.273***	-0.275***	-0.272***	-0.274***
	(0.048)	(0.050)	(0.047)	(0.048)	(0.049)	(0.050)
$(EX * FOREIGN25)_{i(t-1)}$	0.243***	0.245***	0.266***	0.268***	0.267***	0.269***
	(0.078)	(0.079)	(0.067)	(0.068)	(0.072)	(0.073)
$TFP^{LP}_{i(t-1)}$	0.056***	0.057***	-0.001	-0.001	0.009	0.010
	(0.012)	(0.012)	(0.011)	(0.011)	(0.012)	(0.013)
$RDPRODUCT_{i(t-1)}$	0.142***		0.102***		0.117***	
	(0.021)		(0.018)		(0.018)	
$RDPROCESS_{i(t-1)}$		0.149***		0.120***		0.128***
		(0.029)		(0.027)		(0.028)
$wage_{i(t-1)}$	0.018	0.017	0.053**	0.053**	0.044*	0.043*
	(0.029)	(0.029)	(0.024)	(0.024)	(0.026)	(0.026)
$size_{i(t-1)}$			0.087***	0.088***		
			(0.011)	(0.011)		
$SMALL_{i(t-1)}$					-0.112***	-0.113***
					(0.025)	(0.026)
$LARGE_{i(t-1)}$					0.108***	0.108***
					(0.037)	(0.037)
$VLARGE_{i(t-1)}$					0.187***	0.189***
					(0.031)	(0.031)
Constant	-0.329**	-0.333**	-0.427***	-0.430***	-0.201	-0.203
	(0.160)	(0.167)	(0.147)	(0.149)	(0.163)	(0.167)
Observations	9521	9521	9521	9521	9521	9521

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4B.12: The Characteristics Associated with the Number of Products Produced (Dep. Var. is $NPRODUCT_{it}$) with $FOREIGN25$ and $TFP^{BUETTNER}$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.003	0.005	-0.084*	-0.084*	-0.071	-0.070
	(0.047)	(0.048)	(0.047)	(0.047)	(0.048)	(0.048)
$FOREIGN25_{i(t-1)}$	-0.254***	-0.254***	-0.283***	-0.283***	-0.280***	-0.281***
	(0.044)	(0.046)	(0.042)	(0.042)	(0.043)	(0.044)
$(EX * FOREIGN25)_{i(t-1)}$	0.248***	0.248***	0.278***	0.279***	0.278***	0.278***
	(0.074)	(0.075)	(0.063)	(0.064)	(0.068)	(0.068)
$TFP^{BUETTNER}_{i(t-1)}$	0.057***	0.057***	-0.009	-0.009	0.005	0.005
	(0.012)	(0.012)	(0.014)	(0.014)	(0.014)	(0.014)
$RDPRODUCT_{i(t-1)}$	0.119***		0.084***		0.099***	
	(0.028)		(0.029)		(0.026)	
$RDPROCESS_{i(t-1)}$		0.133***		0.113***		0.118***
		(0.038)		(0.038)		(0.039)
$wage_{i(t-1)}$	0.008	0.007	0.065**	0.065**	0.049	0.049
	(0.030)	(0.029)	(0.029)	(0.029)	(0.030)	(0.030)
$size_{i(t-1)}$			0.090***	0.091***		
			(0.012)	(0.012)		
$SMALL_{i(t-1)}$					-0.113***	-0.113***
					(0.027)	(0.027)
$LARGE_{i(t-1)}$					0.110***	0.110***
					(0.035)	(0.035)
$VLARGE_{i(t-1)}$					0.189***	0.191***
					(0.033)	(0.033)
Constant	-0.460***	-0.459***	-0.440***	-0.437***	-0.230	-0.228
	(0.135)	(0.138)	(0.136)	(0.136)	(0.149)	(0.152)
Observations	9195	9195	9195	9195	9195	9195

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4B.13: The Characteristics Associated with the Number of Products Produced (Dep. Var. is $NPRODUCT_{it}$) with $FOREIGN25$ and $TFP^{LABPROD}$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.042	0.045	-0.075	-0.075	-0.061	-0.061
	(0.051)	(0.051)	(0.047)	(0.047)	(0.049)	(0.049)
$FOREIGN25_{i(t-1)}$	-0.237***	-0.238***	-0.273***	-0.274***	-0.270***	-0.272***
	(0.050)	(0.052)	(0.047)	(0.048)	(0.049)	(0.051)
$(EX * FOREIGN25)_{i(t-1)}$	0.235***	0.237***	0.266***	0.268***	0.267***	0.269***
	(0.082)	(0.083)	(0.068)	(0.068)	(0.073)	(0.073)
$TFP^{LABPROD}_{i(t-1)}$	0.012	0.012	-0.009	-0.009	-0.005	-0.005
	(0.016)	(0.016)	(0.014)	(0.014)	(0.014)	(0.014)
$RDPRODUCT_{i(t-1)}$	0.153***		0.103***		0.118***	
	(0.021)		(0.018)		(0.019)	
$RDPROCESS_{i(t-1)}$		0.158***		0.121***		0.130***
		(0.027)		(0.026)		(0.028)
$wage_{i(t-1)}$	0.070**	0.070**	0.063**	0.063**	0.061**	0.061**
	(0.031)	(0.031)	(0.030)	(0.030)	(0.030)	(0.030)
$size_{i(t-1)}$			0.087***	0.088***		
			(0.010)	(0.010)		
$SMALL_{i(t-1)}$					-0.117***	-0.117***
					(0.026)	(0.026)
$LARGE_{i(t-1)}$					0.111***	0.111***
					(0.036)	(0.037)
$VLARGE_{i(t-1)}$					0.193***	0.196***
					(0.028)	(0.029)
Constant	-0.468***	-0.475***	-0.426***	-0.429***	-0.219	-0.221
	(0.125)	(0.129)	(0.140)	(0.142)	(0.154)	(0.157)
Observations	9554	9554	9554	9554	9554	9554

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

4B.2.3 At the 50% Cut-Off Point for Foreign Ownership

Table 4B.14: The Characteristics Associated with the Number of Products Produced (Dep. Var. is $NPRODUCT_{it}$) with $FOREIGN50$ and TFP^{LP}

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.041	0.043	-0.047	-0.047	-0.034	-0.034
	(0.043)	(0.043)	(0.045)	(0.045)	(0.046)	(0.046)
$FOREIGN50_{i(t-1)}$	-0.106	-0.107	-0.156**	-0.158**	-0.151**	-0.153**
	(0.071)	(0.073)	(0.067)	(0.068)	(0.067)	(0.068)
$(EX * FOREIGN50)_{i(t-1)}$	0.100	0.101	0.131*	0.133*	0.133*	0.134*
	(0.088)	(0.090)	(0.074)	(0.076)	(0.077)	(0.078)
$TFP^{LP}_{i(t-1)}$	0.054***	0.055***	-0.002	-0.002	0.008	0.008
	(0.012)	(0.012)	(0.011)	(0.011)	(0.012)	(0.012)
$RDPRODUCT_{i(t-1)}$	0.139***		0.099***		0.114***	
	(0.022)		(0.017)		(0.019)	
$RDPROCESS_{i(t-1)}$		0.145***		0.115***		0.123***
		(0.028)		(0.026)		(0.028)
$wage_{i(t-1)}$	0.005	0.003	0.041*	0.041*	0.032	0.031
	(0.029)	(0.029)	(0.023)	(0.023)	(0.025)	(0.025)
$size_{i(t-1)}$			0.086***	0.087***		
			(0.011)	(0.011)		
$SMALL_{i(t-1)}$					-0.112***	-0.112***
					(0.025)	(0.026)
$LARGE_{i(t-1)}$					0.106***	0.106***
					(0.037)	(0.037)
$VLARGE_{i(t-1)}$					0.182***	0.185***
					(0.031)	(0.031)
Constant	-0.220	-0.223	-0.325**	-0.328**	-0.099	-0.101
	(0.160)	(0.166)	(0.141)	(0.143)	(0.159)	(0.162)
Observations	9521	9521	9521	9521	9521	9521

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4B.15: The Characteristics Associated with the Number of Products Produced (Dep. Var. is $NPRODUCT_{it}$) with $FOREIGN50$ and $TFP^{BUETTNER}$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.028	0.030	-0.054	-0.053	-0.042	-0.040
	(0.044)	(0.045)	(0.045)	(0.045)	(0.046)	(0.046)
$FOREIGN50_{i(t-1)}$	-0.118*	-0.116	-0.177***	-0.176***	-0.171***	-0.170***
	(0.071)	(0.073)	(0.063)	(0.064)	(0.063)	(0.064)
$(EX * FOREIGN50)_{i(t-1)}$	0.107	0.106	0.152**	0.151**	0.152**	0.151*
	(0.090)	(0.092)	(0.074)	(0.075)	(0.076)	(0.078)
$TFP^{BUETTNER}_{i(t-1)}$	0.055***	0.056***	-0.009	-0.009	0.005	0.005
	(0.012)	(0.012)	(0.014)	(0.014)	(0.014)	(0.014)
$RDPRODUCT_{i(t-1)}$	0.116***		0.081***		0.096***	
	(0.027)		(0.027)		(0.025)	
$RDPROCESS_{i(t-1)}$		0.129***		0.108***		0.113***
		(0.038)		(0.038)		(0.038)
$wage_{i(t-1)}$	-0.005	-0.006	0.052*	0.052*	0.036	0.036
	(0.031)	(0.030)	(0.030)	(0.029)	(0.030)	(0.030)
$size_{i(t-1)}$			0.089***	0.090***		
			(0.012)	(0.012)		
$SMALL_{i(t-1)}$					-0.113***	-0.113***
					(0.026)	(0.027)
$LARGE_{i(t-1)}$					0.107***	0.107***
					(0.036)	(0.036)
$VLARGE_{i(t-1)}$					0.184***	0.186***
					(0.032)	(0.032)
Constant	-0.346**	-0.344**	-0.338**	-0.334**	-0.128	-0.125
	(0.142)	(0.145)	(0.138)	(0.138)	(0.152)	(0.155)
Observations	9195	9195	9195	9195	9195	9195

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4B.16: The Characteristics Associated with the Number of Products Produced (Dep. Var. is $NPRODUCT_{it}$) with $FOREIGN50$ and $TFP^{LABPROD}$

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.066	0.069	-0.045	-0.046	-0.032	-0.031
	(0.046)	(0.046)	(0.045)	(0.045)	(0.046)	(0.046)
$FOREIGN50_{i(t-1)}$	-0.094	-0.096	-0.156**	-0.157**	-0.151**	-0.152**
	(0.073)	(0.075)	(0.066)	(0.068)	(0.067)	(0.068)
$(EX * FOREIGN50)_{i(t-1)}$	0.089	0.091	0.132*	0.133*	0.133*	0.134*
	(0.091)	(0.093)	(0.074)	(0.076)	(0.077)	(0.078)
$TFP^{LABPROD}_{i(t-1)}$	0.011	0.011	-0.009	-0.010	-0.005	-0.006
	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)
$RDPRODUCT_{i(t-1)}$	0.150***		0.100***		0.115***	
	(0.021)		(0.018)		(0.019)	
$RDPROCESS_{i(t-1)}$		0.154***		0.116***		0.125***
		(0.027)		(0.026)		(0.028)
$wage_{i(t-1)}$	0.056*	0.056*	0.051*	0.051*	0.048*	0.048*
	(0.030)	(0.030)	(0.029)	(0.029)	(0.029)	(0.029)
$size_{i(t-1)}$			0.086***	0.087***		
			(0.010)	(0.010)		
$SMALL_{i(t-1)}$					-0.116***	-0.116***
					(0.025)	(0.026)
$LARGE_{i(t-1)}$					0.109***	0.109***
					(0.037)	(0.037)
$VLARGE_{i(t-1)}$					0.188***	0.191***
					(0.028)	(0.028)
Constant	-0.359***	-0.366***	-0.323**	-0.324**	-0.116	-0.118
	(0.131)	(0.135)	(0.139)	(0.141)	(0.154)	(0.157)
Observations	9554	9554	9554	9554	9554	9554

Notes: Robust clustered standard errors in parentheses. Region, two-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

5

Productivity and Export Spillovers from FDI in the Host Country

5.1 Introduction

Policymakers and governments across the world implement policies aimed at attracting FDI. One important motivation is that FDI inflows can stimulate economic growth and foreign investors act as an efficient channel for knowledge and technology transfer that could benefit domestically-owned firms in the host economy (see e.g. Aitken *et al.* 1997, Görg and Greenaway 2004, Bwalya 2006, Girma *et al.* 2007, Bitzer *et al.* 2008). Because foreign firms have more advanced technology, employ higher numbers of highly skilled workers and invest more in R&D compared to domestic firms, there is the possibility that such proprietary assets can leak to domestic firms which in turn has a beneficial effect on productivity (Caves, 1996).

Empirically, the evidence for productivity spillovers is mixed. Due to data availability, early studies used cross-sectional data and tends to find evidence for positive spillovers (see e.g. Caves 1974, Blomström and Persson 1983, Kokko 1994 and 1996, Blomström and Sjöholm 1999, Sjöholm 1999a and 1999b) while for more recent studies using either industry-level or firm-level

panel data the evidence is mixed (see e.g. Haddad and Harrison 1993, Aitken and Harrison 1999, Barrios and Strobl 2002, Javorcik 2004, Bwalya 2006, Kugler 2006, Bitzer *et al.* 2008).[1] The mixed evidence on productivity spillovers and the different levels of aggregation motivated Görg and Strobl (2001) to conduct meta-analysis of productivity spillovers. They point out that most of the studies that use cross-sectional data show positive spillovers effects due to the higher t-statistic. Although the results obtained from panel data estimation are quite mixed, panel data is more appropriate as it allows us to investigate time-invariant and sector specific effects on the firm's productivity performance over the time. Lipsey and Sjöholm (2005) explain that the mixed results arise from the differences in the datasets used and the characteristics of firms in each country.

Other channels of possible leakage from foreign to domestic firms are via export spillovers. However, the empirical studies on export spillovers are not as extensively explored as productivity spillovers (Görg and Greenaway, 2004). Evidence on export spillovers is also mixed. Aitken *et al.* (1997), Greenaway *et al.* (2004) and Kneller and Pisu (2007) find positive export spillovers while Barrios *et al.* (2003), and Ruane and Sutherland (2005) find negative or even insignificant results.

The mechanism for export spillovers is that the presence of foreign firms may have an influence on a firm's export market participation, especially on the entry decision into export markets by local firms based on information, and imitation or competition effects (Kneller and Pisu, 2007). Before beginning to export, domestic firms must incur fixed costs to set up for example international networks, channels of distribution, research and development in products in foreign countries. Foreign firms can act as a natural source of such information that would assist domestic firms to enter export markets (Aitken *et al.,* 1997). An increase in the presence

[1] For a survey of studies on productivity spillovers see Blomström and Kokko (1998), Görg and Strobl (2001) and Görg and Greenaway (2004).

of foreign-owned firms also boosts the level of competition which forces domestic firms to increase productivity in order to remain in the market which in turn can positively influence the probability of entering export markets. In contrast, Aitken *et al.* (1999) argue that there are possibilities of productivity reductions which tend to decrease the export intensity of domestic firms. Some domestic firms that are unable to compete with foreign firms are also forced to exit the market.

For Thailand, Diao *et al.* (2005) point out that the openness of a country has a positive effect on economic growth which is driven by capital investment from foreign countries. The Thai government encourages FDI, providing various incentives and privileges to potential foreign investors. The manufacturing sector has received the majority of FDI inflows in recent years. As a consequence, this chapter searches for evidence of productivity and export spillovers from FDI to domestic firms by examining both horizontal and vertical linkages using the same data set as Chapters two to four.

Our results suggest significant evidence of productivity and export spillovers. In terms of productivity spillovers, we find positive and significant horizontal productivity spillovers. Both domestic market-oriented and export-oriented foreign firms operating in the same industry have a positive and significant impact on the productivity of all domestic firms. The entry of foreign firms into the same industry pushes up the level of competition which forces domestic firms to become more productive in order to compete successfully. If we distinguish between different types of domestic firms, the results on horizontal spillovers remain unchanged. The productivity of domestic exporters is increased as a result of the rise in the presence of export-oriented foreign firms in the same industry whereas domestic non-exporters gain from both domestic market-oriented and export-oriented foreign firms. There is some evidence of vertical productivity spillovers to domestic non-exporters in the downstream and upstream industries

which indicates buyer-supplier linkages between foreign firms and domestic non-exporters. Contact between foreign firms and their domestic suppliers that do not export leads to productivity gains as foreign firms may assist domestic suppliers through the improvement of products which are sold as intermediates inputs, production technology and market information. Moreover, foreign firms generate positive spillovers to their domestic customers that do not export. Since foreign firms supply inputs to their domestic customers, spillovers can be leaked through the knowledge and technology used to produce the intermediate inputs.

As regards to export spillovers, mixed evidence is found before and after the entry into export markets. For the export participation decision, there is positive evidence of information externalities generated by contact between foreign firms and their domestic customers. Competition effects are also observed since there is a negative and weakly significant coefficient on horizontal export spillovers. Such negative effects are explained by the dominant effects from the presence of domestic market orientation of foreign firms operating in the same industry. The increased competition generated by the domestic market orientation of foreign firms enforces domestic firms need to compete in the production sold in domestic markets rather than place emphasis on export markets which is likely to reduce the probability of exporting. In terms of export intensity, no evidence is found for vertical spillovers but we find significant evidence for horizontal spillovers. Foreign firms in the same industry increase the export intensity of domestic firms driven by the presence of foreign exporters. This result indicates that domestic exporters can benefit from both information and competition effects which therefore enhances export intensity. Other firm-level characteristics also affect the productivity of domestic firms as well as the decision to export and how much to export.

The structure of the remainder of this chapter is organised as follows. Section 5.2 discusses horizontal and vertical spillovers and the empirical literature on productivity and export

spillovers. Section 5.3 describes and discusses the empirical models, variables and data. Our empirical results for productivity and export spillovers from FDI are presented in Section 5.4. Section 5.5 concludes.

5.2 Literature Review

5.2.1 Spillovers from FDI

Why is it important for policymakers to implement policy that attracts FDI inflow? The presence of foreign investors is often seen as one means to stimulate economic growth (Girma *et al.*, 2008). Foreign firms are believed to have both a direct and indirect impact that would possibly benefit the host economy. The direct impact on the host economy would be for example an increase in capital inflows, employment creation, and R&D and training investments. At the same time, foreign firms can indirectly benefit domestic firms in the host economy due to the externalities arising from proprietary assets. Caves (1996) points out foreign firms are likely to have more advanced technology in the production, superior knowledge and strategic management compared to local producers. The possibility of spillovers can then be generated through knowledge and technology transfers as multinationals experience leakages of their intangible proprietary assets. These positive spillovers induce domestic firms to learn from multinationals and enhance their performance through the development of new products as well as production techniques and production processes.

Bloomström and Kokko (1997) describe the channels to which spillovers from FDI can be transferred. The first channel is through the mobility of workers. If there is a movement of well trained and high skilled workers from foreign to domestic firms, domestic firms can benefit from the knowledge and technology used in the production of foreign firms by workers who

were trained and used to work in foreign firms. The second channel is through contacts and the arm's length relationship between foreign and domestic firms. Domestic firms can learn from advanced production technologies, know-how, and management strategy and, therefore, adapt that knowledge to improve their own production and management techniques. The last channel is through competition effects. The increased competition generated by foreign firms forces domestic firms to improve production techniques to become more productive.

Channels for spillovers from FDI also depend upon how foreign and domestic firms are contacted horizontally or vertically. Horizontal spillovers take place if contacts between foreign and domestic firms are in the same industry. However, if contacts are between industries, vertical spillovers are likely to occur. In terms of horizontal spillovers, the competitive firms in the same industry either benefit or suffer from the presence of foreign-owned firms. Competitive firms in the same industry can benefit from positive leakages of knowledge and new technology transfer if they employ some high-skilled workers who previously worked in the foreign firms. The entry of foreign firms in the same industry can also results in increased competition which forces domestic firm to improve the quality of their products and/or become more productive. In contrast, Aitken and Harrison (1999) argue that foreign investment can generate negative spillovers to domestic firms through a reduction in the productivity of domestic firms in the same industry. If foreign firms can produce with lower marginal costs, they are likely to compete with domestic firms by increasing their production. Domestic firms would therefore lose their market shares to the foreign-owned firms and have to cut the volume of their production which results in a decline in their productivity.

The definition of vertical spillovers follows Hirschman (1958). Vertical spillovers can be generated by foreign firms towards downstream (forward linkages) and/or upstream firms (backward linkages). Forward linkages are the spillovers from foreign producers that supply

intermediate inputs to their potential domestic customers while backward linkages are linkages from foreign firms to their potential local suppliers of intermediate inputs. These are also recognised as buyer-supplier linkages between foreign and domestic firms. Inter-industry contact between foreign and domestic firms can lead to arm's length relationships which can induce demonstration effects where domestic firms can easily learn and gain from technology and knowledge transfers. For example, foreign firms may demand high quality of intermediate goods from suppliers. If this is the case, suppliers may have to upgrade or improve the quality of goods, with foreign firms potentially sharing technology with their suppliers.

Theoretically, Rodríguez-Clare (1996) develops a model to explain how foreign multinationals generate spillovers through the vertical linkages. The model shows that local firms in the host country benefit from the positive vertical spillovers when intermediate inputs are used intensively in the production at foreign multinationals plants. Local firms also benefit from spillovers when there are large communication costs between the headquarters and production plants and when the varieties of intermediate input between the home and host country are relatively similar that can be substituted in the production.

5.2.2 Empirical Evidence of Spillovers from FDI

Blomström and Kokko (1998), Lipsey (2002), Görg and Greenaway (2004) provide literature surveys of the empirical evidence of spillovers to domestic firms that arise from FDI through the presence of foreign firms or MNEs in the host country. Although domestic firms may be affected via different channels such as export spillovers, productivity spillovers, wage spillovers, knowledge and technology spillovers, this chapter only considers those productivity and export spillovers from FDI.

5.2.2.1 Productivity spillovers from FDI

The empirical analysis on productivity spillovers is based on a basic framework that regresses productivity, either labour productivity or TFP, on various independent variables including different measures of the presence of FDI or foreign multinationals. Most of the early studies use cross-sectional industry-level data. The first empirical test on productivity spillovers from FDI is conducted by Caves (1974) using data for Australia in 1966. The result shows that the presence of foreign firms has positive effect on labour productivity. Positive effects on productivity spillovers from FDI are also found in Globerman (1979) for Canada, Blomström and Persson (1983) and Blomström (1986) for Mexico.

In Venezuela, the government implements policy to attract FDI in order to acquire technology spillovers. The empirical investigation by Aitken and Harrison (1999) reveals two contrasting results. First, domestic firms benefit from FDI because an increase in the percentage of foreign-owned shares has a positive impact on the firms' performance. Second, there is negative evidence for horizontal spillovers because an increase in foreign investment decreases the productivity of domestic firms in the same industry. The entry of foreign firms into the domestic market increases the level of competition so domestic firms lose market share to foreign entrances. This means domestic firms have to cut production but at the same time they still face the same fixed costs. On balance, the negative effect of FDI on domestic firms' productivity appears to be fairly small. In addition, they find no evidence of technology spillovers from FDI to domestic firms as assumed earlier by the government.

