International Trade and Firm Productivity:
Evidence from Vietnam

by

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Abstract

This thesis examines the link between trade liberalization and firm productivity in Vietnam. In the thesis, the relationship between exporting activity and firm productivity in Vietnam is also examined.

Chapter 2 gives an overview of Vietnam's economy from the pre-reform period to the reform process that was introduced in 1986. Chapter 3 and Chapter 4 introduce the related theoretical and empirical literature. Chapter 5 examines the relationship between trade liberalization and firm productivity in Vietnam, using micro-level data of the Vietnamese manufacturing firms from 2000 to 2003. The results given in the study show that a decrease in output tariffs and input tariffs increases firm productivity in Vietnam, implying that trade liberalization has a positive impact on firm productivity levels and economic growth in Vietnam. The results given in the study are confirmed in both fixed-effects and first-differences models. The study also employs the instrumental variable method to control for the possible endogeneity between productivity and trade liberalization.

Chapter 6 examines the relationship between the firm's decision to export and firm-specific characteristics in Vietnam by using the Vietnamese manufacturing and services firm data. The study also examines the country-of-origin effects of foreign

investment on a firm's export decision. The empirical results given in this study support the evidence of the positive effects of firm productivity on a firm's export decision, implying that the most productive firms self-select into export markets. Interestingly, the results show the negative effect of capital intensity on a firm's export decision, consistent with the situation in Vietnam owing to Vietnam's comparative advantage in labour-intensive sectors. Sunk entry costs are also an important determinant of the export decision for firms in Vietnam. In addition, foreign ownership status could have a positive effect on a firm's decision to export, but the magnitude of the effect is different across countries of origin of foreign investment such as Japan, Korea, Singapore, Taiwan and Hong Kong (China), the top five sources of FDI in Vietnam.

In Chapter 7, the study examines the effect of learning by exporting in both manufacturing and services sectors in Vietnam, allowing for the self-selection effects. To identify the learning effect, the study uses the propensity score matching techniques and differences-in-differences method. This methodology has the advantage of reducing heterogeneity between exporters and non-exporters and therefore allows the study to identify the learning effects from exporting. The findings given in the study indicate that the entry into export markets increases productivity growth and this expands as the firm continues to export. The effect of exporting on employment growth and profit growth, however, is less evident. Once the matching technique is used separately for each subsector, the effects of exporting on productivity growth are also less evident.

Finally, Chapter 8 concludes the thesis by summarizing the main findings, contribution and limitations of the thesis.

Declaration

I, Kim Toan Vu certify that this work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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Kim Toan Vu, 29th September 2012.

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Chapter 1 Introduction

One frequently asked question in the trade literature is whether international trade can increase productivity and hence promote the economic growth of countries. The so-called miracle of economic growth in East Asian countries, particularly the eight countries that formed the focus of the World Bank (1993) report,[1] sheds light on the importance of international trade in economic growth. Sustained high rates of economic growth in these East Asian countries between the 1960s and 1990s have often been attributed to rapidly increased participation of these countries in world trade. As suggested by the World Bank (1993), trade expansion can increase productivity and improve economic growth.

The association between international trade and productivity has long been examined since the first trade theory of Ricardo, who introduced the model of comparative advantage, whereby the country can expand its efficiency by specializing in the good in which it has a comparative advantage. The Ricardian model set a starting point for robust development in trade theory that continues to this day through the work of Grossman, Helpman, Krugman and many others. Since the introduction of new trade theory as developed by Krugman (1979, 1980) and others, theoretical models have shed light on the effect of trade liberalization on firm productivity. In those models, trade liberalization can raise firm productivity thanks to the effects of tougher competition from imports and a greater variety of intermediate inputs. In

[1] World Bank (1993) focuses on the miracle of the economic growth in eight East Asian countries including Japan, South Korea, Hong Kong (China), Taiwan, Singapore, Thailand, Malaysia and Indonesia.

addition, although the link between international trade and productivity has long been examined, little has been discussed about the association between firm productivity and exporting in the theoretical literature until the recent theoretical models which have integrated firm heterogeneity into the theoretical frameworks. Melitz (2003) and others who developed the models on the basis of firm heterogeneity showed that firm heterogeneity in productivity can explain why only some firms can export and whether firm productivity gains can be achieved through learning by exporting.

Motivated by the theoretical models, there are a number of empirical studies that examine the effects of trade liberalization on firm productivity in both developing and developed countries, including Schor (2004), Fernandes (2007) and Amiti and Konings (2007). Although the evidence for the positive effect of trade liberalization has been confirmed in a number of countries, little is known about whether productivity gains can arise from trade liberalization in a country in transition from a centrally planned to a market-oriented economy.

In addition, a number of empirical studies show that only some firms can export and that the most productive firms self-select into export markets (Roberts and Tybout, 1997; Bernard and Jensen, 1999; Clerides et al., 1998). Although the self-selection hypothesis has been confirmed in these studies, the evidence for the learning-by-exporting hypothesis has been not clear as shown in the work of Wagner (2007). In addition, most studies focus on the relationship between firms' exporting activity and firm productivity in the manufacturing sector. There are just a few studies that examine this relationship in services firms, such as Love and Mansury (2009). Furthermore, notably fewer studies examine this relationship in the services sector of a transitional country going from a centrally planned to a market-oriented economy.