Barrios and Strobl (2002) focus on an empirical investigation of Spain and that local firms may have superior absorptive capability due to the fact that the country is industrialised and receives a large share of FDI inflows. When time invariant and sector-specific effects are not taken into account in the OLS regression, their negative result for a foreign presence on productivity are

consistent with Aitken and Harrison (1999). To investigate further, they include additional variables to examine different aspects of possible spillovers effects that arise from a foreign presence. They do not find any significant evidence for absorptive capacity and inter-sectoral spillovers. However, they do find evidence of positive productivity spillovers but only for the domestically-owned exporters.

Haddad and Harrison (1993) and Görg and Strobl (2005) search for evidence of intra-industry spillovers from FDI in Africa. Haddad and Harrison (1993) could not find robust evidence of positive productivity spillovers using Moroccan data for the second half of the 1980s. There is no evidence to support positive spillovers for domestically-owned firms. However, joint ventures between local and foreign firms did gain from spillovers effects of FDI. Görg and Strobl (2005) investigate how productivity spillovers from FDI can be generated through the movement of workers from MNEs to domestic firms using detailed firm-level data for Ghana and also information on the employment experience of domestic firms' owners and on whether they used to work in an MNEs or not. There is an evidence to support a positive spillovers effect through worker mobility of which the productivity of domestic firms, where the owners had working experiences from MNEs in the same industry, are higher compared to other domestic firms.

In the UK, many studies search for the evidence of intra-industry productivity spillovers from FDI. For instant, Liu *et al.* (2000), Driffield (2001) and Haskel *et al.* (2002) find evidence to support positive productivity spillovers between foreign and domestic firms in the same industry while Girma *et al.* (2001), Girma and Wakelin (2002), Girma (2005) find mixed or even insignificant evidence.

Most early empirical studies were more concerned about spillover effects in the same industry rather than between industries (Blomström *et al.*, 2000). Only a few studies find positive and

significant evidence of productivity spillovers within industries. Some studies even discover a negative relationship between productivity spillovers and FDI, due mainly to the fact that foreign-owned firms may have capacity to prevent the information and knowledge leakages to local domestic competitors in the same industry (Javorcik, 2004). This explanation motivated researchers to turn their interests towards inter-industry spillovers through the vertical linkages where foreign-owned firms may transfer technology to their suppliers and/or customers.

Recent studies highlight the consequences of both intra- and inter-industry spillovers. Javorcik (2004) uses firm-level panel data for Lithuania from 1996 to 2000 and finds evidence of positive productivity spillovers through backward linkages. No robust results are found on horizontal spillovers and vertical spillovers through forward linkages. An additional investigation into the structure of FDI projects associated with productivity indicates that wholly-owned foreign firms do not have any significant effect on the productivity of local firms although partially-owned firms do.

Bwalya (2006) employs firm-level data for Zambia and found evidence of both productivity losses and gains. First, the productivity of domestically-owned firms tends to decrease as MNEs in the same industry increase. This is because of the increased competition generated by MNEs. Second, the results support the existence of vertical spillovers through backward linkages that means local suppliers of intermediate inputs benefit from know-how and technology transfer generated by foreign firms in order to enhance production efficiency and productivity of local firms.

Bitzer *et al.* (2008) use industry-level data from 17 OECD countries and find positive and significant evidences on horizontal productivity spillovers and vertical productivity spillovers through backward linkages. They used cross-country data to allow comparisons of the magnitude of spillover effects among different groups. In comparison to other OECD

countries, FDI in Central and Eastern European Countries (CEECs) was found to have a larger effect on the productivity of local firms in the same industry, when vertical linkages variables were not included in the model, and local suppliers that supply intermediate inputs.

In an analysis of Indonesia, Blalock and Gertler (2008) find a positive and significant result on vertical productivity spillovers for downstream industries which is consistent with the evidence of Javorcik (2004), Bwalya (2006) and Bitzer *et al.* (2008). Multinationals transfer technology to their local supplier in order to increase productivity and to be supplied intermediate inputs at lower prices. However, they do not find any evidence for horizontal spillovers.

A few studies examine both intra- and inter-industry productivity spillovers in the UK. Driffield *et al.* (2002) use industry-level panel data from 1984 to 1992 to investigate for the spillovers effects on productivity growth of domestic firms in the manufacturing industries and allow for spillovers through horizontal, backward and forward linkages. Their findings show positive and significant evidence for positive spillovers through forward linkages but insignificant for backward linkages. Inconsistent results are found on horizontal spillovers. Harris and Robinson (2004) estimate for the effects of horizontal and vertical productivity spillovers in 20 manufacturing industries from 1974 to 1995. However, their framework does not distinguish between vertical spillovers that occur through backward or forward linkages. Their results show that vertical spillovers are more widespread than horizontal spillovers. The overall inter-industry effects in UK are inconclusive as each individual industry has different spillover results. Negative spillovers are found in some industries while others find positive spillovers.

In a recent study of the UK, Girma *et al.* (2008) use firm-level data between 1992 and 1999 to investigate for evidences of both horizontal and vertical spillovers through backward and forward linkages, and separately investigate possible spillovers to domestic exporters and domestic non-exporters. Under the assumption that different incentives for FDI may generate

different spillovers effects towards domestic firms, they consider the spillover effects from domestic- and export-market oriented FDI. Results for spillovers to domestic firms are quite complex and depend on the type of FDI. Different samples (domestic exporters and domestic non-exporters) show different significant results on productivity spillovers. In general, the results confirm the existence of positive horizontal productivity spillovers from export-oriented FDI. For vertical spillovers, only domestic-market oriented FDI generate positive backward linkages to domestic firms for both exporters and non-exporters.

Furthermore, a study by Javorcik and Spatareanu (2008) provides a detailed investigation of spillovers from different types of investment projects by ownership structure (jointly and wholly owned) to local producers in the same industry and upstream sectors. Using 6 years of Romanian firm-level data from 1998 to 2003, the results show a positive and significant association between investment projects with joint domestic and foreign ownership on vertical spillovers to upstream sectors. However, for wholly-owned foreign subsidiaries, they found no significant evidence of vertical spillovers. Jointly-owned firms may choose to engage in local outsourcing of the intermediate inputs because local suppliers can provide intermediate inputs at lower costs compare to wholly-owned foreign subsidiaries. In contrast to inter-industry productivity spillovers, FDI has a negative horizontal spillover effects on local firms. When comparing the magnitude of the horizontal spillover effects between different types of ownership structure, jointly-owned firms have a less negative impact on local firms than wholly-owned firms.

Another dimension of the productivity spillover literature is examined by Alvarez and López (2008) who highlight the importance of productivity spillovers from export activities both intra- and inter-industry, using a plant-level data for Chile between 1990 and 1999. They find positive and significant effect of backward spillovers from exporting. When they distinguish export

activities by different types of ownership, the evidence shows that export activities of foreign firms as well as domestic firms, increases the productivity of domestic firms. Foreign-owned exporters generate positive horizontal and backward spillovers to domestic non-exporters while domestically-owned exporters only have positive influence on the productivity of domestic suppliers who do not export.

In Thailand, studies on spillovers are limited. Diao *et al.* (2005) links foreign spillovers to economic growth by focusing on the analysis related to openness, productivity, and foreign investment using a growth model. High economic growth in Thailand is a result of openness, tariff reduction and productivity which is driven by spillovers from foreign investment. Kohpaiboon (2006) uses cross-sectional data from the 1997 Industrial Census to examine spillovers from FDI through technology transfer. He finds that FDI generates negative productivity spillovers to locally owned industries. The effect of spillovers also depends upon the trade policy regime. Tomohara and Yokota (2007) investigate for productivity spillovers from FDI using a firm-level panel data between 1999 and 2003 from the National Statistic Office of Thailand (TNSO). The overall results indicate significant evidence of positive horizontal productivity spillovers but not for vertical spillovers. However, when they split establishments into different samples: export orientation, material import, operation year and size, they observe different spillovers effects. For instance, export-oriented firms benefit from spillovers through forward linkages while horizontal and backward linkages have a negative effect on productivity.

5.2.2.2 Export Spillovers from FDI

Most studies search for productivity spillovers from foreign to domestic firms while only a small number of studies empirically investigate the possibility of export spillovers. The key mechanism of export spillovers is the assumption that domestic firms may learn and gain knowledge from the export activities and firm specific advantages of MNEs which help to enhance their productivity and, therefore, has an impact on the entry decision into export markets and the export intensity of existing exporters.

One of the first empirical studies by Aitken *et al.* (1997) links spillovers with export behaviour and FDI by emphasising the role of foreign investment has as a catalyst for domestically-owned firms to enter export markets. These export spillovers from foreign investment arise from the fact that MNEs appear to have greater access to information, foreign markets, distribution services and advance production technology. These same factors could benefit domestically-owned firms if they learn from MNEs. Using plant-level data from the Mexican manufacturing industry between 1986 and 1990, they find evidence for export spillovers from MNEs that act as export catalysts for domestically-owned firms. The probability of domestically-owned firms exporting is positively associated with the proximity of MNEs who export.

Kokko *et al.* (2001) use cross sectional data for 1998 manufacturing firms in Uruguay to search for export spillovers. At different periods of time, the government implements policy aimed at attracting different types of MNEs.[2] Kokko *et al.* (2001) define two types MNEs according to their year of establishment. There is no evidence for export spillovers from MNEs established in the inward-oriented period (before 1972). However, MNEs established in the outward-

[2] The policies implemented by government are inward- and outward-oriented policy. The explanation of the former is based on the framework of protectionism. The government subsidises import substitution aimed at replacing the imported goods and services with domestic production. The latter is implemented in order to stimulate more exports by providing various incentives to the new and existing exporters for example reduces tariff and non-tariff barriers, and maintains competitive exchange rate.

oriented period (after 1973) generate positive export spillovers to domestic firms in Uruguay and also its neighbouring markets in Brazil and Argentina.

In terms of developed countries, evidence for export spillovers from FDI to domestic firms in different European countries is mixed. Barrios *et al.* (2003) emphasise the importance of export spillovers from R&D expenditure and export activity of both domestic firms and MNEs using Spanish firm-level panel data from 1990 to 1998. The presence of MNEs in this study is measured by their R&D expenditure and export activity. Results from a probit model on the entry decision shows that there is no significant evidence for export spillovers from either R&D or export activities of MNEs in the same sector. However, positive and significant results are found on the export activity of domestic firms. In the tobit model, only R&D expenditures of MNEs have positive spillovers effects on export ratio of domestic firms.

For the UK, Greenaway *et al.* (2004) try to explain an indirect channel for productivity spillovers from FDI generated through exports using firm-level panel data from 1992 to 1996. They measure the presence of MNEs based on their employment and export share. They find positive evidence for export spillovers from both measures. The presence of MNEs has a positive effect on the export participation decision of domestic firms and the propensity to export. Further investigation by Kneller and Pisu (2007) look at the effect of industrial linkages and export spillovers from FDI between 1992 and 1999. The empirical results from Heckman selection model show that MNEs generate export spillovers to domestic firms. Firstly, there is a positive and significant relationship between vertical spillovers through backward linkages and export share. Secondly, a positive and significant coefficient on horizontal export spillovers from export-oriented MNEs indicates that exported-oriented MNEs have a significant effect on the probability of exporting for those domestic firms operating in the same industry.

Ruane and Sutherland (2005) compute the presence of foreign firms using an identical methodology to Greenaway *et al.* (2004). Using data from Irish manufacturing industry during the period 1991 and 1998 they investigate export spillovers from foreign firms on the export decision and export intensity of domestic firms. The empirical evidence reveals two contrasting findings which are a positive and significant effect of export spillovers from employment share of foreign firms but a negative and significant effect on export spillovers from the export share of foreign firms. The negative effect is explained by the fact that US-owned firms invest in Ireland in order to use the country as an export platform to produce and distribute products to other countries in Europe.

As regards to recent studies from a developing country perspective, Alyson (2006) investigates export spillovers to Chinese-owned firms using data from 29 provinces between 1993 and 2000. The presence of foreign firms is measured by their export activity. Foreign firms owned by different countries generate different effects on the entry decision of domestic firms. The evidence indicates a positive relationship between the presence of foreign firms from OECD countries and the decision of domestic firms to enter export markets. Alvarez (2007) investigates factors that determine the export participation decision in Chile during 1990 and 1996. Results show that multinationals generate positivity spillovers on the probability of becoming a permanent exporter which can be explained either by the competition effects or information effects through technology and knowledge transfer that encourage other firms to improve efficiency and export performance.

5.3. Model Specification, Variables and Data

5.3.1 Empirical Models

In this section, we present empirical models for the estimation of the relationship between FDI, MNEs in Thailand, productivity and the export behaviour of domestic firms. Factors included in each model are in line with previous theoretical and empirical literature. Our main focus is on the variables that capture productivity and export spillovers from foreign to domestic firms for both horizontal and vertical linkages. In addition to spillovers variables, we also include the standard firm-level specific characteristics that are assumed to affect productivity and the export behaviour of domestic firms.

5.3.1.1 Empirical Model of Productivity Spillovers

We carry out a two step estimation procedure in the search for productivity spillovers. The first step is to estimate a production function in order to obtain TFP following Levinsohn and Petrin (2003). This estimation technique takes account of a simultaneity problem as well as an unobserved firm-specific productivity shock. We include the data of all firms and estimate the production function separately for each two-digit industry.[3]

Since we would like to investigate the effect on domestic firms, in the second step, we regress TFP of domestic firms only on spillovers variables and other control variables such as industry-level characteristics and various firm-level specific characteristics. All independent variables except spillovers are lagged by one year to avoid possible simultaneity problems. Thus, our model is given by:

[3] See Appendix 2B in Chapter two for the estimation procedure.

$$
\begin{aligned}
TFP_{it} = {} & \gamma_0 + \gamma_1 FORW_{jt} + \gamma_2 HOR_{jt} + \gamma_3 BACK_{jt} \\
& + \gamma_4 INRDSHARE_{j(t-1)} + \gamma_5 INEXSHARE_{j(t-1)} \\
& + \gamma_6 CONCEN_{rj(t-1)} + \gamma_7 SMALL_{i(t-1)} + \gamma_8 LARGE_{i(t-1)} \\
& + \gamma_9 VLARGE_{i(t-1)} + \gamma_{10} wage_{i(t-1)} + \gamma_{11} wage^2_{i(t-1)} \\
& + \gamma_{12} TRAIN_{i(t-1)} + \gamma_{13} EX_{i(t-1)} + \varepsilon_{it}
\end{aligned}
\tag{5.1}
$$

where the subscripts *i*, *j*, *r*, *t* refer to firm, industry, region and time respectively.

TFP is total factor productivity of a firm.

$FORW$ is a measure of vertical spillovers via forward linkages.

HOR is a measure of horizontal spillovers.

$BACK$ is a measure of vertical spillovers via backward linkages.

$INRDSHARE$ is a share of industry R&D expense.

$INEXSHARE$ is the industry export share.

$CONCEN$ is a measure for geographic concentration of firm in industries and regions.

$SMALL$ is a dummy variable to represent a small firm.

$LARGE$ is a dummy variable to represent a large firm.

$VLARGE$ is a dummy variable to represent a very large firm.

$wage$ is the log of wages per employee.

$wage^2$ is a quadratic term of the log of wages per employee.

$TRAIN$ is a dummy variable for both in-house and outside training.

$EX_{i(t-1)}$ represents the export experience of a firm.

ε is the error term.

As previously discussed in Chapter two about the panel structure setting, a problem unobserved firm heterogeneity exists and should be modelled as fixed or random effects. According to

Equation (5.1), the error term (ε_{it}) comprises of two components where $\varepsilon_{it} = \mu_i + \eta_{it}$. μ_i is the unobserved firm specific effect and η_{it} is the stochastic disturbance term.

The fixed effects estimator assumes that μ_i are fixed parameters to be estimated that vary over the individual firm and η_{it} follows $\eta_{it} \sim IID(0, \sigma_\eta^2)$. In addition, the regressors are assumed to be independent of η_{it} for all *i* and *t*. In contrast, the random effects estimator assumes that μ_i are random factors so $\mu_i \sim IID(0, \sigma_\mu^2)$, $\eta_{it} \sim IID(0, \sigma_\eta^2)$ and μ_i are independent of η_{it}. In addition, the regressors are assumed to be independent of μ_i and η_{it} for all *i* and *t* (Baltagi, 2005).

We estimate our model for both two-way fixed effects and random effects. Both estimations include a set of time indicator variables to control for unobserved time varying effects. For the fixed effects model, we use within regression estimator which is an OLS regression required regressors' variation over time within unit. For the random effects model, we use the generalised least square estimator (GLS) which is a matrix-weighted average of the between and within estimator (Verbeek, 2004).

In order to test the appropriateness of the fixed versus random effects, we use the Hausman (1978) specification test.[4] The null hypothesis is that ε_{it} and the regressors are uncorrelated. However, if they are correlated, the GLS estimator is biased and inconsistent while the within estimator is unbiased and consistent (Baltagi, 2005). The Hausman specification test reported in the Appendix 5C reject the null hypothesis. The significance suggests that the within estimator is appropriate. Therefore, we choose within estimator which is often called fixed effects estimator as our estimation technique. In addition, we allow for robust clustering at the industry

[4] See Appendix 5C for a detailed discussion.

level. This technique relaxes the independence assumption and requires only that the observations are independent across sectors.

5.3.1.2 Empirical Model of Export Spillovers

We investigate two aspects of export spillovers which are the export participation decision and how much to export. This is known as a two-stage decision process as firms firstly have to decide whether to export or not and secondly the amount firms should export (Kneller and Pisu, 2007). In order to enter export markets, firms have to invest in sunk entry costs, so not every firm decides to export. The export intensity is, therefore, restricted to the subset of firms that do export. As a result, a Heckman selection model is used in order to avoid sample selection bias in the coefficients of our estimated results (Heckman, 1979).[5] We estimate our equations using a Heckman model with maximum likelihood estimation method because it is more appropriate and more efficient than the two-step estimation method.[6] The model consists of two equations:

Export share equation:

$$s_{it}^{*} = X_{it}\beta + \omega_{it} \tag{5.2}$$

Export decision equation:

$$d_{it}^{*} = Z_{it}\alpha + \nu_{it} \tag{5.3}$$

[5] This estimation technique is also used in UK studies by Greenaway *et al.* (2004) and Kneller and Pisu (2007).

[6] The maximum likelihood estimation method uses a full maximum likelihood procedure to jointly estimate the inverse Mills ratio and the coefficients in the two equations (export decision and export share). For the two-step estimation, the first step is to regress the probit model of the export decision and compute the invest Mill ratio as the prediction of a binomial probit. Then, the invest Mill ratio is inserted as a regressor in the export share regression in the second step. The two-step method is easy but it is less efficient than the maximum likelihood method.

where $s_{it} = s_{it}^{*}, d_{it}=1 \; if \; d_{it}^{*} > 0$ and $s_{it} = 0, \; d_{it} = 0 \; if \; d_{it}^{*} \leq 0$

From both equations, identifying export intensity is dependent upon whether a firm exports or not. The export value (s_{it}) is not observed if a firm does not export $(d_{it} = 0)$ but if a firm exports $(d_{it} = 1)$, we observe positive export sales. The unobserved errors (ν_{it} and ω_{it}) are conditional upon whether $\nu_{it} \sim N(0,1)$, $\omega_{it} \sim N(0, \delta)$, $corr(\nu_{it}, \omega_{it}) = \rho$ and (ν_{it}, ω_{it}) ~bivariate normal $[0, 0, 1, \delta, \rho]$.

In terms of our Heckman selection model, some factors included in both equations should be different (Baum, 2006). If variables included in vector X and Z are the same, the coefficients and the error terms in both equations would be equal ($\beta = \alpha$ and $\omega_{it} = \nu_{it}$) so the model would reduce to standard tobit model.[7] For this reason, we include an additional variable which is the lag of export dummy $(EX_{i(t-1)})$ in the selection equation (export decision equation) because this variable is theoretically consistent with recently developed models of exports by Melitz 2003, Helpman *et al.* 2004 and Bernard *et al.* 2003 that take into account sunk costs of export.[8] In general, this variable is included in the standard regression model to empirically identify the factors that influence the entry decision into export market (see e.g. Roberts and Tybout 1997, Bernard and Jensen 2004, Kimura and Kiyota 2006). If the lag of export dummy is positive and significant, it is usually interpreted as an evidence of sunk costs of export. Apart from the lag of export dummy, other variables are likely to appear in both equations. All independent variables apart from spillovers are lagged by one year to avoid possible simultaneity problems. Our full specification of the export decision (Equation (5.4)) and export share (Equation (5.5)) equations are as follows:

[7] See Verbeek (2004) for a detailed discussion.

[8] A recent study of export spillovers by Kneller and Pisu (2007) also uses a Heckman model and includes the lag of export dummy in the selection equation.

$$
\begin{aligned}
EX_{it} = {} & \alpha_0 + \alpha_1 EX_{i(t-1)} + \alpha_2 FORW_{jt} + \alpha_3 HOR_{jt} + \alpha_4 BACK_{jt} \\
& + \alpha_5 INRDSHARE_{j(t-1)} + \alpha_6 INEXSHARE_{j(t-1)} \\
& + \alpha_7 TFP_{i(t-1)} + \alpha_8 TFP^2_{i(t-1)} + \alpha_9 SMALL_{i(t-1)} + \alpha_{10} LARGE_{i(t-1)} \\
& + \alpha_{11} VLARGE_{i(t-1)} + \alpha_{12} wage_{i(t-1)} + \alpha_{13} wage^2_{i(t-1)} \\
& + \alpha_{14} SKILL_{i(t-1)} + \alpha_{15} TRAIN_{i(t-1)} + \sum_{r=1}^{5} \alpha_r REGION_r + \nu_{it}
\end{aligned}
\tag{5.4}
$$

$$
\begin{aligned}
EXSHARE_{it} = {} & \beta_0 + \beta_1 FORW_{jt} + \beta_2 HOR_{jt} + \beta_3 BACK_{jt} \\
& + \beta_4 INRDSHARE_{j(t-1)} + \beta_5 INEXSHARE_{j(t-1)} \\
& + \beta_6 TFP_{i(t-1)} + \beta_7 TFP^2_{i(t-1)} + \beta_8 SMALL_{i(t-1)} \\
& + \beta_9 LARGE_{i(t-1)} + \beta_{10} VLARGE_{i(t-1)} + \beta_{11} wage_{i(t-1)} \\
& + \beta_{12} wage^2_{i(t-1)} + \beta_{13} SKILL_{i(t-1)} + \beta_{14} TRAIN_{i(t-1)} \\
& + \sum_{r=1}^{5} \beta_r REGION_r + \omega_{it}
\end{aligned}
\tag{5.5}
$$

where the subscripts *i*, *j*, *r*, *t* refer to firm, industry, region and time respectively.

EX is a dummy for export status of firm i.

$EXSHARE$ is the ratio of export sale to total sale of firm i.

$EX_{i(t-1)}$ represents the export experience of a firm.

$FORW$ is a measure of vertical spillovers via forward linkages.

HOR is a measure of horizontal spillovers.

$BACK$ is a measure of vertical spillovers via backward linkages.

$INRDSHARE$ is a share of industry R&D expense.

$INEXSHARE$ is the industry export share.

TFP is total factor productivity of a firm.

TFP^2 is a quadratic term of total factor productivity of a firm.

$SMALL$ is a dummy variable to represent a small firm.

$LARGE$ is a dummy variable to represent a large firm.

$VLARGE$ is a dummy variable to represent a very large firm.

$wage$ is the log of wages per employee.

$wage^2$ is a quadratic term of the log of wages per employee.

$SKILL$ is a ratio of skilled labour to total labour.

$TRAIN$ is a dummy variable for both in-house and outside training.

$REGION$ is a vector of five regional dummies which indicates the regional location of a firm.

In addition to region dummies, we include industry and year dummies to control for the unobserved, industry and time varying effects. We also allow for robust clustering at the industry level which relaxes the independence assumption and requires only that the observations are independent across industries.

5.3.2 Variables

We use two indicators to identify a firm's export behaviour. The first indictor is used to determine whether a firm exports or not which is a dummy variable for export status (EX) which equals 1 if the firm has positive export sales and 0 otherwise. The second indicator is the value of a firm's export share ($EXSHARE$) which is used to determine the export intensity of a firm.

Total factor productivity (TFP) is a measurement for efficiency in the production process. The higher the value of TFP determines the greater effectiveness use of inputs and hence a greater shifts of production function. Since we only use TFP as one of the independent variables in the export spillovers model, we thus expect a positive relationship between TFP and both a firm's

decision to export and export intensity.[9] We use a semi-parametric approach following Levinsohn and Petrin (2003) that takes account of unobserved firm-specific productivity shock (TFP^{LP}). In a sensitivity analysis, we use another measurement of productivity which is the standard labour productivity ($TFP^{LABPROD}$) defined as the log of value added divided by total labour.

Firm size is expected to be one of the important firm characteristics that affect both productivity and export behaviours. We believe the productivity is positively correlated to firm size. Small firms are less likely to increase their productivity whilst large firms seem to have more advanced technology and higher production efficiency that affects the increase in productivity. This therefore can possibly induce firms to enter export markets as well as enhance export sales among the existing exporters. We categorise firm size into small ($SMALL$), medium ($MEDIUM$), large ($LARGE$) and very large ($VLARGE$) by following the quartile distribution of the total employment for all firms operating in the same two-digit industry. We omit *MEDIUM* firms in our analysis.

In terms of labour force, we used different measures to capture the quality of the labour. First, wage ($wage$) is defined as the log of wages per employee where wages per employee are the ratio of total salaries to total worker less owners who do not receive salaries. If employees receive high wages, they tend to be the skilled and professional workers. In contrast, employees who receive low wages tend to be the unskilled workers. Our second measure is the ratio of skilled labour to total labour ($SKILL$).[10] Finally, we include a measure of training ($TRAIN$) where a dummy variable equals 1 if employees within a firm receive formal training either in-

[9] Our expectation of the positive relationship is based on the empirical evidence that supports the fact that highly productive firms are more likely to enter export markets (see e.g. Bernard and Jensen 1999 and 2004, Kneller and Pisu 2004) and increase export intensity (see e.g. Kneller and Pisu 2007).

[10] Since a variable that measures a number of workforces is already included when estimating TFP, we do not include *SKILL* in the productivity spillovers model but we do include that in the export spillovers model.

house or outside training or both at least once and 0 otherwise. Specialisation and working expertise tend to be increased in those workers who are trained. Therefore, we expect that the higher the wage, the more superior the quality of labour. The higher the ratio of skilled labour or workers who received training should also have a positive impact on the firms' export behaviour. The wage and training are also expected to have a positive effect on the firm productivity.

For horizontal and vertical spillovers variables from foreign to domestic firms, we compute indices at the industry level to capture the presence of foreign firms for both intra- and inter-industry.[11] Foreign ownership is defined as if at least 10% of shares are owned by foreign investors. The index that captures horizontal spillovers effects (HOR) is defined as:

$$HOR_{jt} = \frac{Y_{jt}^{f}}{Y_{jt}} \tag{5.6}$$

The horizontal spillover variable is the ratio of total sales of foreign firms operating in Thailand (Y_{jt}^{f}) in industry *j* at time *t* to total sales of all firms (Y_{jt}) that includes both foreign and domestic firms. The empirical evidence for horizontal productivity and export spillovers is mixed so the coefficients could be either negative or positive.

Moreover, we take into account the difference between export-oriented and domestic market-oriented FDI by computing additional indices for horizontal spillovers as we assume that the different market orientation of foreign firms may have different spillover effects on domestic firms. For example, foreign exporters may have firm specific advantages, such as information about foreign markets that are able to generate positive export spillovers to domestic firms, and

[11] Different definitions are used to measure foreign presence such as share of foreign equity participation (Aitken and Harrison 1999, Javorcik 2004), growth rate of sales of foreign firms (Driffield, 2001), employment share and export share of foreign firms (Greenaway *et al.* 2004, and Ruane and Sutherland 2005), total production of foreign firms (Kneller and Pisu 2007, Javorcik and Spatareanu 2008 and Girma *et al.* 2008).

advanced production processes that would have positive productivity spillovers to domestic firms. Two indices that capture horizontal spillovers from foreign firms according to domestic market orientation ($HOR-Domestic$) and export market orientation ($HOR-Export$) are computed as:

$$HOR-Domestic_{jt} = \frac{Y_{jt}^{df}}{Y_{jt}} \tag{5.7}$$

$$HOR-Export_{jt} = \frac{Y_{jt}^{ef}}{Y_{jt}} \tag{5.8}$$

$HOR-Domestic_{jt}$ is the ratio of total domestic sales in a host country of foreign firms (Y_{jt}^{df}) in industry *j* at time *t* to total sales of all firms (Y_{jt}) whilst $HOR-Export_{jt}$ is the ratio of total export sales of the same foreign firms (Y_{jt}^{ef}) in industry *j* at time *t* to total sales of all firms in the same industry and same time.

For the vertical spillovers variables, an Input-Output (I-O) table is used to calculate backward and forward linkages. The I-O table contains information on the value of output of one industry supplies as inputs to another industry. We compute the backward and forward linkages in the same way as Javorcik (2004), Kneller and Pisu (2007) and Girma *et al.* (2008).

Backward linkages index ($BACK$) captures the contact between foreign firms and their potential local suppliers of intermediate inputs. The measurement of backward linkages is computed as:

$$BACK_{jt} = \sum_{k} \alpha_{kjt} HOR_{kt} \quad for\ k \neq j \tag{5.9}$$

where the variable α_{kjt} represents the proportion of industry *k*'s output supplied to industry *j* that can be specified as $\alpha_{kjt} = \frac{Y_{kjt}}{Y_{kt}}$. Y_{kjt} is the output of industry *k* that is provided to industry *j* and Y_{kt} is the total output of industry *k*.

The forward linkage variable ($FORW$) is an index that captures the contact between foreign firms and their domestic customers. As a consequence, we measure the forward variable in the similar way to the backward variable. However, instead of using α_{kjt}, we use β_{jht} which corresponds to the proportion of the output that industry *j* supplies to industry *h* that can be specified as $\beta_{jht} = \frac{Y_{jht}}{Y_{ht}}$. The measurement of forward index is thus defined as:

$$FORW_{jt} = \sum_{h} \beta_{jht} HOR_{ht} \quad for\ h \neq j \tag{5.10}$$

In addition, we measure the industry-level variables which are the industry export share (*INEXSHARE*) defined as the ratio between total export sales and total sales of industry *j* in the same year, industry R&D expense (*INRDSHARE*) defined as the ratio of R&D expenses in industry *j* to total R&D expense of all industry in the same year, and concentration (*CONCEN*). The concentration variable is included because we assume that the geographical concentration of industries and regions may have some impact on the firms' productivity. If firms agglomerate in some industries and regions, these agglomeration effects may enhance the productivity of firms that operate in the particular industry or region. The measurement of concentration in this chapter is based on the methodology outlined in by Álvarez and López (2008) which is defined as:

$$CONCEN = \frac{\left(Total\ Sale_{rjt} \Big/ Total\ Sale_{jt} \right)}{\left(Total\ Sale_{rt} \Big/ Total\ Sale_{t} \right)} \tag{5.11}$$

where the subscripts *r*, *j*, *t* refer to region, industry and time respectively.

5.3.3 Data

We use the same data set as Chapters two to four which is a firm-level panel data from the Annual Survey of Thailand's manufacturing industry by the OIE between 2001 and 2004. In addition, we use the 2000 I-O table from Office of the National Economic and Social Development Board (NESDB), Thailand to calculate our spillovers indices.[12]

Details of definitions are presented in Table 5A.1 of the Appendix 5A. As all regressors in the model except the spillovers variables are lagged by one year to minimise possible simultaneity problems, the data in the estimated sample of productivity spillovers includes 6,529 observations and export spillovers includes 6,768 observations. Descriptive statistics for both samples are provided in Tables 5A.2 and 5A.3 of the Appendix 5A. Table 5A.4 shows the raw correlations of variables.

Table 5.1 presents summary statistics of a firm's characteristics where we report the means and standard deviations for different types of firms. Amongst different characteristics and performances such as output, sales, capital stock and employment, we observe that foreign firms have superior performance compared to domestic firms. Employees who work in foreign firms receive higher wages compared to those working in domestic firms. The means reported also

[12] From the I-O table of Thailand, we use 58x58 sectors but only restrict ourselves to sectors that relate to manufacturing activities so 30 sectors are selected. Since the classification of sectors in the I-O table and two-digit ISIC in the manufacturing survey are different, we have to group 30 sectors and 22 two-digit ISIC in order to create a 18x18 matrix used to calculate measurements of vertical spillovers through backward and forward linkages (see Appendix 5B for details of the construction).

shows that foreign firms are slightly more productive than domestic firms. If we make a distinction between domestic exporters and domestic non-exporters, the former perform better. For example, domestic exporters have more assets, are more productive, and pay higher wages.

Table 5.1: Summary Statistics

	Foreign Firms	Domestic Firms	Domestic Exporters	Domestic Non-Exporters
Output	327.499	77.233	128.94	45.148
	(765.61)	(267.06)	(327.99)	(214.84)
Sales	403.826	95.706	161.60	54.789
	(906.57)	(342.03)	(445.18)	(249.48)
Assets	375.241	127.339	181.32	78.098
	(857.42)	(598.03)	(782.44)	(347.12)
Capital stock	156.790	38.065	72.518	16.631
	(454.61)	(325.61)	(516.46)	(69.92)
Labour	642.338	271.601	519.64	117.592
	(1204.26)	(561.93)	(792.21)	(245.62)
Wage	42.082	23.546	25.531	22.313
	(87.80)	(17.91)	(14.01)	(19.86)
Productivity	9.848	9.118	9.552	8.849
	(1.91)	(1.56)	(1.47)	(1.56)
Observation	2,558	6,529	2,501	4,028

Notes: Standard deviations are reported in parentheses. Capital stock is a firm's total fixed assets. Labour is total employment including owners. Productivity is obtained from the estimation technique of Levinsohn and Petrin (2003). Wage is the ratio of total labour costs to total employment less owners who do not receive wage. Output, sales and capital stock are measured in hundreds of thousands of US Dollars while wage is measured in hundred of US Dollars.

Our figures of Thailand are in line with the explanation provided by Caves (1996), that foreign firms are larger, perform better, and have greater knowledge, technology and production capacity than domestic firms. These attributes can be observed by domestic firms, based on the explanation from information and/or competition effects, hence we search the presence of spillovers from foreign firms to domestic firms and present the results in the next section.

5.4 Results

This section contains 2-sub sections for our productivity spillover and export spillover results.

5.4.1 Productivity Spillovers from FDI

Since we are interested in the spillover effects from foreign firms to domestic firms, we estimate the productivity spillover effects from foreign to all domestic firms and also separately estimate the effect from foreign firms to domestic exporters and domestic non-exporters. Tables 5.2 to 5.4 present the estimated results that are obtained from the fixed effects estimation. Different columns demonstrate how the model is built by starting from the horizontal and vertical spillovers variables. Additional industry- and firm-level characteristics are included. We also present a comparison of our productivity spillover results for the aggregate sample with other previous studies in Table 5.5.

For all domestic firms in Table 5.2, the results show that there is evidence of productivity spillovers from foreign to domestic firms in the same industry. The horizontal variable (HOR_{jt}) has a positive and significant influence on productivity of domestic firms in all specifications (Columns (2) to (8)) which indicates that adding one percentage point to the horizontal index will increase the productivity of domestic firms by 0.7 percent.[13] The positive horizontal spillovers are explained by the competition effects generated by foreign firms. Domestic firms have to develop their productive efficiency in order to compete with foreign firms. This positive evidence of intra-industry productivity spillovers from FDI is consistent with the findings from Thailand provided by Tomohara and Yokota (2007) and from other

[13] Since TFP is a log transformed, the economic magnitude of the effect is calculated as [exp(0.007*1)-1]*100=0.7%.

countries such as the UK by Lui *et al.* (2000) and Haskel *et al.* (2002), and Ghana by Görg and Strobl (2005).

With regards to vertical spillover effects, the coefficients on both forward and backward linkage variables are positive but insignificant. The contact between foreign firms and their domestic customers and suppliers do not have any significant effect on the productivity of domestic firm. This is in line with the previous study of Thailand by Tomohara and Yokota (2007) who do not find significant effects of vertical spillovers to domestic firms in the upstream or downstream industries. The insignificant evidence is explained by the technology gaps between foreign and domestic firms. When the technology gaps are relatively large, domestic firms in the upstream and downstream industries do not gain from spillovers. In Thailand, technology gaps are larger in industries such as electrical machinery and automotive than in industries such as food and beverage (Tomohara and Yokota, 2007). Another plausible interpretation is that foreign firms in Thailand are perhaps able to protect leakages of their intangible proprietary assets that can be generated through knowledge and technology. Industry R&D investment share, industry export share and geographic concentration have the expected positive relationship with the productivity of domestic firms. However, only the share of R&D investment in Columns (2) and (3) has a significant effect on productivity. Domestic firms operating in an industry with high levels of R&D investment tend to experience high productivity levels.

In addition, various firm-level characteristics affect their TFP. In Column (5), we take account of firm size because we expect that differences in firm size may have different effects on the productivity. We categorise firm size into small, large and very large. A negative and significant coefficient of small firms indicates that the productivity of small firms will be lower compared to other firm sizes. Being a large or very large domestic firm has no significant effect on the productivity.

Two variables are used to proxy for the quality of labour; wage and training. Firstly, the higher the wage implies the higher the quality of labour a firm employed. However, our result shows that the linear term of wage has no significant effect on the productivity of domestic firms and only a quadratic term of wage rate has a negative and significant coefficient at the 10% level. Secondly, training is a means for workers to enhance their working skills and expertise. The coefficient on training variable is positive as expected but insignificant. The evidence for Thailand shows that wage and training have no significant impact on the productivity upgrading in domestically-owned firms. One plausible explanation is that the production process of some products does not require training nor demand high quality of labour. The deviation of overall significant result of wage rate is also explained by the characteristic of each industry, as wage is positive and significant in some industries such as machinery and equipment chemicals and motor vehicles but insignificant in others such as basic metals and publishing and printing. In addition, the limitation of our data allows us to use only a dummy variable that indicates whether a firm carries out training or not. However, the dummy variable may not be a proper measure of quality of labour since we do not have information about the percentage of workforce who actually receives training.

In the final column, export status of a domestic firm is included because of the learning-by-exporting hypothesis of which the productivity tends to increase further after a firm exports (see e.g. Van Biesebroeck 2003, Blalock and Gertler 2004, Alvarez and López 2005). For Thailand, we find no evidence of the learning-by-exporting hypothesis since we observe an insignificant coefficient of export status. Thus, previous export experience has no significant effect on the level of productivity of a domestic firm in the current period. Our result is in line with for example Aw *et al.* (2000) for South Korea, and Arnold and Hussinger (2005) for Germany.

In Table 5.3, we investigate spillover effects for the different market orientation of FDI towards domestic firms. We replace horizontal spillovers variable (HOR_{jt}) by the horizontal domestic index ($HOR-Domestic_{jt}$) and horizontal export index ($HOR-Export_{jt}$). The horizontal domestic index captures the production share of foreign firms sold in domestic market while horizontal export index is an index that captures the presence of the export activity of foreign firms. Results are presented in Table 5.3. The positive and significant of horizontal spillovers variable in Table 5.2 is explained by the significance of both horizontal domestic and export indices. The horizontal domestic index has a positive coefficient and is significant at the 10% level except for Column (1). The horizontal export index also has a positive coefficient and is significant at the 5% level in Columns (2) to (8) which is consistent with evidence from Chile by Alvarez and López (2008). Our results indicate that the production of foreign firms in the same industry for both domestic and export markets do generate positive spillover effects to domestic firms. Adding one percentage point to the horizontal domestic and export indices will increase the productivity of domestic firms by 0.7 percent.[14]

Results for other variables are consistent with Table 5.2. There is no significant evidence of vertical spillovers through forward and backward linkages. Industry R&D investment is positive and significant only in Columns (2) and (3). Wage is positive but insignificant in Columns (6) to (8). Negative and significant coefficients are found on a quadratic term of wage rate and a dummy variable for small firm.

[14] The figure is calculated as [exp(0.007*1)-1]*100=0.7%.

Table 5.2: Fixed Effects Model for Productivity Spillovers to all Domestic Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$FORW_{jt}$	0.022	0.022	0.022	0.022	0.021	0.021	0.021	0.020
	(0.015)	(0.014)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.016)
HOR_{jt}	0.007**	0.007**	0.007**	0.007**	0.007**	0.007**	0.007**	0.007**
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$BACK_{jt}$	0.005	0.006	0.006	0.005	0.006	0.005	0.005	0.005
	(0.004)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$INRDSHARE_{j(t-1)}$		0.065**	0.062*	0.056	0.058	0.055	0.055	0.054
		(0.031)	(0.031)	(0.037)	(0.035)	(0.036)	(0.036)	(0.036)
$INEXSHARE_{j(t-1)}$			0.145	0.190	0.179	0.158	0.158	0.158
			(0.417)	(0.423)	(0.416)	(0.428)	(0.429)	(0.435)
$CONCEN_{rj(t-1)}$				0.042	0.049	0.051	0.051	0.050
				(0.082)	(0.075)	(0.079)	(0.080)	(0.080)
$SMALL_{i(t-1)}$					-0.152***	-0.147***	-0.147***	-0.147***
					(0.050)	(0.048)	(0.048)	(0.048)
$LARGE_{i(t-1)}$					0.001	-0.006	-0.006	-0.005
					(0.063)	(0.063)	(0.063)	(0.062)
$VLARGE_{i(t-1)}$					0.123	0.102	0.102	0.106
					(0.122)	(0.121)	(0.121)	(0.119)
$wage_{i(t-1)}$						0.692	0.692	0.686
						(0.407)	(0.407)	(0.407)
$wage^2_{i(t-1)}$						-0.052*	-0.052*	-0.051*
						(0.026)	(0.026)	(0.026)
$TRAIN_{i(t-1)}$							0.009	0.010
							(0.031)	(0.031)
$EX_{i(t-1)}$								-0.081
								(0.059)
Constant	8.162***	8.122***	8.087***	8.031***	8.038***	5.806***	5.796***	5.858***
	(0.510)	(0.513)	(0.496)	(0.488)	(0.481)	(1.580)	(1.585)	(1.601)
Observation	6529	6529	6529	6529	6529	6529	6529	6529

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 5.3: Fixed Effects Model for Productivity Spillovers (Domestic Market- and Export-Oriented FDI) to all Domestic Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$FORW_{jt}$	0.022	0.022	0.022	0.022	0.022	0.021	0.021	0.021
	(0.016)	(0.014)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
$HOR-Domestic_{jt}$	0.007*	0.007*	0.007*	0.007*	0.007*	0.007*	0.007*	0.008*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$HOR-Export_{jt}$	0.007**	0.007**	0.007**	0.007**	0.007**	0.007**	0.007**	0.007**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$BACK_{jt}$	0.005	0.006	0.006	0.005	0.005	0.005	0.005	0.005
	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$INRDSHARE_{j(t-1)}$		0.066**	0.062*	0.056	0.058	0.054	0.054	0.054
		(0.030)	(0.031)	(0.037)	(0.035)	(0.036)	(0.036)	(0.036)
$INEXSHARE_{j(t-1)}$			0.147	0.192	0.185	0.167	0.166	0.168
			(0.436)	(0.442)	(0.433)	(0.445)	(0.445)	(0.452)
$CONCEN_{rj(t-1)}$				0.041	0.049	0.051	0.051	0.050
				(0.082)	(0.075)	(0.079)	(0.079)	(0.080)
$SMALL_{i(t-1)}$					-0.152***	-0.147***	-0.147***	-0.147***
					(0.050)	(0.048)	(0.048)	(0.048)
$LARGE_{i(t-1)}$					0.001	-0.006	-0.006	-0.005
					(0.064)	(0.063)	(0.063)	(0.062)
$VLARGE_{i(t-1)}$					0.124	0.102	0.102	0.106
					(0.122)	(0.121)	(0.121)	(0.119)
$wage_{i(t-1)}$						0.694	0.694	0.689
						(0.405)	(0.405)	(0.405)
$wage^2_{i(t-1)}$						-0.052*	-0.052*	-0.051*
						(0.026)	(0.026)	(0.026)
$TRAIN_{i(t-1)}$							0.009	0.010
							(0.031)	(0.031)
$EX_{i(t-1)}$								-0.081
								(0.059)
Constant	8.153***	8.120***	8.083***	8.025***	8.024***	5.778***	5.769***	5.828***
	(0.520)	(0.519)	(0.513)	(0.505)	(0.494)	(1.563)	(1.567)	(1.583)
Observation	6529	6529	6529	6529	6529	6529	6529	6529

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%

For further analysis, we distinguish the spillover effects from foreign firms to different types of domestic firms which are domestic exporters and domestic non-exporters. The results presented in Table 5.4 are from the sample of domestic exporters and domestic non-exporters, respectively.[15] The coefficients reported show the significant evidence of horizontal spillovers from foreign firms to both domestic exporters and domestic non-exporters. Adding one percentage point to the horizontal index will increase the productivity of domestic exporters by 0.6 percent and of domestic non-exporters by 0.8 percent.[16] If we make a distinction between horizontal spillovers from domestic market-oriented and export-oriented foreign firms, we observe that in Column (2) the horizontal spillovers from export-oriented foreign firms has a positive and significant effect on the productivity of domestic exporters. In Column (4), there is a positive and significant evidence of horizontal spillovers from both domestic market-oriented and export-oriented foreign firms to domestic non-exporters.

Amongst vertical spillovers, we only find significant evidence to support the existence of vertical productivity spillovers from foreign firms to domestic non-exporters. Positive and significant coefficients on forward linkages from foreign firms to domestic non-exporters are observed suggesting that foreign firms can generate a positive externality effect on the productivity of their domestic customers that do not export. These productivity gains are generated by contacts between foreign firms and domestic customers through the knowledge and technology used in the production of intermediate inputs that are supplied by foreign firms to their domestic customers. Additionally, the coefficients on backward linkages are positive and significant in Columns (3) and (4). These results on backward linkages indicate that foreign firms can positively affect the productivity of their domestic suppliers that only sell in local market. The

[15] See Tables 5D.1 to 5D.4 in the Appendix 5D for the model construction and results of each sample in details.
[16] The figures are calculated as [exp(0.006*1)-1]*100=0.6% and [exp(0.008*1)-1]*100=0.8%.

economic magnitude of the effect indicates that adding one percentage point to the backward index will only increase the productivity of domestic non-exporters by 1.41 percent.[17]

Foreign firms may generate positive spillovers to their domestic suppliers through the improvement of technological knowledge such as improvement in the design of products, quality and market information. Although we do only find significant evidence of vertical spillover effects from foreign firms to domestic non-exporters, our results on backward linkages are in line with the empirical findings of Lithuania by Jarvorcik (2004), Zambia by Bwalya (2006) and the UK by Girma *et al.* (2008).

For our other variables, industry R&D investment has a positive coefficient but is only significant at the 1% level for domestic non-exporters. In both samples, a dummy that represent a small firm has a positive and significant coefficient which indicates that being a small firm is likely to decrease the productivity of domestic exporters by about 19 percent and the productivity of domestic non-exporters by about 16 percent.[18] The insignificant coefficient of the wage variable in Tables 5.2 and 5.3 is now explained by a dominant effect from the domestic exporters' sample. In Columns (1) and (2) of Table 5.4, a linear term and a quadratic term of wage are insignificant whilst we observe significant relationships for both variables and the productivity of domestic non-exporters in Columns (3) and (4). These significant coefficients suggest an inverted U-shaped relationship between the wage rate and the productivity of domestic non-exporters with the effect increasing at a decreasing rate. For example in Column (3) the turning point is 7.66 which equals to approximately US$ 2122.[19]

[17] The figure is calculated as [exp(0.014*1)-1]*100=1.41%.
[18] The figures are calculated as [exp(0.178)-1]*100=19.48% and [exp(0.148)-1]*100=15.95%.
[19] The figure is obtained from computation of exp[0.766/(0.05*2)]=2121.757.

Table 5.4: Fixed Effects Model for Productivity Spillovers to Domestic Exporters and Domestic Non-Exporters

	Domestic Exporters		Domestic Non-Exporters	
	(1)	**(2)**	**(3)**	**(4)**
$FORW_{jt}$	0.012	0.010	0.028*	0.029**
	(0.023)	(0.023)	(0.014)	(0.013)
HOR_{jt}	0.006***		0.008*	
	(0.002)		(0.004)	
$HOR-Domestic_{jt}$		0.005		0.009*
		(0.004)		(0.004)
$HOR-Export_{jt}$		0.007***		0.007*
		(0.002)		(0.004)
$BACK_{jt}$	-0.010	-0.010	0.014*	0.013*
	(0.008)	(0.008)	(0.007)	(0.007)
$INRDSHARE_{j(t-1)}$	0.031	0.035	0.078**	0.077*
	(0.060)	(0.058)	(0.037)	(0.037)
$INEXSHARE_{j(t-1)}$	-0.182	-0.224	0.426	0.430
	(0.577)	(0.623)	(0.585)	(0.590)
$CONCEN_{rj(t-1)}$	0.140	0.141	0.035	0.036
	(0.088)	(0.088)	(0.107)	(0.107)
$SMALL_{i(t-1)}$	-0.185**	-0.185**	-0.152***	-0.152***
	(0.077)	(0.078)	(0.051)	(0.052)
$LARGE_{i(t-1)}$	0.053	0.055	-0.015	-0.015
	(0.081)	(0.082)	(0.074)	(0.074)
$VLARGE_{i(t-1)}$	0.094	0.095	0.200	0.201
	(0.121)	(0.121)	(0.191)	(0.191)
$wage_{i(t-1)}$	-1.404	-1.412	0.766**	0.771**
	(1.010)	(1.004)	(0.272)	(0.271)
$wage^2_{i(t-1)}$	0.079	0.080	-0.050**	-0.050**
	(0.065)	(0.064)	(0.019)	(0.019)
$TRAIN_{i(t-1)}$	0.182	0.182	-0.051	-0.052
	(0.116)	(0.116)	(0.037)	(0.037)
Constant	15.175***	15.256***	4.297***	4.256***
	(3.467)	(3.440)	(1.135)	(1.134)
Observation	2501	2501	4028	4028

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 5.5: Summary of Results on Productivity Spillovers

Author	Dependent Variable	Country	Period	Results[a]		
				Hor	Forw	Back
Virakul (2009)	TFP	Thailand	2001-2004	+	?	?
Aitken and Harrison (1999)	Log of output	Venezuela	1976-1989	-	N/A	N/A
Barrios and Strobl (2002)	TFP	Spain	1990-1994	?	N/A	N/A
Javorcik (2004)	Log of output	Lithuania	1996-2000	?	N/A	+
Lui *et al.* (2000)	Log of labour productivity	UK		+	N/A	N/A
Görg and Strobl (2005)	TFP	Ghana	1991-1997	+	N/A	N/A
Bwalya (2006)	ΔLog of output	Zambia	1993-1995	?	N/A	+
Tomohara and Yokota (2007)	Log of output	Thailand	1999-2003	+	?	?
Alverez and López (2008)	TFP	Chile	1990-1999	+	+	+
Blalock and Gertler (2008)	Log of output	Indonesia	1988-1996	?	N/A	+
Girma *et al.* (2008)[b]	TFP	UK	1992-1999	?	?	?

Notes:

[a] The symbol+ indicates positive and significant, + indicates negative and significant, and ? indicates mixed or insignificant results on the variable that measure the presence of foreign firms for the aggregate sample. N/A means not applicable.

[b] Distinguish between different incentives of FDI. Results show that different incentives of FDI generate different spillovers effects. For example, there are evidence for positive spillovers on horizontal export-oriented FDI and backward domestic-oriented FDI, and negative spillovers on backward-export oriented FDI.

5.4.2 Export Spillovers from FDI

Results from a Heckman selection model are presented in Tables 5.6 and 5.7. We begin with an investigation of the relationship between export market entry and the performances of domestic firms (both the export participation decision and export intensity) and the measurement of spillover variables without controlling for other covariates. We then extend the model by adding industry-level variables to a number of firm-level characteristics that are assumed to affect the export behaviour of domestic firms. In both tables, our preferred specifications are Column (6.1) for export participation decision and Column (6.2) for export intensity or export share. We also present the marginal effects of the Heckman selection model in Table 5.8. Our spillover results for the aggregate sample are presented in Table 5.9 in order to clarify similarity and/or dissimilarity with other studies.

In terms of the export participation decision equation, the results in Table 5.6 show that measures on the presence of foreign firms are insignificant for both horizontal and backward variables. However, a significant result is found on the forward linkages variable which indicates that contacts between foreign multinationals and their domestic customers have positive impact on the probability of exporting. Because domestic firms purchase intermediate inputs from foreign firms, spillover effects may be generated through the greater access to less costly or even the quality improvement of intermediate inputs produced by foreign firms. These would reduce the production costs of domestic firms as well as improve the quality of their products that would enable domestic firms to enter export markets. Other industry-level variables, both industry R&D share and industry export share, have insignificant effects on the entry decision into the export market. Such insignificant results can be explained by the inclusion of the fixed industry effects (Kneller and Pisu, 2007).

In terms of our firm-level characteristics, in the probit regression for the export participation decision, the coefficients have the expected signs that are in line with the empirical evidence from other countries studies provided for example by Roberts and Tybout (1997) for Columbia, Bernard and Jensen (1999 and 2004) for the US, Greenaway and Kneller (2004) for the UK, Kimura and Kiyota (2006) for Japan. The export participation decision of domestic firms is positively affected by the export status in the previous period at the 1% significant level. If a domestic firm had export experience in the previous year, the probability of current period exporting is likely to increase. This importance is typically interpreted as the evidence of sunk costs of exports, an initial large and one-off investment faced by a firm in order to enter the export market, which positively influences the entry decision of a firm (see e.g. Roberts and Tybout 1997, Bernard and Jensen 2004, Greenaway and Kneller 2004).

Productivity is positive while a quadratic term of TFP is negative. Both variables are significant at the 1% level. The probability of exporting increases with productivity but at a decreasing rate. Firm size is another important factor that affects the export decision of firms. Three categories of firm size provide different results. The negative and significant coefficient on small firms indicates that small firms are less likely to become exporters. However, we observe increasingly positive and significant results when firm sizes increase. The coefficients of large and very large firms indicate that the larger the size, the more likely the firm is to enter the export market.

The results on different measures of the quality of labour show that wage, a quadratic term of wage rate and a dummy for training have the expected signs but insignificant coefficients. One plausible explanation arises from the differences in the characteristic of products exported. Some products do not require high quality of labour or training in their production while some do. Moreover, some firms tend to export mass-produced products or intermediate inputs that are produced using cheap labour costs. We find that only the ratio of skilled labour significantly

affects the increase in the probability of exporting. This positive and significant result is in line with the findings from other countries such as the UK by Roper and Love (2002), the US by Bernard and Jensen (2004) and Chile by Alvarez and López (2005).

Regarding the export share equation, we observe different results on the measurement of foreign presence compared to the export participation decision. We do not find any significant evidence to support the effect of vertical spillovers through forward and backward linkages. However, the coefficient on horizontal variable is positive and significant at the 1% level which means that once a firm enters an export market, their export intensity tends to increase as a consequence of an increase in the presence of foreign firms in the same industry. Domestic exporters may gain from information externalities generated by foreign firms operating in the same industry and such information externality encourages domestic exporters to enhance their export intensity. Another possible explanation is that competition with foreign firms within the industry obliges exporters to improve their production efficiency and facilitates them to an increase in export share.

Once more, the industry-level variables for both industry R&D share and industry export share are insignificant. For firm-level variables, the relationship between export intensity and firm characteristics are generally consistent with the results from the export participation equation of which productivity and large firm have positive and significant effects on the export intensity whereas a quadratic term of productivity and being a small firm have a negative and significant effect.

Table 5.6: Heckman Selection Model for Export Spillovers to all Domestic Firms

	(1)		(2)		(3)	
	(1.1) ***EX Decision***	(1.2) ***EX Share***	(2.1) ***EX Decision***	(2.2) ***EX Share***	(3.1) ***EX Decision***	(3.2) ***EX Share***
$EX_{i(t-1)}$	3.684***		3.687***		3.617***	
	(0.069)		(0.067)		(0.066)	
$FORW_{jt}$	0.077**	0.004	0.079**	0.004	0.073**	0.005
	(0.031)	(0.005)	(0.031)	(0.005)	(0.034)	(0.005)
HOR_{jt}	-0.003	0.003***	-0.003	0.003**	-0.004	0.003***
	(0.004)	(0.001)	(0.005)	(0.001)	(0.005)	(0.001)
$BACK_{jt}$	-0.002	0.001	-0.010	0.002	-0.010	0.002
	(0.033)	(0.002)	(0.031)	(0.002)	(0.031)	(0.002)
$INRDSHARE_{j(t-1)}$			-0.245	0.005	-0.207	0.007
			(0.204)	(0.018)	(0.215)	(0.020)
$INEXSHARE_{j(t-1)}$			0.546	-0.237	0.835	-0.206
			(1.986)	(0.231)	(2.006)	(0.233)
$TFP^{LP}_{i(t-1)}$					0.755***	0.111*
					(0.205)	(0.063)
$(TFP^{LP}_{i(t-1)})^2$					-0.028***	-0.007**
					(0.010)	(0.003)
$SMALL_{i(t-1)}$						
$LARGE_{i(t-1)}$						
$VLARGE_{i(t-1)}$						
$wage_{i(t-1)}$						
$wage^2_{i(t-1)}$						
$SKILL_{i(t-1)}$						
$TRAIN_{i(t-1)}$						
Constant	-2.552*	0.479***	-2.731	0.607***	-6.991**	0.117
	(1.523)	(0.132)	(1.984)	(0.100)	(2.787)	(0.331)
ρ	-0.450***		-0.449***		-0.458***	
	(0.062)		(0.061)		(0.064)	
λ	-0.152***		-0.152***		-0.154***	
	(0.023)		(0.023)		(0.024)	
Observations	6768	6768	6768	6768	6768	6768

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Region, two-digit industry and time dummies are included. ρ is the estimated correlation between the error terms of the two equations; if it is different from zero it suggests that the two equations are related and that the selection model is appropriate. λ is the estimated coefficient of the inverse Mills ratio; if it is different from zero it suggests that there is sample selection.

Table 5.6: Continued

	(4)		(5)		(6)	
	(4.1) ***EX Decision***	(4.2) ***EX Share***	(5.1) ***EX Decision***	(5.2) ***EX Share***	(6.1) ***EX Decision***	(6.2) ***EX Share***
$EX_{i(t-1)}$	3.537***		3.533***		3.531***	
	(0.058)		(0.061)		(0.062)	
$FORW_{jt}$	0.079**	0.004	0.080**	0.004	0.081**	0.004
	(0.033)	(0.005)	(0.033)	(0.005)	(0.032)	(0.005)
HOR_{jt}	-0.004	0.003***	-0.004	0.003***	-0.004	0.003***
	(0.006)	(0.001)	(0.006)	(0.001)	(0.006)	(0.001)
$BACK_{jt}$	-0.012	0.002	-0.012	0.002	-0.013	0.002
	(0.032)	(0.002)	(0.032)	(0.002)	(0.033)	(0.002)
$INRDSHARE_{j(t-1)}$	-0.244	0.008	-0.246	0.007	-0.246	0.005
	(0.201)	(0.021)	(0.201)	(0.020)	(0.201)	(0.020)
$INEXSHARE_{j(t-1)}$	0.707	-0.196	0.799	-0.168	0.816	-0.170
	(2.034)	(0.243)	(2.037)	(0.250)	(2.036)	(0.249)
$TFP^{LP}_{i(t-1)}$	0.621***	0.101*	0.554***	0.098*	0.561***	0.104*
	(0.196)	(0.056)	(0.202)	(0.058)	(0.200)	(0.057)
$(TFP^{LP}_{i(t-1)})^2$	-0.026***	-0.006**	-0.025**	-0.005*	-0.025***	-0.006*
	(0.010)	(0.003)	(0.010)	(0.003)	(0.010)	(0.003)
$SMALL_{i(t-1)}$	-0.236***	0.085*	-0.233***	0.085*	-0.240***	0.077
	(0.076)	(0.050)	(0.077)	(0.050)	(0.079)	(0.047)
$LARGE_{i(t-1)}$	0.225**	0.064***	0.231**	0.061***	0.232**	0.062***
	(0.094)	(0.019)	(0.091)	(0.019)	(0.093)	(0.020)
$VLARGE_{i(t-1)}$	0.307***	0.059	0.326***	0.050	0.327***	0.053
	(0.082)	(0.054)	(0.086)	(0.048)	(0.086)	(0.047)
$wage_{i(t-1)}$			0.700	0.508	0.526	0.492
			(0.903)	(0.419)	(0.805)	(0.442)
$wage^2_{i(t-1)}$			-0.032	-0.036	-0.022	-0.035
			(0.056)	(0.027)	(0.050)	(0.029)
$SKILL_{i(t-1)}$					0.166*	0.062
					(0.095)	(0.042)
$TRAIN_{i(t-1)}$					0.078	-0.008
					(0.082)	(0.023)
Constant	-5.889**	0.124	-8.954**	-1.677	-8.387**	-1.634
	(2.744)	(0.270)	(3.876)	(1.505)	(3.654)	(1.579)
ρ	-0.456***		-0.457***		-0.459***	
	(0.061)		(0.062)		(0.063)	
λ	-0.153***		-0.153***		-0.153***	
	(0.023)		(0.023)		(0.023)	
Observations	6768	6768	6768	6768	6768	6768

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Region, two-digit industry and time dummies are included. ρ is the estimated correlation between the error terms of the two equations; if it is different from zero it suggests that the two equations are related and that the selection model is appropriate. λ is the estimated coefficient of the inverse Mills ratio; if it is different from zero it suggests that there is sample selection.

In further analysis, we make a distinction between types of FDI (domestic market- and export-oriented FDI) as we intend to investigate whether market oriented FDI generates possible export spillover effects. Previous research such as Kneller and Pisu (2007) also use the same measure for export orientation of foreign firms in order to capture the idea that export spillovers are perhaps caused by information externalities. Results from a Heckman selection model are presented in Table 5.7 where we include horizontal domestic and horizontal export indices to capture domestic market orientation and export orientation of foreign firms, respectively.

For the reason that other industry- and firm-level variables are unchanged, we only discuss the coefficients of our spillover variables. The coefficient on forward linkages remains positive but does not significantly affect the probability of exporting (except for Column (6.1)) and export intensity. Our backward linkage variable is found to be insignificant. The negative coefficient on horizontal spillovers in the export participation decision from Table 5.6 is now explained by the negative and weakly significant coefficient of the horizontal domestic index which can be interpreted as to mean that the domestic market orientation of foreign firms operating in the same industry significantly decreasing the probability of exporting. The result implies that there is an increase in the level of competition in the domestic market between domestic and foreign firms in the same industry. Domestic firms may lose some of their market share to foreign firms operating in the same industry whilst domestic firms face the same fixed costs. It is less likely that domestic firms would be able to generate enough profit to cover the sunk entry cost of exporting. In contrast to the UK study by Kneller and Pisu (2007), we do not find a significant relationship between a horizontal export index and the probability of exporting. However, our finding supports evidence of Mexican firms provided by Atiken *et al.* (1997) who do not find evidence of spillovers from the general export activity. Export-oriented foreign

firms are able to protect leakages from their export activities and do not really provide information about foreign market opportunities that helps domestic firms to overcome or even reduce sunk costs of exports.

In the export share equation, a positive and significant coefficient on horizontal spillovers in Table 5.6 is now explained by a dominant effect from a positive and significant effect of the of horizontal export index. The export orientation of foreign firms operating in the same industry helps domestically-owned firms to enhance their export intensity. After domestic firms enter export markets, they benefit from the export orientation of foreign firms operating in the same industry through imitation, knowledge spillovers or even foreign market specific information. An increase in the presence of export-oriented foreign firms can also cause an increase in the level competition with domestic exporters in the same industry that forces domestic exporters to become more productive and thus increase their export intensity. This explanation is in line with the finding from the previous sub-section (5.4.1) where horizontal export index has a positive and significant effect on the productivity of domestic exporters.

To understand the economic magnitude of the our spillover variables discussed in Table 5.7, we present in Table 5.8 the coefficients obtained from the marginal effects of the Heckman selection model. The marginal effects are calculated at the mean of each continuous independent variable (except for the dummy variable) keeping all other variables constant. We, therefore, compute the marginal effects separately for the export decision and export share regression. For the export decision, adding one percentage point to the forward index will add to the probability of exporting about 0.024 percentage points. In contrast, adding one percentage point to horizontal domestic index will reduce to the probability of exporting around 0.009 percentage points. The significance on the coefficients of TFP and a quadratic term suggest that the probability of exporting is increased with productivity but at a decreasing rate.

The turning point is when TFP equals to approximately 11.[20] Different size categories also significantly affect the probability of exporting. For example, the interpretation for *SMALL* is that being a small firm is likely to decrease the probability of exporting by 8.4 percentage points. Another factor that determines the probability of exporting is the ratio of skilled labour of which adding one unit increase in the ratio of skilled labour will increase the probability of exporting by around 5.9 percentage points. In terms of export share regression, horizontal export index has a positive and significant coefficient that is explained as adding one percentage point to horizontal export index increases the export share by 0.004 point.

[20] The figure is calculated as [0.197/(0.009*2)]=10.94.

Table 5.7: Heckman Selection Model for Export Spillovers (Domestic Market- and Export-Oriented FDI) to all Domestic Firms

	(1)		(2)		(3)	
	(1.1) ***EX Decision***	(1.2) ***EX Share***	(2.1) ***EX Decision***	(2.2) ***EX Share***	(3.1) ***EX Decision***	(3.2) ***EX Share***
$EX_{i(t-1)}$	3.691***		3.693***		3.623***	
	(0.070)		(0.068)		(0.067)	
$FORW_{jt}$	0.062	0.003	0.065*	0.003	0.059	0.004
	(0.038)	(0.006)	(0.039)	(0.006)	(0.043)	(0.006)
$HOR-Domestic_{jt}$	-0.026*	0.002	-0.024*	0.002	-0.026*	0.002
	(0.014)	(0.002)	(0.014)	(0.002)	(0.015)	(0.002)
$HOR-Export_{jt}$	0.007	0.003***	0.007	0.003***	0.005	0.003***
	(0.009)	(0.001)	(0.009)	(0.001)	(0.010)	(0.001)
$BACK_{jt}$	0.003	0.002	-0.002	0.003*	-0.003	0.003
	(0.032)	(0.002)	(0.031)	(0.002)	(0.031)	(0.002)
$INRDSHARE_{j(t-1)}$			-0.218	0.008	-0.180	0.009
			(0.185)	(0.018)	(0.199)	(0.020)
$INEXSHARE_{j(t-1)}$			0.310	-0.291	0.592	-0.249
			(2.125)	(0.234)	(2.174)	(0.238)
$TFP^{LP}_{i(t-1)}$					0.746***	0.111*
					(0.205)	(0.063)
$(TFP^{LP}_{i(t-1)})^2$					-0.028***	-0.007**
					(0.010)	(0.003)
$SMALL_{i(t-1)}$						
$LARGE_{i(t-1)}$						
$VLARGE_{i(t-1)}$						
$wage_{i(t-1)}$						
$wage^2_{i(t-1)}$						
$SKILL_{i(t-1)}$						
$TRAIN_{i(t-1)}$						
Constant	-3.235**	0.474***	-3.281	0.624***	-7.459**	0.133
	(1.617)	(0.129)	(2.049)	(0.110)	(2.919)	(0.331)
ρ		-0.450***		-0.450***		-0.457***
		(0.061)		(0.055)		(0.064)
λ		-0.152***		-0.152***		-0.154***
		(0.023)		(0.023)		(0.024)
Observations	6768	6768	6768	6768	6768	6768

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Region, two-digit industry and time dummies are included. ρ is the estimated correlation between the error terms of the two equations; if it is different from zero it suggests that the two equations are related and that the selection model is appropriate. λ is the estimated coefficient of the inverse Mills ratio; if it is different from zero it suggests that there is sample selection.

Table 5.7: Continued

	(4)		(5)		(6)	
	(4.1) ***EX Decision***	(4.2) ***EX Share***	(5.1) ***EX Decision***	(5.2) ***EX Share***	(6.1) ***EX Decision***	(6.2) ***EX Share***
$EX_{i(t-1)}$	3.542***		3.538***		3.536***	
	(0.060)		(0.062)		(0.063)	
$FORW_{jt}$	0.066	0.003	0.067	0.002	0.068*	0.002
	(0.041)	(0.006)	(0.041)	(0.006)	(0.040)	(0.006)
$HOR-Domestic_{jt}$	-0.025*	0.002	-0.025*	0.002	-0.025*	0.002
	(0.015)	(0.002)	(0.015)	(0.002)	(0.014)	(0.002)
$HOR-Export_{jt}$	0.005	0.003***	0.005	0.003***	0.005	0.003***
	(0.010)	(0.001)	(0.010)	(0.001)	(0.010)	(0.001)
$BACK_{jt}$	-0.006	0.003	-0.006	0.003	-0.007	0.002
	(0.032)	(0.002)	(0.033)	(0.002)	(0.033)	(0.002)
$INRDSHARE_{j(t-1)}$	-0.221	0.011	-0.222	0.010	-0.221	0.008
	(0.186)	(0.021)	(0.186)	(0.020)	(0.186)	(0.020)
$INEXSHARE_{j(t-1)}$	0.520	-0.248	0.616	-0.224	0.627	-0.222
	(2.191)	(0.251)	(2.193)	(0.258)	(2.184)	(0.254)
$TFP^{LP}_{i(t-1)}$	0.612***	0.101*	0.544***	0.098*	0.551***	0.104*
	(0.194)	(0.056)	(0.201)	(0.057)	(0.198)	(0.057)
$(TFP^{LP}_{i(t-1)})^2$	-0.025***	-0.006**	-0.024**	-0.005*	-0.025**	-0.006*
	(0.010)	(0.003)	(0.010)	(0.003)	(0.010)	(0.003)
$SMALL_{i(t-1)}$	-0.236***	0.085*	-0.234***	0.085*	-0.240***	0.077
	(0.076)	(0.050)	(0.077)	(0.050)	(0.079)	(0.047)
$LARGE_{i(t-1)}$	0.222**	0.064***	0.228**	0.061***	0.230**	0.063***
	(0.093)	(0.019)	(0.090)	(0.019)	(0.092)	(0.019)
$VLARGE_{i(t-1)}$	0.307***	0.059	0.326***	0.051	0.326***	0.053
	(0.081)	(0.054)	(0.085)	(0.048)	(0.085)	(0.047)
$wage_{i(t-1)}$			0.719	0.511	0.544	0.494
			(0.899)	(0.421)	(0.802)	(0.444)
$wage^2_{i(t-1)}$			-0.033	-0.036	-0.023	-0.036
			(0.056)	(0.027)	(0.050)	(0.029)
$SKILL_{i(t-1)}$					0.166*	0.062
					(0.094)	(0.042)
$TRAIN_{i(t-1)}$					0.082	-0.008
					(0.081)	(0.023)
Constant	-6.381**	0.142	-9.524**	-1.669	-8.951**	-1.625
	(2.884)	(0.267)	(4.028)	(1.512)	(3.801)	(1.585)
ρ	-0.455***		-0.456***		-0.459***	
	(0.061)		(0.062)		(0.062)	
λ	-0.153***		-0.153***		-0.153***	
	(0.023)		(0.023)		(0.023)	
Observations	6768	6768	6768	6768	6768	6768

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Region, two-digit industry and time dummies are included. ρ is the estimated correlation between the error terms of the two equations; if it is different from zero it suggests that the two equations are related and that the selection model is appropriate. λ is the estimated coefficient of the inverse Mills ratio; if it is different from zero it suggests that there is sample selection.

Table 5.8: Marginal Effects of the Heckman Selection Model from Column (6) of Table 5.7

	(1) *EX Decision*	(2) *EX Share*
$EX_{i(t-1)}$	0.922***	
	(0.006)	
$FORW_{jt}$	0.024*	0.010
	(0.014)	(0.010)
$HOR-Domestic_{jt}$	-0.009*	-0.001
	(0.005)	(0.002)
$HOR-Export_{jt}$	0.002	0.004***
	(0.004)	(0.001)
$BACK_{jt}$	-0.003	0.001
	(0.012)	(0.004)
$INRDSHARE_{j(t-1)}$	-0.079	-0.016
	(0.066)	(0.033)
$INEXSHARE_{j(t-1)}$	0.224	-0.152
	(0.779)	(0.376)
$TFP^{LP}_{i(t-1)}$	0.197***	0.165***
	(0.071)	(0.057)
$(TFP^{LP}_{i(t-1)})^2$	-0.009**	-0.008***
	(0.003)	(0.003)
$SMALL_{i(t-1)}$	-0.084***	0.050
	(0.027)	(0.050)
$LARGE_{i(t-1)}$	0.084**	0.088***
	(0.034)	(0.017)
$VLARGE_{i(t-1)}$	0.121***	0.089
	(0.033)	(0.052)
$wage_{i(t-1)}$	0.194	0.555
	(0.286)	(0.463)
$wage^2_{i(t-1)}$	-0.008	-0.038
	(0.018)	(0.030)
$SKILL_{i(t-1)}$	0.059*	0.080
	(0.033)	(0.048)
$TRAIN_{i(t-1)}$	0.029	0.002
	(0.028)	(0.025)

Notes: Standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Region, two-digit industry and time dummies are included.

In Table 5.9, we compare our findings for export spillovers with results from other studies. Some studies find positive export spillovers while some find different results when distinguishing between horizontal and vertical spillovers. Our result is consistent with Kneller and Pisu (2007) on the horizontal export spillovers when the export share is used as the dependent variable. We do not find any significant evidence for backward spillovers but Kneller and Pisu (2007) find a positive and significant result. One explanation for the differences in the results is because of dissimilarity between developed and developing countries. Lipsey and Sjöholm (2005) also mention that different country may find dissimilar results because of the difference in the characteristics of firms in each country. For instance, Kneller and Pisu (2007) find that horizontal export spillovers are driven by significance of export-oriented foreign firms operating in the same industry. Imitation or information externalities allow domestic firms to compete successfully in order to participate in the export market. However, in the case of Thailand, horizontal export spillovers are negatively determined by the domestic market orientation of foreign firms operating in the same industry that implies a negative competition effect. Domestic firms may gain from knowledge and information externalities generated by foreign firms operating in the same industry, and also from competition effects as their intensities to export are increased following the entry into export market.

In a sensitivity analysis, we use an alternative measurement of productivity which is the standard labour productivity ($TFP^{LABPROD}$). The results presented in the Appendix 5E but are generally consistent with the results discussed in Tables 5.2 to 5.4 for productivity spillovers, and Tables 5.6 and 5.7 for export spillovers.

Table 5.9: Summary of Results on Export Spillovers

Author	Dependent Variable	Country	Period	Results[a]			
				Overall	Hor	Forw	Back
Virakul (2009)	Export Dummy	Thailand	2001-2004	N/A	?	+	?
	Export Share	Thailand	2001-2004	N/A	+	?	?
Aitken *et al.* (1997)	Export Dummy	Mexico	1986/1989	N/A	+	N/A	N/A
Kneller and Pisu (2007)	Export Dummy	UK	1992-1999	N/A	?	?	?
	Export Share	UK	1992-1999	N/A	+	?	+
Kokko *et al.* (2001)[c]	Export Dummy	Uruguay	2001	?	N/A	N/A	N/A
Ma (2006)[c]	Export Dummy	China	1993-2000	+	N/A	N/A	N/A
Alvarez (2007)[c]	Export Dummy	Chile	1990-1996	+	N/A	N/A	N/A

Notes:

[a] The symbol+ indicates positive and significant, + indicates negative and significant, and ? indicates mixed or insignificant results on the measurement of foreign presence for the aggregate sample. N/A means not applicable.

[c] Do not distinguish between intra- and inter-industry spillovers.

5.5 Conclusions

Policymakers in both developed and developing countries have attempted to implement policies to encourage FDI inflows assuming that they benefit the host country. The direct impact of FDI is through increases in capital inflows, employment, as well as R&D investment all of which can be seen as ways to stimulate economic growth. Foreign firms may particularly indirectly benefit domestic firms through externalities arising from the proprietary assets of foreign firms. This chapter presents an empirical investigation into the existence or otherwise of productivity and export spillovers from FDI through the presence of foreign firms using an unbalanced panel of firm-level data from Thailand between 2001 and 2004. We search for both intra- and inter-industry spillovers from foreign firms. Furthermore, we differentiate between different types of FDI and whether the foreign firms are domestic market oriented or export oriented and how this affect the productivity and export behaviour, for both the export participation decision and how much to export, of domestic firms.

Our findings show significant evidence on productivity and export spillovers. For productivity spillovers, there is a positive association between the presence of foreign firms operating in the same industry and the productivity of domestic firms. Both domestic market-oriented and export-oriented foreign firms tend to increase the productivity of all domestic firms in the same industry. It is suggested that the increased competition generated by foreign firms forces domestic firms to become more productive in order to compete successfully. In addition, our results show that spillover effects on domestic exporters are different from domestic non-exporters. An increase in the productivity of domestic exporters is affected by an increase in the presence of export-oriented foreign firms in the same industry. At the same time, domestic non-exporters gain from both horizontal and vertical productivity spillovers. The competition between foreign firms and domestic non-exporters in the same industry force the latter to

improve their productive efficiency. Buyer-supplier linkages also appear to improve the productivity of domestic non-exporters.

Looking at the export behaviours of domestic firms, we model two decisions. The first is whether a firm chooses to export or not. The second is how much to export. The export participation decision of domestic firms is determined by vertical spillovers through forward linkages suggesting the importance of contacts between foreign firms and their domestic customers. Regarding horizontal spillovers, a negative and weakly significant result is found which can be explained by the dominant effect from domestic market- oriented foreign firms operating in the same industry. An increase in competition among domestic firms and domestic market-oriented foreign firms in the same industry diminishes the probability of exporting. We observe different results in the export share equation. Foreign firms, especially export-oriented foreign firms, operating in the same industry have a positive effect on the export intensity of domestic exporters. This indicates that domestic exporters can benefit from both information and competition effects. Other firm-level characteristics also have a significant impact on the productivity, export participation decision and export intensity of domestic firms.

Our results prove that domestic firms in Thailand do indeed gain from FDI measured by the presence of foreign-owned firms operating in the same and across industries. Different incentives for FDI have different spillover effects towards domestic firms. In addition, productivity and export spillovers are diverse and affect exporters and non-exporters differently. Therefore, government have to carefully design the right policy that stimulate growth in economy as well as benefit domestic firms. Export-oriented FDI show the Thai government should stress on as the empirical evidence show that export-oriented foreign firms horizontally generate positive productivity and export spillovers to domestic firms. Another implication is that the government should cautiously consider protecting some industries lose market share or

face significant competitions pressures due to the inflows of FDI because there is evidence suggesting negative export spillovers from domestic market-oriented foreign firms to domestic firms.

Since we find evidence that the productivity and export decision of domestic non-exporters seems to be affected by contacts they have with foreign firms, the policy design should also emphasise on the impact of FDI via vertical linkages between foreign and domestic firms that can be generated through technology, knowledge and skill transfers. The government should carry out targeted investment promotion activities so as to fill technology gaps and technology needs. This implication would enhance the possibility of spillovers. Moreover, rather than attracting new investment, the government should work more closely with the existing MNEs in the country in order to increase arm length relationship with domestic firms and enhance spillovers benefit. For example, government may promote linkages by providing incentives and promotion packages that encourage MNEs to use more intermediate inputs from the local economy rather than import.

Appendix 5A: Definition of Variables and Descriptive Statistics

Table 5A.1: Definition of Variables

Level	Variable	Definition
Firm	EX_{it}	A dummy variable for export status where a dummy equals 1 if firm i has positive export sales and 0 otherwise.
	$EX_{i(t-1)}$	The lagged of export status represents for the past export experience or the sunk entry costs.
	$EXSHARE_{it}$	The share of export sale total sale of firm i .
	$TFP^{LP}_{i(t-1)}$	Total factor productivity that is obtained from the estimation of the semi-parametric approach of Levinsohn and Petrin (2003).
	$TFP^{LABPROD}_{i(t-1)}$	Labour productivity calculated as the log of value added divided by total labour.
	$SMALL_{i(t-1)}$	A dummy variable equal to 1 if the total labour of firm i at time $t-1$ is in the first quartile of the distribution of the total labour of all firms operating in the same two-digit industry level as firm i at time $t-1$.
	$LARGE_{i(t-1)}$	A dummy variable equal to 1 if the total labour of firm i at time $t-1$ is in the third quartile of the distribution of the total labour of all firms operating in the same two-digit industry level as firm i at time $t-1$.
	$VLARGE_{i(t-1)}$	A dummy variable equal to 1 if the total labour of the firm i at time $t-1$ is in the forth quartile of the distribution of the total labour of all firms operating in the same two-digit industry level as firm i at time $t-1$.
	$wage_{i(t-1)}$	The log of wage per employee calculated as the ratio of total labour payments over total labour less owner's wage.
	$SKILL_{i(t-1)}$	Skilled labour is the ratio of skilled labour to total employment.
	$TRAIN_{i(t-1)}$	A dummy variable for training whether workforce within a firm receive either in house- or outside training at least once or not. A dummy equals 1 if workforce of firm i has received some training and 0 otherwise.
Industry	$FORW_{jt}$	An index for vertical spillovers through forward linkages where the computation was described in Expression (5.10).
	HOR_{jt}	An index for horizontal spillovers captures the presences of foreign firms in each industry of which the computation was described in Expression (5.6).
	$HOR-Domestic_{jt}$	Horizontal domestic index is an index that captures the production of foreign firms sold in Thailand only. The computation was described in Expression (5.7).
	$HOR-Export_{jt}$	Horizontal export index is an index that captures the presence of the export activity of foreign firms only. The computation was described in Expression (5.8).

	$BACK_{jt}$	An index for vertical spillovers through backward linkages where the computation was described in Expression (5.9).
	$INRDSHARE_{j(t-1)}$	A share of industry R&D expense is defined as the ratio between industry R&D spending and total R&D expense of all industries in the same year.
	$INEXSHARE_{j(t-1)}$	The industry export share is defined as the ratio between export sales and total sales of the same industry and same year.
	$CONCEN_{rj(t-1)}$	A measure for geographic concentration of firm in industries and regions is computed as described in Expression (5.11).
Region	*BKKM*	A dummy variable identifies whether firm locates in Bangkok and Metropolitan Area or not.
	CENTRAL	A dummy variable equals 1 if a firm locates in Central region excluding Bangkok and Metropolitan Area and 0 otherwise.
	EAST	A dummy variable equals 1 if a firm locates in Eastern region and 0 otherwise.
	NORTHEAST	A dummy variable equals 1 if a firm locates in the Northeast of Thailand and 0 otherwise.
	NORTH	A dummy variable equals 1 if a firm locates in the North of Thailand and 0 otherwise.
	SOUTH	A dummy variable equals 1 if a firm locates in the South of Thailand and 0 otherwise.

Table 5A.2: Descriptive Statistics for the Estimated Sample on Productivity Spillovers

Variable	Obs	Mean	Std. Dev.	Min	Max
TFP_{it}^{LP}	6529	9.12	1.56	1.93	16.75
$TFP_{it}^{LABPROD}$	6667	8.81	0.96	2.21	16.21
$EX_{i(t-1)}$	6529	0.38	0.49	0	1
$wage_{i(t-1)}$	6529	7.57	0.47	3.08	10.29
$wage_{i(t-1)}^{2}$	6529	57.45	7.11	9.50	105.83
$SMALL_{i(t-1)}$	6529	0.31	0.47	0	1
$LARGE_{i(t-1)}$	6529	0.24	0.43	0	1
$VLARGE_{i(t-1)}$	6529	0.19	0.39	0	1
$SKILL_{i(t-1)}$	6529	0.54	0.32	0	1
$INRDSHARE_{j(t-1)}$	6529	0.24	0.15	0.01	0.77
$INEXSHARE_{j(t-1)}$	6529	0.42	0.19	0.04	0.83
$FORW_{jt}$	6529	24.83	21.79	0.00	66.20
HOR_{jt}	6529	49.62	22.47	7.50	97.67
$HOR-Domestic_{jt}$	6529	25.46	15.27	2.65	93.72
$HOR-Export_{jt}$	6529	24.17	18.12	0.00	83.06
$BACK_{jt}$	6529	29.21	19.37	0.88	79.27
$CONCEN_{rj(t-1)}$	6529	1.34	1.28	0.01	23.74

Table 5A.3: Descriptive Statistics for the Estimated Sample on Export Spillovers

Variable	Obs	Mean	Std. Dev.	Min	Max
$EXSHARE_{it}$	6768	0.20	0.34	0	1
EX_{it}	6768	0.39	0.49	0	1
$EX_{i(t-1)}$	6768	0.38	0.49	0	1
$TFP^{LP}_{i(t-1)}$	6768	9.05	1.56	1.35	16.69
$(TFP^{LP}_{i(t-1)})^2$	6768	84.38	28.70	1.83	278.47
$TFP^{LABPROD}_{i(t-1)}$	6801	8.73	0.93	1.45	13.65
$(TFP^{LABPROD}_{i(t-1)})^2$	6801	77.11	16.64	2.10	186.34
$wage_{i(t-1)}$	6768	7.57	0.47	3.08	10.29
$wage^2_{i(t-1)}$	6768	57.52	7.07	9.50	105.83
$SMALL_{i(t-1)}$	6768	0.31	0.46	0	1
$LARGE_{i(t-1)}$	6768	0.24	0.43	0	1
$VLARGE_{i(t-1)}$	6768	0.19	0.39	0	1
$SKILL_{i(t-1)}$	6768	0.54	0.32	0	1
$TRAIN_{i(t-1)}$	6768	0.85	0.36	0	1
$INRDSHARE_{j(t-1)}$	6768	0.24	0.15	0.01	0.76
$INEXSHARE_{j(t-1)}$	6768	0.42	0.19	0.04	0.83
$FORW_{jt}$	6768	24.81	21.79	0.00	66.20
HOR_{jt}	6768	49.51	22.52	7.50	97.67
$HOR-Domestic_{jt}$	6768	25.44	15.33	2.65	93.72
$HOR-Export_{jt}$	6768	24.07	18.14	0.00	83.06
$BACK_{jt}$	6768	29.17	19.36	0.88	79.27

Table 5A.4: Correlation Matrix

	EXSHARE	*EX*	*FORW*	*HOR*	*HOR-Domestic*	*HOR-Export*	*BACK*	*INRDSHARE*	*INEXSHARE*	*CONCEN*	TFP^{LP}	$(TFP^{LP})^2$	$TFP^{LABPROD}$	$(TFP^{LABPROD})^2$	*SMALL*	*LARGE*	*VLARGE*	*wage*	$wage^2$	*SKILL*	*TRAIN*
EXSHARE	1.00																				
EX	0.73	1.00																			
FORW	0.21	0.17	1.00																		
HOR	-0.09	-0.04	0.09	1.00																	
HOR-Domestic	-0.19	-0.10	0.32	0.60	1.00																
HOR-Export	0.05	0.04	-0.16	0.74	-0.10	1.00															
BACK	0.09	0.07	-0.68	0.19	0.01	0.23	1.00														
INRDSHARE	-0.02	-0.02	0.06	0.02	0.10	-0.06	-0.10	1.00													
INEXSHARE	0.20	0.15	-0.45	0.28	-0.49	0.76	0.28	-0.07	1.00												
CONCEN	0.04	0.02	-0.06	-0.10	-0.16	0.01	-0.01	0.02	0.10	1.00											
TFP^{LP}	0.13	0.25	0.04	0.01	0.23	-0.20	0.04	-0.05	-0.14	0.04	1.00										
$(TFP^{LP})^2$	0.11	0.24	0.03	0.01	0.25	-0.21	0.05	-0.05	-0.18	0.03	0.99	1.00									
$TFP^{LABPROD}$	0.06	0.17	0.04	0.05	0.15	-0.07	0.03	-0.04	-0.15	0.01	0.67	0.68	1.00								
$(TFP^{LABPROD})^2$	0.05	0.16	0.04	0.05	0.15	-0.07	0.03	-0.04	-0.16	0.02	0.67	0.68	0.99	1.00							
SMALL	-0.26	-0.35	0.01	0.04	0.04	0.02	0.02	0.01	0.01	-0.03	-0.28	-0.28	-0.25	-0.24	1.00						
LARGE	0.14	0.17	-0.01	-0.01	-0.01	0.01	0.01	-0.01	0.01	-0.01	0.12	0.12	0.13	0.12	-0.38	1.00					
VLARGE	0.27	0.34	-0.03	-0.10	-0.04	-0.09	0.01	-0.01	-0.03	0.01	0.25	0.25	0.15	0.14	-0.33	-0.27	1.00				
wage	0.07	0.19	0.07	0.14	0.11	0.07	-0.01	-0.08	-0.06	-0.10	0.45	0.45	0.60	0.59	-0.22	0.12	0.12	1.00			
$wage^2$	0.07	0.19	0.07	0.14	0.12	0.07	-0.01	-0.08	-0.07	-0.09	0.45	0.46	0.60	0.60	-0.22	0.12	0.12	0.99	1.00		
SKILL	0.03	-0.01	0.01	0.02	-0.03	0.05	-0.02	-0.01	0.03	-0.02	-0.05	-0.04	-0.01	0.01	0.12	-0.54	-0.05	0.08	0.07	1.00	
TRAIN	0.13	0.19	-0.04	0.02	0.03	-0.01	0.03	-0.01	-0.01	0.01	0.20	0.20	0.19	0.18	-0.28	0.13	0.17	0.18	0.18	-0.04	1.00

Appendix 5B: New Construction of Industry from the Manufacturing Survey and I-O Table

Office of the National Economic and Social Development Board (NESDB), Thailand provides three ranges of the for I-O table (16x16 sectors, 26x26 sectors and 58x58 sectors). In this paper we use 58x58 sectors of the I-O 2000 and control for sectors that only relate to manufacturing activities so 30 sectors are selected. The sector classification in the I-O table of Thailand is slightly differed from the two-digit ISIC classification in the manufacturing survey of Thailand. We have to match 30 sectors from I-O table with 22 two-digit ISIC from the survey.[21] Finally, we have 18x18 sectors matrix that is used to calculate indexes of vertical spillovers through backward and forward linkages. The construction of 18 industries is explained as follow;

Industry	Manufacturing Survey		Input-Output Table	
	Two-digit	Division	Code	Description
1	ISIC 15	Food products and beverages	15-21	Slaughtering, processing and preserving of foods, rice and other grain milling, sugar refineries, other foods, animal food and beverages
2	ISIC 16	Tobacco products	22	Tobacco processing and products
3	ISIC 17-18	Textiles and wearing apparel	23-24	Spinning, weaving, bleaching and textile product
4	ISIC 19	Tanning and dressing of leather	42	Leather products
5	ISIC 20	Wood and product of wood and cork except furniture	43	Saw mill and wood products
6	ISIC 21	Paper and paper products	25	Paper and paper products
7	ISIC 22	Publishing and printing and reproduction of recorded media	26	Printing and Publishing
8	ISIC 23	Coke, refined petroleum products and nuclear fuel	30	Petroleum refineries
9	ISIC 24	Chemicals and chemical	27-29	Basic chemical products,

[21] Actually, there are 23 two-digit ISIC but so we account for only 22 two-digit industries as we exclude Recycling (ISIC 37) from our sample.

		products		fertilizer and pesticides, other chemical products
10	ISIC 25	Rubber and plastics products	31-32	Rubber products and plastic wares
11	ISIC 26	Other non-metallic mineral products	33-34	Cement and concrete products, other non-metallic products
12	ISIC 27	Basic metals	35-36	Iron, steel and non-ferrous metal
13	ISIC 28	Fabricated metal products	37	Fabricated metal products
14	ISIC 29	Machinery and equipment	38	Industrial machinery
15	ISIC 30-32	Office, accounting, computing machinery, and electrical machinery, radio, television and communication equipment	39	Electrical machinery and apparatus
16	ISIC 34	Motor vehicles, trailers and semi-trailers	40	Motor vehicles and repairing
17	ISIC 35	Other transport equipment	41	Other transportation equipment
18	ISIC 33+36	Medical, precision optical instruments, watch and clocks, and furniture; manufacturing n.e.c.	44	Other manufacturing products such as, photographic and optical goods, watches and clocks, jewellery and related articles, recreation and athletic equipment

Note: From I-O table of 58 sectors, we limit our interest on sectors in the manufacturing industry so only 30 sectors are related to the manufacturing activities. In the ISIC 33, we exclude the ISIC 3610 (manufacture of furniture) at the four-digit level and only account for ISIC 3691-3694 and ISIC 3699. In the manufacture of furniture, we separate types of furniture according to the input of materials used in the production. For example, if a firm produces wood furniture, we include this firm in sector 43 or ISIC 20. If a firm produces metal furniture, we include this firm in sector 37 or ISIC 28.

Appendix 5C: Hausman Specification Test

The Hausman specification test is used to test the appropriateness of fixed effects versus random effects under the null hypothesis that the error term (ε_{it}) and the regressors (Z_{it}) are uncorrelated, $E(\varepsilon_{it}|Z_{it}) = 0$. If $E(\varepsilon_{it}|Z_{it}) \neq 0$ which means ε_{it} and Z_{it} are correlated, GLS estimator $(\hat{\beta}_{GLS})$ becomes biased and inconsistent for β but the within estimator $(\tilde{\beta}_{Within})$ is unbiased and consistent for β. The GLS estimator is BLUE (best linear biased estimator), consistent and efficient only if ε_{it} and Z_{it} are uncorrelated (Baltagi, 2005).

Regarding a comparison between the two estimators, the covariance matrix is used to evaluate the significant of the difference in vector $\tilde{\beta}_{Within} - \hat{\beta}_{GLS}$. Since $\hat{\beta}_{GLS}$ is efficient under the null hypothesis, it can be shown that

$$V\{\tilde{\beta}_{within} - \hat{\beta}_{GLS}\} = V\{\tilde{\beta}_{Within}\} - V\{\hat{\beta}_{GLS}\} \tag{5C.1}$$

Therefore, the Hausman test statistic can be computed as:

$$\xi_H = (\tilde{\beta}_{Within} - \hat{\beta}_{GLS})' [\hat{V}\{\tilde{\beta}_{Within}\} - \hat{V}\{\hat{\beta}_{GLS}\}]^{-1} (\tilde{\beta}_{Within} - \hat{\beta}_{GLS}) \tag{5C.2}$$

where $\hat{V}$ is the estimates of the true covariance matrices and the statistic ξ_H has an asymptotic Chi-square distribution (χ^2_K) with K degree of freedom.

The Hausman specification test is used to test whether within and GLS estimators are significantly different. If the test statistic fails to reject the null hypothesis, there is no systematic difference between the two estimators so $\hat{\beta}_{GLS}$ is efficient. However, if the null hypothesis is rejected, $\hat{\beta}_{GLS}$ is inefficient. Hence, the within estimator or the fixed effects approach is appropriated.

From the Hausman specification test, the test statistics of the model in Equation (5.1) are $\chi^2(15) = 530.46$ and the p-value = 0.00. This result shows that the null hypothesis is rejected which means the within estimator produce the efficient results so we estimate the model in Equation (5.1) with the within estimator which is often called the fixed effects estimator.

Appendix 5D: Additional Results

Table 5D.1: Fixed Effects Model for Productivity Spillovers to Domestic Exporters

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$FORW_{jt}$	0.010	0.009	0.010	0.009	0.011	0.012	0.012
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.022)	(0.023)
HOR_{jt}	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$BACK_{jt}$	-0.011	-0.010	-0.009	-0.010	-0.010	-0.010	-0.010
	(0.006)	(0.007)	(0.008)	(0.007)	(0.007)	(0.008)	(0.008)
$INRDSHARE_{j(t-1)}$		0.036	0.039	0.026	0.030	0.034	0.031
		(0.062)	(0.060)	(0.061)	(0.061)	(0.057)	(0.060)
$INEXSHARE_{j(t-1)}$			-0.184	-0.070	-0.104	-0.158	-0.182
			(0.554)	(0.549)	(0.530)	(0.572)	(0.577)
$CONCEN_{rj(t-1)}$				0.148	0.145	0.134	0.140
				(0.087)	(0.086)	(0.086)	(0.088)
$SMALL_{i(t-1)}$					-0.204**	-0.189**	-0.185**
					(0.077)	(0.075)	(0.077)
$LARGE_{i(t-1)}$					0.057	0.049	0.053
					(0.089)	(0.087)	(0.081)
$VLARGE_{i(t-1)}$					0.115	0.088	0.094
					(0.124)	(0.123)	(0.121)
$wage_{i(t-1)}$						-1.502	-1.404
						(0.963)	(1.010)
$wage^2_{i(t-1)}$						0.085	0.079
						(0.062)	(0.065)
$TRAIN_{i(t-1)}$							0.182
							(0.116)
Constant	9.471***	9.460***	9.502***	9.288***	9.226***	15.762***	15.175***
	(0.538)	(0.540)	(0.532)	(0.530)	(0.557)	(3.309)	(3.467)
Observation	2501	2501	2501	2501	2501	2501	2501

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 5D.2: Fixed Effects Model for Productivity Spillovers (Domestic Market- and Export-Oriented FDI) to Domestic Exporters

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$FORW_{jt}$	0.008	0.008	0.008	0.008	0.009	0.010	0.010
	(0.022)	(0.022)	(0.021)	(0.021)	(0.021)	(0.023)	(0.023)
$HOR-Domestic_{jt}$	0.005	0.004	0.004	0.004	0.004	0.004	0.005
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$HOR-Export_{jt}$	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$BACK_{jt}$	-0.010	-0.010	-0.008	-0.009	-0.009	-0.009	-0.010
	(0.006)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$INRDSHARE_{j(t-1)}$		0.038	0.043	0.030	0.034	0.038	0.035
		(0.060)	(0.058)	(0.059)	(0.059)	(0.055)	(0.058)
$INEXSHARE_{j(t-1)}$			-0.226	-0.114	-0.148	-0.199	-0.224
			(0.600)	(0.592)	(0.574)	(0.615)	(0.623)
$CONCEN_{rj(t-1)}$				0.148	0.145	0.134	0.141
				(0.087)	(0.086)	(0.086)	(0.088)
$SMALL_{i(t-1)}$					-0.204**	-0.188**	-0.185**
					(0.077)	(0.075)	(0.078)
$LARGE_{i(t-1)}$					0.058	0.051	0.055
					(0.091)	(0.089)	(0.082)
$VLARGE_{i(t-1)}$					0.115	0.089	0.095
					(0.125)	(0.124)	(0.121)
$wage_{i(t-1)}$						-1.510	-1.412
						(0.959)	(1.004)
$wage^2_{i(t-1)}$						0.086	0.080
						(0.061)	(0.064)
$TRAIN_{i(t-1)}$							0.182
							(0.116)
Constant	9.502***	9.497***	9.557***	9.346***	9.282***	15.840***	15.256***
	(0.567)	(0.567)	(0.570)	(0.567)	(0.581)	(3.290)	(3.440)
Observation	2501	2501	2501	2501	2501	2501	2501

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 5D.3: Fixed Effects Model for Productivity Spillovers to Domestic Non-Exporters

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$FORW_{jt}$	0.028*	0.029**	0.028**	0.028**	0.028**	0.028*	0.028*
	(0.014)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)	(0.014)
HOR_{jt}	0.008*	0.008*	0.008**	0.008*	0.008*	0.008*	0.008*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$BACK_{jt}$	0.014***	0.016***	0.014**	0.014*	0.015**	0.014*	0.014*
	(0.004)	(0.005)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
$INRDSHARE_{j(t-1)}$		0.091***	0.079**	0.077*	0.080**	0.077**	0.078**
		(0.030)	(0.031)	(0.038)	(0.035)	(0.036)	(0.037)
$INEXSHARE_{j(t-1)}$			0.440	0.453	0.419	0.429	0.426
			(0.537)	(0.586)	(0.563)	(0.584)	(0.585)
$CONCEN_{rj(t-1)}$				0.011	0.026	0.033	0.035
				(0.120)	(0.103)	(0.106)	(0.107)
$SMALL_{i(t-1)}$					-0.151**	-0.150***	-0.152***
					(0.053)	(0.051)	(0.051)
$LARGE_{i(t-1)}$					-0.016	-0.015	-0.015
					(0.074)	(0.074)	(0.074)
$VLARGE_{i(t-1)}$					0.196	0.199	0.200
					(0.197)	(0.191)	(0.191)
$wage_{i(t-1)}$						0.771**	0.766**
						(0.269)	(0.272)
$wage^2_{i(t-1)}$						-0.050**	-0.050**
						(0.019)	(0.019)
$TRAIN_{i(t-1)}$							-0.051
							(0.037)
Constant	7.359***	7.285***	7.167***	7.153***	7.197***	4.249***	4.297***
	(0.589)	(0.572)	(0.580)	(0.585)	(0.555)	(1.133)	(1.135)
Observation	4028	4028	4028	4028	4028	4028	4028

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 5D.4: Fixed Effects Model for Productivity Spillovers (Domestic Market- and Export-Oriented FDI) to Domestic Non-Exporters

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$FORW_{jt}$	0.029**	0.029**	0.029**	0.029**	0.029**	0.028**	0.029**
	(0.014)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
$HOR-Domestic_{jt}$	0.009*	0.008*	0.008*	0.008*	0.009*	0.009*	0.009*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$HOR-Export_{jt}$	0.007	0.007	0.008*	0.008*	0.007*	0.007*	0.007*
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$BACK_{jt}$	0.014***	0.016***	0.014**	0.014*	0.014**	0.013*	0.013*
	(0.004)	(0.005)	(0.006)	(0.007)	(0.006)	(0.007)	(0.007)
$INRDSHARE_{j(t-1)}$		0.091***	0.079**	0.077*	0.079**	0.076*	0.077*
		(0.031)	(0.032)	(0.039)	(0.036)	(0.036)	(0.037)
$INEXSHARE_{j(t-1)}$			0.441	0.455	0.422	0.432	0.430
			(0.542)	(0.590)	(0.568)	(0.588)	(0.590)
$CONCEN_{rj(t-1)}$				0.011	0.026	0.033	0.036
				(0.120)	(0.103)	(0.106)	(0.107)
$SMALL_{i(t-1)}$					-0.151**	-0.150***	-0.152***
					(0.053)	(0.051)	(0.052)
$LARGE_{i(t-1)}$					-0.016	-0.015	-0.015
					(0.074)	(0.074)	(0.074)
$VLARGE_{i(t-1)}$					0.196	0.199	0.201
					(0.198)	(0.191)	(0.191)
$wage_{i(t-1)}$						0.776**	0.771**
						(0.268)	(0.271)
$wage^2_{i(t-1)}$						-0.050**	-0.050**
						(0.019)	(0.019)
$TRAIN_{i(t-1)}$							-0.052
							(0.037)
Constant	7.340***	7.275***	7.155***	7.141***	7.175***	4.214***	4.256***
	(0.577)	(0.558)	(0.581)	(0.584)	(0.550)	(1.131)	(1.134)
Observation	4028	4028	4028	4028	4028	4028	4028

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%

Appendix 5E: Sensitivity Analysis

In the Appendix 5E, we present a sensitivity checks on the productivity variable in both models by using the standard labour productivity ($TFP^{LABPROD}$) defined as the log of value added to total labour.

Tables 5E.1 to 5E.3 report the estimated results from the fixed effects model for the export spillovers. The results are generally consistent with the results discussed in Tables 5.2 to 5.4. In Table 5E.1, we find a positive and significant evidence for the horizontal productivity spillovers. In Table 5E.2, we distinguish between different market orientations of FDI. The coefficients for both indices ($HOR-Domestic$ and $HOR-Export$) are positive and significant. In addition, we also find some evidence of vertical spillovers through the forward and backward linkages in Colum (2) of Table 5E.2.

Tables 5E.4 and 5E.5 provide the estimated results from the Heckman selection model for export spillovers. In both export decision and export share equations, $TFP^{LABPROD}$ has a positive coefficient while $(TFP^{LABPROD})^2$ has a negative coefficient. However, these coefficients are significant only if $wage$ and $wage^2$ are excluded from the model. This can be explained by the fact that $TFP^{LABPROD}$ and $wage$ are correlated (see Table 5A.4). For all other variables including spillovers, results are consistent with those in Tables 5.6 and 5.7.

5E.1 Productivity Spillovers

Table 5E.1: Fixed Effects Model for Productivity Spillovers to all Domestic Firms (Dep. Var. is $TFP_{it}^{LABPROD}$)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$FORW_{jt}$	0.023	0.023	0.022	0.022	0.022	0.021	0.021	0.021
	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)	(0.015)
HOR_{jt}	0.007**	0.007**	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$BACK_{jt}$	0.007*	0.008*	0.007	0.007	0.007	0.007	0.007	0.007
	(0.004)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$INRDSHARE_{j(t-1)}$		0.079**	0.074**	0.067	0.068*	0.065	0.065	0.065
		(0.030)	(0.033)	(0.039)	(0.037)	(0.038)	(0.038)	(0.037)
$INEXSHARE_{j(t-1)}$			0.227	0.274	0.260	0.237	0.237	0.237
			(0.440)	(0.463)	(0.460)	(0.478)	(0.478)	(0.480)
$CONCEN_{rj(t-1)}$				0.044	0.054	0.056	0.055	0.054
				(0.096)	(0.088)	(0.092)	(0.092)	(0.093)
$SMALL_{i(t-1)}$					-0.158**	-0.154**	-0.153**	-0.153**
					(0.058)	(0.056)	(0.055)	(0.055)
$LARGE_{i(t-1)}$					-0.024	-0.031	-0.031	-0.030
					(0.065)	(0.064)	(0.064)	(0.064)
$VLARGE_{i(t-1)}$					0.077	0.058	0.058	0.061
					(0.115)	(0.115)	(0.114)	(0.113)
$wage_{i(t-1)}$						0.687	0.687	0.682
						(0.417)	(0.417)	(0.418)
$wage^2_{i(t-1)}$						-0.051*	-0.051*	-0.050*
						(0.027)	(0.027)	(0.027)
$TRAIN_{i(t-1)}$							0.011	0.012
							(0.034)	(0.034)
$EX_{i(t-1)}$								-0.065
								(0.075)
Constant	7.766***	7.727***	7.671***	7.612***	7.646***	5.405***	5.395***	5.448***
	(0.481)	(0.489)	(0.458)	(0.455)	(0.446)	(1.592)	(1.594)	(1.623)
Observation	6667	6667	6667	6667	6667	6667	6667	6667

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 5E.2: Fixed Effects Model for Productivity Spillovers (Domestic Market- and Export-Oriented FDI) to all Domestic Firms (Dep. Var. is $TFP_{it}^{LABPROD}$)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$FORW_{jt}$	0.024	0.023	0.023	0.023	0.022	0.022	0.022	0.022
	(0.015)	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
$HOR-Domestic_{jt}$	0.009*	0.008*	0.008*	0.008*	0.008*	0.008*	0.008*	0.008*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$HOR-Export_{jt}$	0.007**	0.007**	0.007**	0.007**	0.007**	0.007**	0.007**	0.007**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$BACK_{jt}$	0.006	0.008*	0.007	0.006	0.007	0.006	0.006	0.006
	(0.004)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$INRDSHARE_{j(t-1)}$		0.079**	0.073**	0.066	0.067*	0.064	0.063	0.063
		(0.030)	(0.033)	(0.040)	(0.038)	(0.039)	(0.038)	(0.038)
$INEXSHARE_{j(t-1)}$			0.238	0.286	0.275	0.255	0.254	0.255
			(0.463)	(0.483)	(0.478)	(0.494)	(0.494)	(0.497)
$CONCEN_{rj(t-1)}$				0.044	0.054	0.056	0.056	0.055
				(0.096)	(0.087)	(0.091)	(0.092)	(0.092)
$SMALL_{i(t-1)}$					-0.158**	-0.154**	-0.154**	-0.153**
					(0.058)	(0.056)	(0.055)	(0.055)
$LARGE_{i(t-1)}$					-0.024	-0.031	-0.031	-0.030
					(0.065)	(0.064)	(0.064)	(0.064)
$VLARGE_{i(t-1)}$					0.077	0.058	0.058	0.061
					(0.115)	(0.115)	(0.114)	(0.113)
$wage_{i(t-1)}$						0.690	0.691	0.686
						(0.414)	(0.414)	(0.415)
$wage^2_{i(t-1)}$						-0.051*	-0.051*	-0.051*
						(0.027)	(0.027)	(0.027)
$TRAIN_{i(t-1)}$							0.010	0.011
							(0.034)	(0.034)
$EX_{i(t-1)}$								-0.066
								(0.075)
Constant	7.738***	7.708***	7.646***	7.585***	7.612***	5.353***	5.344***	5.396***
	(0.479)	(0.485)	(0.472)	(0.467)	(0.455)	(1.575)	(1.576)	(1.604)
Observation	6667	6667	6667	6667	6667	6667	6667	6667

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 5E.3: Fixed Effect Model for Productivity Spillovers to Domestic Exporters and Domestic Non-Exporters (Dep. Var. is $TFP_{it}^{LABPROD}$)

	Domestic Exporters		Domestic Non-Exporters	
	(1)	**(2)**	**(3)**	**(4)**
$FORW_{jt}$	0.007	0.006	0.030**	0.031**
	(0.025)	(0.026)	(0.012)	(0.012)
HOR_{jt}	0.006**		0.008**	
	(0.002)		(0.004)	
$HOR-Domestic_{jt}$		0.005		0.010**
		(0.006)		(0.004)
$HOR-Export_{jt}$		0.006**		0.008*
		(0.002)		(0.004)
$BACK_{jt}$	-0.010	-0.009	0.015**	0.015**
	(0.009)	(0.010)	(0.007)	(0.007)
$INRDSHARE_{j(t-1)}$	0.060	0.062	0.078*	0.076*
	(0.061)	(0.061)	(0.037)	(0.038)
$INEXSHARE_{j(t-1)}$	0.004	-0.020	0.452	0.457
	(0.721)	(0.812)	(0.589)	(0.594)
$CONCEN_{rj(t-1)}$	0.095	0.095	0.047	0.048
	(0.108)	(0.108)	(0.116)	(0.115)
$SMALL_{i(t-1)}$	-0.338	-0.338	-0.130*	-0.130*
	(0.197)	(0.197)	(0.064)	(0.064)
$LARGE_{i(t-1)}$	0.003	0.004	-0.020	-0.020
	(0.087)	(0.089)	(0.071)	(0.072)
$VLARGE_{i(t-1)}$	0.016	0.016	0.166	0.167
	(0.117)	(0.117)	(0.174)	(0.174)
$wage_{i(t-1)}$	-1.211	-1.214	0.747**	0.753**
	(1.014)	(1.009)	(0.269)	(0.268)
$wage_{i(t-1)}^2$	0.068	0.068	-0.048**	-0.049**
	(0.065)	(0.065)	(0.020)	(0.020)
$TRAIN_{i(t-1)}$	0.215*	0.215*	-0.055	-0.055
	(0.118)	(0.118)	(0.043)	(0.043)
Constant	13.906***	13.945***	4.067***	4.012***
	(3.402)	(3.365)	(1.125)	(1.119)
Observation	2543	2543	4124	4124

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%

5E.2 Export Spillovers

Table 5E.4: Heckman Selection Model for Export Spillovers with $TFP^{LABPROD}$ to all Domestic Firms

	(1)		(2)		(3)	
	(1.1) ***EX Decision***	(1.2) ***EX Share***	(2.1) ***EX Decision***	(2.2) ***EX Share***	(3.1) ***EX Decision***	(3.2) ***EX Share***
$EX_{i(t-1)}$	3.689***		3.691***		3.659***	
	(0.068)		(0.067)		(0.066)	
$FORW_{jt}$	7.684**	0.344	7.888**	0.407	7.712**	0.611
	(3.072)	(0.529)	(3.071)	(0.508)	(3.226)	(0.555)
HOR_{jt}	-0.354	0.299***	-0.263	0.306**	-0.323	0.312***
	(0.440)	(0.105)	(0.496)	(0.120)	(0.511)	(0.118)
$BACK_{jt}$	-0.242	0.146	-0.977	0.250	-0.862	0.266
	(3.293)	(0.199)	(3.065)	(0.211)	(3.075)	(0.206)
$INRDSHARE_{j(t-1)}$			-0.245	0.007	-0.233	0.004
			(0.204)	(0.017)	(0.206)	(0.020)
$INEXSHARE_{j(t-1)}$			0.561	-0.240	0.879	-0.194
			(1.979)	(0.231)	(1.948)	(0.241)
$TFP^{LABPROD}_{i(t-1)}$					1.005***	0.206
					(0.332)	(0.140)
$(TFP^{LABPROD}_{i(t-1)})^2$					-0.047***	-0.014*
					(0.018)	(0.008)
$SMALL_{i(t-1)}$						
$LARGE_{i(t-1)}$						
$VLARGE_{i(t-1)}$						
$wage_{i(t-1)}$						
$wage^2_{i(t-1)}$						
$SKILL_{i(t-1)}$						
$TRAIN_{i(t-1)}$						
Constant	-2.546*	0.479***	-2.734	0.608***	-8.042***	-0.196
	(1.520)	(0.131)	(1.982)	(0.097)	(2.996)	(0.693)
ρ	-0.450***		-0.449***		-0.460***	
	(0.077)		(0.061)		(0.068)	
λ	-0.152***		-0.152***		-0.154***	
	(0.023)		(0.023)		(0.025)	
Observations	6801	6801	6801	6801	6801	6801

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Region, two-digit industry and time dummies are included. ρ is the estimated correlation between the error terms of the two equations; if it is different from zero it suggests that the two equations are related and that the selection model is appropriate. λ is the estimated coefficient of the inverse Mills ratio; if it is different from zero it suggests that there is sample selection.

Table 5E.4: Continued

	(4)		(5)		(6)	
	(4.1) ***EX Decision***	(4.2) ***EX Share***	(5.1) ***EX Decision***	(5.2) ***EX Share***	(6.1) ***EX Decision***	(6.2) ***EX Share***
$EX_{i(t-1)}$	3.543***		3.538***		3.536***	
	(0.058)		(0.061)		(0.062)	
$FORW_{jt}$	8.339***	0.518	8.557***	0.485	8.704***	0.484
	(3.209)	(0.544)	(3.211)	(0.551)	(3.128)	(0.548)
HOR_{jt}	-0.383	0.312**	-0.329	0.322***	-0.324	0.320***
	(0.542)	(0.123)	(0.551)	(0.122)	(0.550)	(0.121)
$BACK_{jt}$	-1.065	0.265	-1.061	0.242	-1.212	0.206
	(3.262)	(0.208)	(3.283)	(0.209)	(3.347)	(0.207)
$INRDSHARE_{j(t-1)}$	-0.260	0.006	-0.263	0.004	-0.263	0.003
	(0.195)	(0.020)	(0.195)	(0.020)	(0.196)	(0.020)
$INEXSHARE_{j(t-1)}$	0.737	-0.185	0.849	-0.170	0.869	-0.172
	(2.004)	(0.248)	(2.014)	(0.252)	(2.015)	(0.250)
$TFP^{LABPROD}_{i(t-1)}$	0.698**	0.189	0.579	0.148	0.574	0.152
	(0.332)	(0.123)	(0.384)	(0.126)	(0.391)	(0.119)
$(TFP^{LABPROD}_{i(t-1)})^2$	-0.033*	-0.013*	-0.030	-0.010	-0.030	-0.010
	(0.018)	(0.007)	(0.020)	(0.007)	(0.020)	(0.007)
$SMALL_{i(t-1)}$	-0.266***	0.090*	-0.252***	0.090*	-0.257***	0.082*
	(0.071)	(0.052)	(0.073)	(0.052)	(0.076)	(0.050)
$LARGE_{i(t-1)}$	0.256***	0.057***	0.252***	0.058***	0.253***	0.060***
	(0.095)	(0.017)	(0.091)	(0.016)	(0.093)	(0.017)
$VLARGE_{i(t-1)}$	0.363***	0.047	0.358***	0.047	0.358***	0.050
	(0.080)	(0.043)	(0.080)	(0.042)	(0.080)	(0.041)
$wage_{i(t-1)}$			0.843	0.357	0.696	0.345
			(0.986)	(0.393)	(0.936)	(0.408)
$wage^2_{i(t-1)}$			-0.039	-0.024	-0.031	-0.023
			(0.061)	(0.026)	(0.058)	(0.026)
$SKILL_{i(t-1)}$					0.158	0.060
					(0.097)	(0.041)
$TRAIN_{i(t-1)}$					0.083	-0.008
					(0.083)	(0.024)
Constant	-6.278**	-0.164	-9.727**	-1.332	-9.215**	-1.294
	(3.070)	(0.604)	(4.144)	(1.450)	(4.077)	(1.512)
ρ	-0.461***		-0.460***		-0.462***	
	(0.065)		(0.064)		(0.064)	
λ	-0.154***		-0.154***		-0.154***	
	(0.024)		(0.024)		(0.024)	
Observations	6801	6801	6801	6801	6801	6801

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Region, two-digit industry and time dummies are included. ρ is the estimated correlation between the error terms of the two equations; if it is different from zero it suggests that the two equations are related and that the selection model is appropriate. λ is the estimated coefficient of the inverse Mills ratio; if it is different from zero it suggests that there is sample selection.

Table 5E.5: Heckman Selection Model for Export Spillovers (Domestic Market- and Export-Oriented FDI) with $TFP^{LABPROD}$ to all Domestic Firms

	(1)		(2)		(3)	
	(1.1) ***EX Decision***	(1.2) ***EX Share***	(2.1) ***EX Decision***	(2.2) ***EX Share***	(3.1) ***EX Decision***	(3.2) ***EX Share***
$EX_{i(t-1)}$	3.695***		3.697***		3.666***	
	(0.069)		(0.068)		(0.067)	
$FORW_{jt}$	0.062	0.002	0.065*	0.003	0.062	0.005
	(0.038)	(0.006)	(0.039)	(0.006)	(0.042)	(0.006)
$HOR-Domestic_{jt}$	-0.026*	0.002	-0.025*	0.002	-0.026*	0.001
	(0.014)	(0.002)	(0.014)	(0.002)	(0.015)	(0.002)
$HOR-Export_{jt}$	0.006	0.003***	0.007	0.003***	0.006	0.003***
	(0.009)	(0.001)	(0.009)	(0.001)	(0.010)	(0.001)
$BACK_{jt}$	0.003	0.002	-0.003	0.003*	-0.001	0.003*
	(0.031)	(0.002)	(0.031)	(0.002)	(0.031)	(0.002)
$INRDSHARE_{j(t-1)}$			-0.218	0.010	-0.205	0.007
			(0.185)	(0.017)	(0.187)	(0.020)
$INEXSHARE_{j(t-1)}$			0.330	-0.294	0.623	-0.256
			(2.122)	(0.233)	(2.123)	(0.244)
$TFP^{LABPROD}_{i(t-1)}$					1.017***	0.208
					(0.332)	(0.141)
$(TFP^{LABPROD}_{i(t-1)})^2$					-0.048***	-0.014*
					(0.018)	(0.008)
$SMALL_{i(t-1)}$						
$LARGE_{i(t-1)}$						
$VLARGE_{i(t-1)}$						
$wage_{i(t-1)}$						
$wage^2_{i(t-1)}$						
$SKILL_{i(t-1)}$						
$TRAIN_{i(t-1)}$						
Constant	-3.230**	0.474***	-3.288	0.625***	-8.628***	-0.188
	(1.612)	(0.127)	(2.046)	(0.107)	(3.155)	(0.704)
ρ	-0.450***		-0.450***		-0.460***	
	(0.061)		(0.061)		(0.067)	
λ	-0.152***		-0.152***		-0.154***	
	(0.023)		(0.023)		(0.025)	
Observations	6801	6801	6801	6801	6801	6801

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Region, two-digit industry and time dummies are included. ρ is the estimated correlation between the error terms of the two equations; if it is different from zero it suggests that the two equations are related and that the selection model is appropriate. λ is the estimated coefficient of the inverse Mills ratio; if it is different from zero it suggests that there is sample selection.

Table 5E.5: Continued

	(4)		(5)		(6)	
	(4.1) ***EX Decision***	(4.2) ***EX Share***	(5.1) ***EX Decision***	(5.2) ***EX Share***	(6.1) ***EX Decision***	(6.2) ***EX Share***
$EX_{i(t-1)}$	3.550***		3.545***		3.542***	
	(0.060)		(0.062)		(0.063)	
$FORW_{jt}$	0.070*	0.003	0.072*	0.003	0.073*	0.003
	(0.041)	(0.006)	(0.041)	(0.006)	(0.039)	(0.006)
$HOR-Domestic_{jt}$	-0.025*	0.001	-0.025*	0.001	-0.025*	0.001
	(0.015)	(0.002)	(0.015)	(0.002)	(0.014)	(0.002)
$HOR-Export_{jt}$	0.006	0.003***	0.007	0.004***	0.007	0.004***
	(0.010)	(0.001)	(0.010)	(0.001)	(0.010)	(0.001)
$BACK_{jt}$	-0.004	0.003**	-0.004	0.003*	-0.006	0.003
	(0.033)	(0.002)	(0.033)	(0.002)	(0.034)	(0.002)
$INRDSHARE_{j(t-1)}$	-0.235	0.010	-0.238	0.008	-0.237	0.007
	(0.179)	(0.020)	(0.178)	(0.020)	(0.178)	(0.020)
$INEXSHARE_{j(t-1)}$	0.549	-0.255	0.670	-0.239	0.684	-0.237
	(2.169)	(0.253)	(2.174)	(0.257)	(2.166)	(0.254)
$TFP^{LABPROD}_{i(t-1)}$	0.708**	0.191	0.590	0.150	0.585	0.154
	(0.331)	(0.123)	(0.385)	(0.126)	(0.391)	(0.119)
$(TFP^{LABPROD}_{i(t-1)})^2$	-0.034*	-0.013*	-0.031	-0.010	-0.030	-0.011
	(0.018)	(0.007)	(0.020)	(0.007)	(0.020)	(0.007)
$SMALL_{i(t-1)}$	-0.266***	0.090*	-0.252***	0.090*	-0.257***	0.082*
	(0.071)	(0.052)	(0.073)	(0.053)	(0.075)	(0.050)
$LARGE_{i(t-1)}$	0.254***	0.058***	0.250***	0.058***	0.250***	0.060***
	(0.094)	(0.017)	(0.090)	(0.016)	(0.093)	(0.017)
$VLARGE_{i(t-1)}$	0.363***	0.047	0.358***	0.047	0.358***	0.050
	(0.078)	(0.043)	(0.079)	(0.042)	(0.079)	(0.041)
$wage_{i(t-1)}$			0.830	0.358	0.683	0.346
			(0.981)	(0.395)	(0.931)	(0.409)
$wage^2_{i(t-1)}$			-0.038	-0.024	-0.030	-0.023
			(0.061)	(0.026)	(0.058)	(0.027)
$SKILL_{i(t-1)}$					0.158*	0.059
					(0.096)	(0.041)
$TRAIN_{i(t-1)}$					0.087	-0.008
					(0.082)	(0.024)
Constant	-6.882**	-0.154	-10.308**	-1.325	-9.791**	-1.287
	(3.237)	(0.616)	(4.304)	(1.458)	(4.227)	(1.519)
ρ	-0.460***		-0.460***		-0.462***	
	(0.064)		(0.063)		(0.064)	
λ	-0.154***		-0.154***		-0.154***	
	(0.024)		(0.024)		(0.024)	
Observations	6801	6801	6801	6801	6801	6801

Notes: Robust clustered standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Region, two-digit industry and time dummies are included. ρ is the estimated correlation between the error terms of the two equations; if it is different from zero it suggests that the two equations are related and that the selection model is appropriate. λ is the estimated coefficient of the inverse Mills ratio; if it is different from zero it suggests that there is sample selection.

6
Conclusions

This chapter includes two sub-sections. First, we provide a summary of the empirical results presented in Chapters two to five and discuss limitations of the study. Recommendations for further research are also discussed in the second section of the chapter.

6.1 Summary of Results

This thesis consists of four empirical studies related to different aspects of exporting, FDI and firm heterogeneity in Thailand. All chapters use a firm-level data from the Annual Survey of Thailand's manufacturing industry by the OIE for the period between 2001 and 2004. The first two studies investigate the determinants of export participation. The third study explains the distinction between single and multi-product firms to contribute to the understanding of the complex relationship between MNEs and exporting and also characteristics associated with

multi-product firms. The final study concerns the effects of FDI inflows on the domestic firms in the host economy.

Chapter two investigates the relationship between firm heterogeneity, origin of ownership and export participation. We find evidence that a firm's decision to export is determined by export experience, structure of ownership, productivity, firm size and its establishment location. As a whole, export experience interpreted as the evidence of sunk entry costs is the most important determinant of the probability of exporting. This finding is consistent with both the theoretical and past empirical explanations where a firm enters export market if the expected gross profit exceeds the sunk entry costs. If a firm exports in the previous period, it is likely to export in the current period as well. For other independent variables, the results that productivity, foreign ownership have positive and significant effects on the probability of exporting. Firms with high wages are likely to enter export markets. The firm size is also important, small firms are less likely to export but the larger a firm then becomes the more likely it is to export. Establishment location of a firm affects the probability of exporting as well of which the probability of exporting is higher for a firm that locates in the south, compared to other regions.

Furthermore, we are able to break down FDI by countries and regions of origin with the intention to investigate the effect of country of origin on the decision of a firm to enter export markets. The results show that country of origin matters in determining the export decision of a firm. The probability of exporting is higher for firms from China, Japan, Singapore, US and UK compared to other countries or regions. These results indicate the evidence of export platform FDI. In addition, using different cut-off points for foreign-owned share, we observe that the behaviour of Chinese- and Singaporean-owned firms is different to firms from others countries with the probability of exporting correlated with the size of the foreign-owned share.

In Chapter three, we further investigate the determinants of export participation decision by linking a firm's financial health with the entry decision into export market because we assume that the investment relates to a firm's internal finance. Exporting is considered as a form of investment as a firm has to invest in sunk entry costs in order to enter export markets. Thus, we re-examine the model in Chapter two and retain all independent variables except for the lag of export status. We replace the lag of export status which is a proxy for sunk entry costs with the financial variables. The financial variables are used to indicate firms' ability of investment especially in sunk entry costs in order to enter export markets. We categorise firm size according to total fixed assets rather than total labour since this chapter emphasises on the internal finance of a firm.

The empirical results show that financial health of a firm affect its decision to export. Liquidity is positive whilst leverage is negative and both ratios are significant. Firms that have high liquidity are more likely to export. In contrast, firms with high leverage are less likely to become exporters. Results for other firm specific characteristics are broadly consistent with those presented in Chapter two. In addition, we investigate factors that affect the size of exports. The financial health is also found to have a significant effect on the export intensity of a firm. This finding reveals a firm's capability to produce goods for export.

In Chapter four, we look at another dimension of firm heterogeneity by focusing on different aspects of multi-product firms in international trade and also making a distinction between single- and multi-product firms. First, we examine the relationship between multi-product firm's extensive margin on output or exporting. We observe little variation for firms' extensive margins in both total output and export sales. If we compare the magnitude of the effect, firms' extensive margins seem to have a higher variation in export sales than in total output.

The second part of Chapter four is about the empirical investigations of the characteristics associated with being a multi-product firm using binary data and the number of products produced using count data. Results show that various factors such as the interaction between export and foreign ownership, TFP, R&D both in product and in the production processes and firm size are associated with being a multi-product firm Productive and large firms and those that carry out R&D also have a strong association with being a multi-product firm. In terms of the characteristics associated with the number of products produced, the results are generally consistent with the factors that associate with the probability of becoming a multi-product firm.

If we distinguish between domestic and foreign firms, we observe that there are systematic differences of the factors associated with being a multi-product firm and the number of products produced. This indicates that domestic firms perform differently to foreign firms. The export status of foreign firms has a positive and significant association with being a multi-product firm and the number of products produced. Both R&D are found to be more important for domestic firms compared to foreign firms.

In Chapter five, we highlight on the effect of FDI inflows that can be generated through spillovers to domestic firms. We account for both productivity and export spillovers via both intra- and inter-industry spillovers. We also make a distinction between different types of FDI to investigate how domestic market-oriented and export-oriented foreign firms affect the productivity and exporting of domestic firms.

Regarding productivity spillovers, there is a significant evidence for positive horizontal productivity spillovers. This is explained by the competition between foreign and domestic firms in the same industry that forces the latter to improve their productive efficiency. Both domestic market-oriented and export-oriented foreign firms tend to increase the productivity of all domestic firms in same industry. If we distinguish between spillovers to domestic exporters and

domestic non-exporters, results show that export-oriented foreign firms generate positive horizontal productivity spillovers to domestic exporters. Domestic non-exporters benefit from both horizontal and vertical productivity spillovers.

In terms of export spillovers, we model two decisions, the export decision and how much to export. In the export participation decision, we find positive and significant evidence for vertical spillovers through forward linkages which suggests the importance of contacts between foreign firms and their domestic customers. Different types of FDI also generate different spillovers to domestic firms. Our results show that domestic-oriented foreign firms generate negative spillovers to the domestic firms in the same industry.

In the export share equation, we observe different results. Domestic exporters benefit from the presences of foreign firms, especially export-oriented foreign firms, operating in the same industry. This indicates that domestic exporters can benefit from both information and competition effects. Other firm-level characteristics also significantly affect the productivity of domestic firms as well as the decision to export and how much to export.

In this thesis, the empirical results lead us to suggest several policy implications. The government should continue to implement policies that encourage firms to export and attract FDI inflows. Both policies are known as a means to stimulate economic growth. However, the government may need to think carefully about whom they should target their inward FDI policies because different countries of origin are found to have different incentives of investment.

In addition, the government should also be aware of making decision on the right policies that do not only stimulate growth but also benefit domestic firms. Our results suggested that different incentives for FDI have different spillover effects towards domestic firms. Some

industries benefit from the spillovers while others lose their market share or face significant competition pressures due to the inflows of FDI. Therefore, the government should stress on those policies that attract certain types of FDI that benefit domestic firms and, at the same time, protect some industries that receive negative spillover effects.

Regarding the policies that encourage exports, the government should also highlight entry-promotion as well as export promotion policies. The financial health of a firm is found to have significant effect on the entry decision of a firm into export markets and also the export intensity. Entry-promotion policies could benefit from government help to reduce sunk entry costs faced by firms, so some financial constrained firms can afford the costs of entry into export markets. The implementation of export promotion policies would support existing exporters to stimulate their export sales.

6.2 Further Research

The key limitation of this thesis relates to our data. Since we have a short panel structure, we cannot perform alternative estimation techniques. In order to improve our analyses of all chapters, our plan is to construct a longer panel by adding the recent years of data.

If we are able to expand the time period, we will carry out other estimation techniques such as the fixed effects probit, GMM or even other dynamic estimators. All of these techniques account for the unobserved heterogeneity problem. In addition, the first-difference GMM estimator by Arellano and Bond (1991) allows for possible endogeneity by requiring two or more lags of the right-hand-side variables as instruments. However, the first-difference GMM is found to have weak instrument problems that arise from the sample bias especially in the short panel (Blundell and Bond, 1998). Furthermore, Blundell and Bond (1998) suggest that the

system GMM is more efficient than the first-difference GMM estimator. The system GMM as it combines two moment conditions; for the differenced equation and for the model in levels. In our models, there may be causality problems between dependent and independent variables. For example, a firm's decision to export may have causality impact on productivity. In this case, the system GMM estimator would be our appropriate estimation technique.

In addition to improvements in the estimation techniques, in Chapters two and three, we could examine the effect of establishment locations from different investment promotion zones on a firm's decision to export if we are able identify whether foreign-owned firms in the sample actually receive privileges from BOI or not. In terms of Chapter four, it would be useful to break down foreign ownership into country of origin to see whether there is a difference between the behaviour of firms from developing and developed countries. The longer time period of the data allows us to examine the behaviour of firms in response to a shock to see whether product adjustment occurs at the intensive or extensive margin. Finally in Chapter five, we can further separately investigate spillover effects of each individual industry to distinguish the difference of the effects among industries. Other channels of possible spillovers such as technology and R&D are also interesting to examine. Rather than focusing on spillovers from FDI, we can look at the spillovers from exporting as well.

Bibliography

Aitken, B. J., Hanson, H. G. and Harrison, A. E. (1997), "Spillovers, Foreign Investment and Export Behavior", *Journal of International Economics*, Vol. 43, No. 1, pp. 103-132.

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

Allanson, P. and Montagna, C. (2005), "Multiproduct Firms and Market Structure: An Explorative Application to the Product Life Cycle", *International Journal of Industrial Organization*, Vol. 23, No. 7-8, pp. 587-597.

Alvarez, R. (2007), "Explaining Export Success: Firm Characteristics and Spillover Effects", *World Development*, Vol. 35, No. 3, pp. 377-393.

Alvarez, R. and López, R. A. (2005), "Exporting and Performance: Evidence from Chilean Plants", *Canadian Journal of Economics*, Vol. 38, No. 4, pp. 1384-1400.

Alvarez, R. and López, R. (2008), "Is Exporting a Source of Productivity Spillovers?", *Review of World Economics*, Vol. 144, No. 4, pp. 723-749.

Alyson, C. M. (2006), "Export Spillovers to Chinese Firms: Evidence from Provincial Data", *Journal of Chinese Economic and Business Studies*, Vol. 4, No. 2, pp. 127-149.

Arellano, M. and Bond, S. (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *Review of Economic Studies*, Vol. 58, No. 2, pp. 277-297.

Arnold, J. M. and Hussinger, K. (2005), "Export Behavior and Firm Productivity in German Manufacturing: A Firm-Level Analysis", *Review of World Economics*, Vol. 141, No. 2, pp. 119-243.

Aw, B. Y., Chung, S. and Roberts, M. J. (2000), "Productivity and Turnover in the Export Market: Micro-level Evidence from the Republic of Korea and Taiwan (China)", *The World Economy*, Vol. 14, No. 1, pp. 65-90.

Aw, B. Y., Roberts, M. J. and Winston, T. (2007), "Export Market Participation, Investment in R&D and Worker Training, and the Evolution of Firm Productivity", *World Economy*, Vol. 30, No. 1, pp. 83-104.

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

Baldwin, R. E. (1989), "Sunk-Cost Hysteresis", *NBER Working Pap*er No. 2911.

Baldwin, J. and Gu, W. (2005), "The Impact of Trade on Plant Scale, Production-Run Length and Diversification", Statistics Canada, mimeo.

Baldwin, R. E. and Ottaviano, G. I. P. (2001), "Multiproduct Multinationals and Reciprocal FDI Dumping", *Journal of International Economics*, Vol. 54, No. 2, pp. 429-448.

Baltagi, B. H. (2005), *Econometric Analysis of Panel Data*, 3rd ed, Chichester: John Wiley & Sons Ltd.

Bank of Thailand (2006), "Thailand's Economic and Monetary Conditions in 2005", Annual Report.

Barrios, S., Görg, H. and Strobl, E. (2003), "Explaining Firms' Export Behaviour: R&D, Spillovers and the Destination Market", *Oxford Bulletin of Economics and Statistics*, Vol. 65, No. 4, pp. 475-496.

Barrios, S. and Strobl, E. (2002), "Foreign Direct Investment and Productivity Spillovers: Evidence from the Spanish Experience", *Review of World Economics*, Vol. 138, No. 3, pp. 459-481.

Baum, C. F. (2006), *An Introduction to Modern Econometrics Using Stata*, Texas: Stata Press Publication.

Berger, P. G. and Ofek, E. (1995), "Diversification Effect on Firm Value", *Journal of Financial Economics*, Vol. 37, No. 1, pp. 39-65.

Bergsman, J. and Shen, X. (1996), "Foreign Direct Investment in Developing Countries", *Journal of Social, Political and Economic Studies*, Vol. 21, No. 3, pp. 343-348.

Bernard, A. B., Eaton, J., Jensen, J. B. and Kortum, S. (2003), "Plants and Productivity in International Trade", *American Economic Review*, Vol. 93, No. 4, pp. 1268-1290.

Bernard, A. B. and Jensen, J. B. (1999), "Exceptional Exporter Performance: Cause, Effect or Both?", *Journal of International Economics*, Vol. 47, No. 1, pp. 1-25.

Bernard, A. B. and Jensen, J. B. (2004), "Why Some Firms Export", *Review of Economics and Statistics*, Vol. 86, No. 2, pp. 561-569.

Bernard, A. B., Jensen, J. B. and Schott, P. K. (2005), "Importers, Exporters, and Multinationals: A Portrait of Firms in the U.S. that Trade Goods", *NBER Working Paper* No. 11404.

Bernard, A. B., Redding, S. J. and Schott, P. K. (2006a), "Multi-product Firms and Product Switching", *NBER Working Paper* No. 12293.

Bernard, A. B., Redding, S. J. and Schott, P. K. (2006b), "Multi-Product Firms and Trade Liberalization", *NBER Working Paper* No. 12782.

Bernard, A. B., Jensen, J. B., Redding, S. J. and Schott, P. K. (2007a), "Firms in International Trade", *NBER Working Pap*er No. 13054.

Bernard, A. B., Redding, S. J. and Schott, P. K. (2007b), "Comparative Advantage and Heterogeneous Firms", *Review of Economic Studies*, Vol. 74, No. 1, pp. 31-66.

Bernard, A. B. and Wagner, J. (1997), "Exports and Success in German Manufacturing", *Review of World Economics*, Vol. 133, No. 1, pp. 134-157.

Bernard, A. B. and Wagner, J. (2001), "Export Entry and Exit by German Firms", *Review of World Economics*, Vol. 137, No. 1, pp. 105-123.

Bhaopichitr, K. (1997), "Thailand's Road to Economic Crisis", *The Nation (Bangkok)*, December.

Bitzer, J., Geishecker, I. and Görg, H. (2008), "Productivity Spillovers through Vertical Linkages: Evidence from 17 OECD Countries", *Economics Letters*, Vol. 99, No. 2, pp. 328-331.

Blalock, G. and Gertler, P. J. (2004), "Learning from Exporting Revisited in a Less Developed Setting", *Journal of Development Economics*, Vol. 75, No. 2 , pp. 397-416.

Blalock, G. and Gertler, P. J. (2008), "Welfare Gains from Foreign Direct Investment through Technology Transfer to Local Suppliers", *Journal of International Economics*, Vol. 74, No. 2, pp. 402-421.

Blalock, G. and Roy, S. (2007), "A Firm-level Examination of the Exports Puzzle: Why East Asian Exports Didn't Increase After the 1997-1998 Financial Crisis", *World Economy*, Vol. 30, No. 1, pp. 39-59.

Blomström, M. (1986), Foreign Investment and Productivity Efficiency: The Case of Mexico, *Journal of Industrial Economics*, Vol. 35, No. 1, pp. 97-112.

Blomström, M. and Kokko, A. (1997), "How Foreign Direct Investment Affects Host Countries", *World Bank Working Paper* No. 1745.

Blomström, M. and Kokko, A. (1998), "Multinational Corporations and Spillovers", *Journal of Economic Surveys*, Vol. 12, No. 3, pp. 247-277.

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

Blomström, M. and Persson, H. (1983), "Foreign Investment and Spillover Efficiency in an Underdeveloped Economy: Evidence from the Mexican Manufacturing Industry", *World Development*, Vol. 11, No. 6, pp. 493-501.

Blomström, M. and Sjöholm, F. (1999), "Technology Transfer and Spillovers: Does Local Participation with Multinationals Matter?", *European Economic Review*, Vol. 43, No. 4-6, pp. 915-923.

Blundell, R. and Bond, S. R. (1998), "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models", *Journal of Econometrics*, Vol. 87, No. 1, pp. 115-143.

Bond, S., Elston, J. A., Mairesse, J. and Mulkay, B. (2003), "Financial Factors and Investment in Belgium, France, Germany, and the United Kingdom: A Comparison Using Company Panel Data", *Review of Economics and Statistics*, Vol. 85, No. 1, pp. 153-165.

Bond, S. and Meghir, C. (1994), "Dynamic Investment Models and the Firm's Financial Policy", *Review of Economic Studies*, Vol. 61, No. 2, pp. 197-222.

Brambilla, I. (2006), "Multinationals, Technology, and the Introduction of Varieties of Goods, *NBER Working Paper* No. 12217.

Brander, J. A. and Eaton, J. (1984), "Product Line Rivalry", *American Economic Review*, Vol. 74, No. 3, pp. 323-334.

Buettner, T. (2003), "R&D and the Dynamics of Productivity" London School of Economics, mimeo.

Bugmamelli, M. and Infante, L. (2003), "Sunk Costs of Exports, *Bank of Italy Discussion Paper* No. 469.

Bwalya, S. M. (2006), "Foreign Direct Investment and Technology Spillovers: Evidence form Panel Data Analysis of Manufacturing Firms in Zambia", *Journal of Development Economics*, Vol. 81, No. 2, pp. 514-526.

Cabral, L. M. B. and Ross, T. W. (2008), "Are Sunk Costs a Barrier to Entry?", *Journal of Economics Management Strategy*, Vol. 17, No. 1, pp. 97-112.

Cameron, A. C. and Trivedi, P. K. (1998), *Regression Analysis of Count Data*, Econometric Society Monograph, New York: Cambridge University Press.

Campa, J. M. (2004), "Exchange Rates and Trade: How Important is Hysteresis in Trade?", *European Economic Review*, Vol. 48, No. 3, pp. 527-548.

Campa, J. M. and Shaver, J. M. (2002), "Exporting and Capital Investment: on the Strategic Behavior of Exporters", *CIFF Research Paper* No. 469, Centro Internacional de Investigación Financiera.

Carpenter, R. E., Fazzari, S. M., Petersen, B. C., Kashyap, A. K. and Friedman, B. M. (1994), "Inventory Investment, Internal-Finance Fluctuations, and the Business Cycle", *Brookings Papers on Economic Activity*, Vol. 1994, No. 2, pp. 75-138.

Caves, R. E. (1974), "Multinational Firms, Competition, and Productivity in Host-country Market", *Economica*, Vol. 41, No. 162, pp. 176-193.

Caves, R. E. (1981), "Intra-Industry Trade and Market Structure in the Industrial Countries", *Oxford Economic Papers*, Vol. 33, No. 2, pp. 203-233.

Caves, R. E. (1996), *Multinational Enterprise and Economic Analysis*, 2nd ed., Cambridge: Cambridge University Press.

Chaipravat, O. (2003), "Thailand's Positioning in a New Global Economic Paradigm", The Fiscal Policy Research Institute, Ministry of Finance, Thailand.

Chaney, T. (2005), "Liquidity Constrained Exporters", Massachusetts Institute of Technology, mimeo.

Clerides, S. K., Lach, S. and Tybout, J. R. (1998), "Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico, and Morocco", *Quarterly Journal of Economics*, Vol. 113, No. 3, pp. 903-947.

Delgado, M. A., Fariñas, J. and Ruano, S. (2002), "Firm Productivity and Export Markets: A Non-parametric Approach", *Journal of International Economics*, Vol. 57, No. 2, pp. 397-422.

Diao, X., Rattsø, J. and Stokke, H. E. (2005), "International spillovers, productivity growth and openness in Thailand: An Intertemporal General Equilibrium Analysis", *Journal of Development Economics*, Vol. 76, No.2. pp. 429-450.

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

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

Driffield, N. (2001), "The Impact on Domestic Productivity of Inward Investment in the UK", *Manchester School*, Vol. 69, No. 1, pp. 103-119.

Driffield, N., Munday, M. and Roberts, A. (2002), "Foreign Direct Investment, Transactions Linkages and the Performance of the Domestic Sector", *International Journal of the Economics of Business*, Vol. 9, No. 3, pp. 335-351.

Eaton, J., Eslava, M., Kugler, M. and Tybout, J. (2007), "Export Dynamics in Colombia: Firm-Level Evidence", *NBER Working Paper* No. 13531.

Eaton, J., Kortum, S. and Kramarz, F. (2004), "Dissecting Trade: Firms, Industries, and Export Destinations", *American Economic Review*, Vol. 94, No. 2, pp. 150-154.

Eckel, C. and Neary, P. J. (2006), "Multi-Product Firms and Flexible Manufacturing in the Global Economy", *Economic Series Working Papers* No. 292, Department of Economics, University of Oxford.

Edward, S. (1993), "Openness, Trade Liberalisation and Growth in Developing Countries", *Journal of Economic Literature*, Vol. 31, No. 3, pp. 1358-1393.

Edward, S. (1998), "Openness, Productivity and Growth: What Do We Really Know?", *Economic Journal*, Vol. 108, No. 447, pp. 383-398.

Fariñas, J. and Martín-Marcos, A. (2007), "Exporting and Economic Performance: Firm-level Evidence of Spanish Manufacturing", *World Economy*, Vol. 30, No. 4, pp. 618-646.

Falvey, R. (1981), "Commercial Policy and Intra-Industry Trade", *Journal of International Economics*, Vol. 11, No. 4, pp. 495-511.

Falvey, R. and Kierzkowski, H. (1987), "Product Quality, Intra-Industry Trade and (Im)Perfect Competition", in H. Kierzkowski (ed.), *Protection and Competition in International Trade*, Oxford: Basil Blackwell, pp. 143-161.

Fazzari, S. M. and Petersen, B. C. (1993), "Working Capital and Fixed Investment: New Evidence on Financing Constraints", *RAND Journal of Economics*, Vol. 24, No. 3, pp. 328-342.

Feenstra, R. and Ma, H. (2007), "Optimal Choice of Product Scope for Multiproduct Firms under Monopolistic Competition", *NBER Working Paper* No. 13703.

Flam, H. and Helpman, R. (1987), "Vertical Product Differentiation and North-South Trade", *American Economic Review*, Vol. 77, No. 5, pp. 810-822.

Garcia-Vaga, M. and Guariglia, A. (2007), "Volatility, Financial Constraints and Trade", *GEP Research Paper 2007/33*, Leverhulme Centre for Research on Globalisation and Economic Policy, University of Nottingham.

Girma, S. (2005), "Absorptive Capacity and Productivity Spillovers from FDI: A Threshold Regression Analysis", *Oxford Bulletin of Economics and Statistics*, Vol. 67, No. 3, pp. 281-306.

Girma, S., Greenaway, D. and Kneller, R. (2004), "Does Exporting Increase Productivity? A Microeconometric Analysis of Matched Firms", *Review of International Economics*, Vol. 12, No. 5, pp. 855-866.

Girma, S., Greenaway, D. and Wakelin, K. (2001), "Who Benefit from Foreign Direct Investment in the UK?", *Scottish Journal of Political Economy*, Vol. 48, No. 2, pp. 119-133.

Girma, S., Görg, H. and Pisu, M. (2008), "Exporting Linkages and Productivity Spillovers from Foreign Direct Investment", *Canadian Journal of Economics*, Vol. 41, No. 1, pp. 320-340.

Girma, S., Kneller, R. and Pisu, M. (2007), "Do Exporters Have Anything to Learn From Foreign Multinationals", *European Economic Review*, Vol. 51, No. 4, pp. 981-998.

Girma, S. and Wakelin, K. (2002), "Are There Regional Spillovers from FDI in the UK?", in D. Greenaway, R. Upward and K. Wakelin (eds.), *Trade, Investment, Migration and Labour Market*, Basingstoke, UK: Macmillan.

Globerman, S. (1979), "Foreign Direct Investment and 'Spillover' Efficiency Benefits in Canadian Manufacturing Industries", *Canadian Journal of Economics*, Vol. 12, No. 1, pp. 42-56.

Goldberg, P. K., Khandelwal, A., Pavcnik, N. and Topalova, P. (2008), "Multi-Product Firms and Product Turnover in the Developing World: Evidence from India", *NBER Working Paper* No. 14127.

Görg, H. and Greenaway, D. (2004), "Much Ado About Nothing? Do Domestic Firms Really Benefit from Foreign Investment?", *World Bank Research Observer*, Vol. 19, No. 2, pp. 171-197.

Görg, H. and Strobl, E. (2001), "Multinational Companies and Productivity Spillovers: A Meta-Analysis", *Economic Journal*, Vol. 111, No. 475, pp. F723-F739.

Görg, H. and Strobl, E. (2005), "Spillovers from Foreign Firms through Worker Mobility: An Empirical Investigation", *Scandinavia Journal of Economics*, Vol. 107, No. 4, pp. 693-709.

Greenaway, D., Guariglia, A., and Kneller, R. (2007), "Financial Factors and Exporting Decisions", *Journal of International Economics*, Vol. 73, No. 2, pp. 377-395.

Greenaway, D., Gullstrand, J. and Kneller, R. (2005), "Exporting Many Not Always Boost Firm Productivity", *Review of World Economics*, Vol. 141, No. 4, pp. 561-582.

Greenaway, D. and Kneller, R. (2004), "Exporting and Productivity in the United Kingdom", *Oxford Review of Economic Policy*, Vol. 20, No. 3, pp. 358-371.

Greenaway, D. and Kneller, R. (2007), "Firm Heterogeneity, Exporting and Foreign Direct Investment", *Economic Journal*, Vol. 117, No. 517, pp. F134-F161.

Greenaway, D., Sousa, N. and Wakelin, K. (2004), "Do Domestic Firms Learn to Export from Multinationals", *European Journal of Political Economy*, Vol. 20, No. 4, pp. 1027-1043.

Grubel, H. G. (1967), "Intra-Industry Specialization and the Pattern of Trade", *Canadian Journal of Economics and Political Science*, Vol. 33, No. 3, pp. 374-388.

Guariglia, A. (1999), "The Effects of Financial Constraints on Inventory Investment: Evidence form a Panel of UK Firms", *Economica*, Vol. 66, No. 261, pp.43-62.

Guariglia, A. and Mateut, S. (2005), "Inventory Investment, Global Engagement, and Financial Constraints in the UK: Evidence from MicroData", *GEP Research Paper 2005/23*, Leverhulme Centre for Research on Globalisation and Economic Policy, University of Nottingham.

Gujarati, D. N. (1995), *Basic Econometrics*, 3rd ed, Singapore: McGraw-Hill.

Haddad, M. and Harrison, A. (1993), "Are There Positive Spillovers from Direct Foreign Investment? Evidence from Panel Data for Morocco", *Journal of Development Economics*, Vol. 42, No. 1, pp. 51-74.

Hallak, J. C. (2006), "Product Quality and the Direction of Trade", *Journal of International Economics*, Vol. 68, No. 1, pp. 238-265.

Hallak, J. C. and Schott, P. K. (2008), "Estimating Cross-Country Differences in Product Quality", *NBER Working Paper* No. 13807.

Hallward-Driemeier, M., Iarossi, G. and Sokoloff, K. L. (2002), "Export and Manufacturing Productivity in East Asia: A Comparative Analysis with Firm-Level Data", *NBER Working Paper* No. 8894.

Harris, R. and Robinson, C. (2004), "Productivity Impacts and Spillovers from Foreign Ownership in the United Kingdom", *National Institute Economic Review*, Vol. 187, No. 1, pp. 58-75.

Harrison, A. E. and McMillan, M. S. (2003), "Does Direct Foreign Investment Affect Domestic Credit Constraints?", *Journal of International Economics*, Vol. 61, No. 1, pp. 73-100.

Hausman, J. A. (1978), "Specification Tests in Econometrics", *Econometrica*, Vol. 46, No. 6, pp. 1251-1271.

Heckman, J. J. (1979), "Sample Selection Bias as a Specification Error", *Econometrica*, Vol. 47, No. 1, pp. 153-161.

Helpman, E. (1981), "International Trade in the Presence of Product Differentiation, Economies of Scale, and Monopolistic Competition: A Chamberlin-Heckscher-Ohlin Approach", *Journal of International Economics*, Vol. 11, No. 3, pp. 305-340.

Helpman, E. and Krugman, P. (1985), *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition and the International Economy*, Cambridge, MA: MIT Press.

Helpman, E., Melitz, M. J. and Yeaple, S. R. (2004), "Export Versus FDI with Heterogeneous Firms", *American Economic Review*, Vol. 94, No. 1, pp. 300-316.

Hirschman, A. O. (1958), *The Strategy of Economic Development*, New Haven, London: Yale University Press.

Hopenhayan, H. (1992), "Entry, Exit and Firm Dynamics in Long Run Equilibrium", *Econometrica*, Vol. 60, No. 5, pp. 1127-1150.

Hubbard, R. G. (1998), "Capital-Market Imperfections and Investment", *Journal of Economic Literature*, Vol. 36, No. 1, pp. 193-225.

Hummels, D. and Klenow, P. J. (2005), "The Variety and Quality of a Nation's Exports", *American Economic Review*, Vol. 95, No. 3, pp. 704-723.

Iacovone, L. and Javorcik, B. S. (2008), "Multi-Product Exporters: Diversification and Micro-Level Dynamics", *World Bank Policy Research Working Paper* No. 4723.

Javorcik, B. S. (2004), "Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers Through Backward Linkages", *American Economic Review*, Vol. 94, No. 3, pp. 605-627.

Javorcik, B. S. and Spatareanu, M. (2008), "To Share or Not to Share: Does Local Participation Matter for Spillovers from Foreign Direct Investment, *Journal of Development Economics*, Vol. 85, No. 1-2, pp. 194-217.

Johnson, J. P. and Myatt, D. P. (2003), "Multiproduct Quality Competition: Fighting Brands and Product Line Pruning", *American Economic Review*, Vol. 93, No. 3, pp. 748-774.

Kashyap, A. K, Lamont, O. A. and Stein, J. C. (1994), "Credit Conditions and the Cyclical Behavior of Inventories", *Quarterly Journal of Economics*, Vol. 109, No. 3, pp. 565-592.

Kimura, F. and Kiyota, K. (2006), "Exports, FDI, and Productivity: Dynamic Evidence from Japanese Firms", *Review of World Economics*, Vol. 142, No. 4, pp. 695-719.

Kneller, R. and Pisu, M. (2004), "Export-Oriented FDI in the UK", *Oxford Review of Economic Policy*, Vol. 20, No. 3, pp. 424-439.

Kneller, R. and Pisu, M. (2007), "Industrial Linkages and Export Spillovers from FDI", *The World Economy*, Vol. 30, No. 1, pp. 105-134.

Kohpaiboon, A. (2006), "Foreign Direct Investment and Technology Spillovers: A Cross-Industry Analysis of Thai Manufacturing", *World Development*, Vol. 34, No. 3, pp. 541-556.

Kokko, A. (1994), "Technology, Market Characteristics, and Spillovers", Journal *of Development Economics*, Vol. 43, No. 2, pp. 279-293.

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

Kokko, A., Zejan, M. and Tansini, R. (2001), "Trade Regimes and Spillover Effects of FDI: Evidence from Uruguay", *Review of World Economics*, Vol. 137, No. 1, pp. 124-149.

Konings, J., Rizov, M. and Vandenbussche, H. (2003), "Investment and Financial Constraints in Transition Economies: Micro Evidence from Poland, the Czech Republic, Bulgaria and Romania", *Economics Letters*, Vol. 78, No. 2, pp. 253-258.

Krongkaew, M. (1999), "Capital Flows and Economic Crisis in Thailand", *The Developing Economies*, Vol. 37, No.4, pp. 395-416.

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

Krugman, P. (1980), "Scale Economies, Product Differentiation, and the Pattern of Trade", *American Economic Review*, Vol. 70, No. 5, pp. 950-959.

Kugler, M. (2006), "Spillovers from Foreign Direct Investment Within or Between Industries?", *Journal of Development Economics*, Vol. 80, No. 2, pp. 444-477.

Lall, S. and Narula, R. (2004), "FDI and its Role in Economic Development: Do We Need a New Agenda", *European Journal of Development Research*, Vol. 16, No. 3, pp. 447-464.

Lang, L. and Stulz, R. (1994), "Tobin's Q Diversification, and Firm Performance", *Journal of Political Economy*, Vol. 102, No. 6. pp. 1248-1280.

Levinsohn, J. and Petrin, A. (2003), "Estimation Production Functions Using Inputs to Control for Unobservables", *Review of Economic Studies*, Vo. 70, No. 2, pp. 317-341.

Linder, S. (1961), *An Essay on Trade and Transformation*, Stockholm: Almqvist and Wiksell.

Lipsey, R. E. (2002), "Home and Host Country Effects of FDI", *NBER Working Paper* No. 9293.

Lipsey, R. E. and Sjöholm, F. (2005), "Host Country Impacts of Inward FDI: Why Such Different Answers?, in M. Blomström, E. Graham and T. Moran (eds.), *The Impact of Foreign Direct Investment on Development*, Institute for International Economics, Washington, DC.

Liu, X., Siler, P., Wang, C. and Wei, Y. (2000), "Productivity Spillovers from Foreign Direct Investments: Evidence from UK Industry Level Panel Data", *Journal of International Business Studies*, Vol. 31, No. 3, pp. 407-425.

Long, J. S. (1997), *Regression Models for Categorical and Limited Dependent Variables* (Advanced Quantitative Techniques in the Social Sciences Series 7), Thousand Oaks, CA: Sage Publications.

López, R. A. (2004), "Self-Selection into the Export Markets: A Conscious Decision?", Department of Economics, Indiana University, mimeo.

López, R. A. (2005), "Trade and Growth: Reconciling the Macroeconomic and Microeconomic Evidence", *Journal of Economic Survey*, Vol. 19, No. 4, pp. 623-648.

Marinov, R., Rocha, N. and DiNino, V. (2008), "Trade Liberalization and New Exporters' Size: A Test of the Heterogeneous Firm Model", *B.E. Journal of Economic Analysis and Policy*, Vol. 8, No.1 (Topics), Article 10.

Melitz, M. J. (2003), "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity", *Econometrica*, Vol. 71, No. 6, pp. 1695-1725.

Melitz, M. and Ottaviano, G. I. P. (2005), "Market Size, Trade and Productivity", *NBER Working Paper* No. 11373.

Nocke, V. and Yeaple, S. (2006), "Globalization and Endogenous Firm Scope", *NBER Working Paper* No. 12322.

Office of Industrial Economics (2001), "Annual Report on Industry Economics Outlook: The 2001 Manufacturing Industry Survey", Ministry of Industry, Bangkok, Thailand (in Thai).

Office of Industrial Economics (2004), "Annual Report on Industry Economics Outlook: The 2004 Manufacturing Industry Survey", Ministry of Industry, Bangkok, Thailand (in Thai).

Olley, G. S. and Pakes, A. (1996), "The Dynamics of Productivity in the Telecommunications Equipment Industry", *Econometrica*, Vol. 64, No. 6, pp. 1263-1297.

Panzar, J. C. and Willing, R. D. (1977), "Economies of Scale in Multi-Output Production", *Quarterly Journal of Economics*, Vol. 91, No. 3, pp. 481-493.

Petrin, A., Poi, B. P. and Levinsohn, J. (2004), "Production Function Estimation in Stata using Inputs to Control for Unobservables", *Stata Journal*, Vol. 4, No. 2, pp. 113-123.

Roberts, M. J. and Tybout, J. R. (1997), "The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs", *American Economic Review*, Vol. 87, No. 4, pp. 545-564.

Rodríguez-Clare, A. (1996), "Multinationals, Linkages, and Economic Development", *American Economic Review*, Vol. 86, No. 4, pp. 852-873.

Roper, S. and Love, J. H. (2002), "Innovation and Export Performance: Evidence from the UK and German Manufacturing Plants", *Research Policy*, Vol. 31, No. 7, pp. 1087-1102.

Ruane, F. and Sutherland, J. (2005), Foreign Direct Investment and Export Spillovers: How Do Export Platforms Fare?" *Institute for International Integration Studies (IIIS) Discussion Paper* No. 58.

Sjöholm, F. (1999a), "Technology Gap, Competition and Spillovers from Direct Foreign Investment: Evidence from Establishment Data", *Journal of Development Studies*, Vol. 36, No. 1, pp. 53-73.

Sjöholm, F. (1999b), "Productivity Growth in Indonesia: The Role of Regional Characteristics and Direct Foreign Investment", *Economic Development and Cultural Change*, Vol. 47, No. 3, pp. 559-584.

Sjöholm, F. (2003), "Which Indonesian Firms Export? The Importance of Foreign Networks", *Papers in Regional Science*, Vol. 82, No. 3, pp. 333-350.

Shaked, A. and Sutton, J. (1987), "Product Differentiation and Industrial Structure", *Journal of Industrial Economics*, Vol. 36, No. 2, pp. 131-146.

Shaked, A. and Sutton, J. (1990), "Multiproduct Firms and Market Structure", *RAND Journal of Economics*, Vol. 21, No. 1, pp. 45-62.

Thomsen, S. (1999), "Southeast Asia: The Role of Foreign Direct Investment Policies in Development", *OECD Working Papers on International Investment No. 1/1999*.

Tomohara, A. and Yokota, K. (2007), "Industry Characteristics and FDI Induced Technology Spillovers", *The International Centre for the Study of East Asian Development Working Paper* No. 16.

Tybout, J. R. (2003), "Plant and Firm Level Evidence on 'New' Trade Theories", in E. K. Choi and J. Harrigan (eds.), *Handbook of International Trade*, Oxford, UK: Basil Blackwell.

Van Biesebroeck, J. (2005), "Exporting Raises Productivity in Sub-Saharan African Manufacturing Firms*", Journal of International Economics*, Vol. 67, No. 2, pp. 373-391.

Verbeek, M. (2004), *A Guide to Modern Econometrics*, 2nd ed., Chichester: John Wiley & Sons Ltd.

Vermeulen, P. (2002), "Business Fixed Investment: Evidence of a Financial Accelerator in Europe", *Oxford Bulletin of Economics and Statistics*, Vol. 64, No. 3, pp. 213-231.

Wagner, J. (2007), "Exports and Productivity: A Survey of the Evidence from Firm-level Data", *World Economy*, Vol. 30, No. 1, pp. 60-82.

Wooldridge, J. M. (2002), *Econometric Analysis of Cross Section and Panel Data,* 2nd ed, Cambridge, MA: MIT Press.

World Bank (1993), "The East Asian Miracle: Economic Growth and Public Policy", Oxford: Oxford University Press.

Yeaple, S. R. (2005), "A Simple Model of Firm Heterogeneity, International Trade, and Wages", *Journal of International Economics*, Vol. 65, No. 1, pp. 1-20.