This thesis contributes to the literature by providing an understanding of the association between trade liberalization and firm productivity and the relationship between firm productivity and exporting in Vietnam, a country that underwent a transformation from a centrally planned to a market-oriented economy. Given that the empirical literature pays little attention to the effect of output tariffs (actual applied tariffs) and input tariffs on firm productivity in Vietnam, this study constructs Vietnam's input tariffs based on output tariffs and then examines whether trade liberalization can increase firm-level productivity through the reductions in output tariffs and input tariffs in Vietnam. In particular, this thesis seeks to answer the following research questions:

(i) To what extent and through which channels do tariff reductions contribute to firm productivity in Vietnam?

(ii) How do firm-specific characteristics such as firm productivity affect a Vietnamese firm's export decision?

(iii) Does exporting increase firm performance in Vietnam?

The thesis begins with an overview of Vietnam's economy from 1945 onwards, focusing on the pre-reform period (1975-85) and the reform process that was introduced in 1986 with a particular emphasis on the association between trade liberalization and firms' performance and the relationship between exporting and firms' performance in Vietnam. This is the content of Chapter 2.

Chapter 3 gives a review of theoretical models of trade and productivity with a particular emphasis on the relationship between trade liberalization and productivity

and the association between exporting and productivity. The objective of Chapter 3 is to introduce the related theoretical background for the research questions in the thesis.

In Chapter 4 the author introduces the related empirical background for the research questions. It is noteworthy that although there are a number of empirical studies in the literature, there are only a few studies that examine these effects in the transition from a centrally planned to a market-oriented economy. This chapter also points out some gaps in the literature that the author will consider empirically in Chapters 5, 6 and 7.

Chapter 5 provides an understanding of the association between trade liberalization and firm productivity in Vietnam. Using data for Vietnamese manufacturing firms from 2000 to 2003, the focus of this chapter is specifically on whether trade liberalization following the Doi Moi reforms of Vietnam has led to an increase in firms' productivity in the country. The chapter also examines channels through which the reductions in output tariffs and input tariffs can increase firm-level productivity in Vietnam.

It should be noted that in Chapter 5, a measure of total factor productivity (TFP) is constructed using the Levinsohn and Petrin (2003) method to control for the simultaneity bias in the estimation of a production function. Subsequently, the effect of tariff reductions on firms' TFP is examined in the fixed-effect model. Alternative estimation specifications are also employed to further examine the effect of tariff changes on TFP change. Finally, the study uses the instrumental variable method to control for possible endogeneity between tariff cuts and TFP.

In Chapter 6, the thesis examines the effects of firms' productivity and sunk entry costs, among other things, on the export decisions of Vietnam's manufacturing firms between 2002 and 2004; and of Vietnam's services firms during 2004-07. Given that the literature pays little attention to the effect of different origins of FDI, the study also examines the country-of-origin effects of foreign investment on firms' export decisions in the presence of the sunk entry costs.

In this chapter, a probit model is used to examine the effects of key factors such as firm productivity and sunk entry costs, among other things, on a firm's export participation. Furthermore, the study advances the literature by employing the Wooldridge (2005) approach for non-linear dynamic models in order to examine the effect of sunk entry costs on a firm's decision to export.

In addition, little attention has been paid to the relationship between exports and firm performance in the services sectors in the literature. This thesis contributes to the empirical literature by examining, in Chapter 7, the learning effects from exporting in both the manufacturing and services sectors. The study investigates whether there is any relationship at all in terms of exporting activity affecting productivity by employing a matching technique and the difference-in-difference (DID) estimator to undertake consistent comparisons between exporters and non-exporters. The use of the matching approach and a DID estimator allows the study to identify the effect of learning by exporting.

Finally, the conclusion summarizing the main findings in the thesis is given in Chapter 8. The findings suggested in the thesis have policy implications for Vietnam. Chapter 8 also provides a discussion of the contribution and limitations of the thesis.

Chapter 2 Trade and firm performance in Vietnam

2.1. Introduction

This chapter describes Vietnam's economy during the reform process, with a particular focus on the association between trade liberalization and firm performance. In addition, the two-way relationship between exporting and firm performance during the reform period in Vietnam is examined here. The purpose of this chapter is to provide a narrative background for these associations.

First, the author describes the background to Vietnam's economy from the pre-reform period (1945-86) to the reform process that was introduced in 1986 with a particular emphasis on trade liberalization. Next, it is argued that Vietnamese firms experienced significant developments under the trade liberalization process, implying an association between trade liberalization and firm performance in Vietnam. In addition, the experience of the reform process which lasted more than two decades (1986-2010) has contributed to export-led growth in Vietnam. Since a number of reforms were introduced in 1986, Vietnam has maintained a high growth rate of GDP and Vietnam's firms have also experienced important developments. At the same time, Vietnam's trade has significantly progressed (Arkadie and Mallon, 2003). Given the substantial developments of exports and firms under the reform process, the chapter also implies hypotheses on the two-way relationship between exporting and the performance of firms in Vietnam.

The rest of the chapter is organized as follows. Section 2.2 introduces Vietnam's economic development and the reform process, taking the reader through

the key historical events affecting Vietnam's economy. In sections 2.3 and 2.4, the author highlights Vietnam's trade liberalization process and Vietnamese firms' performance over the period 1986 to 2010, respectively. Section 2.5 outlines the export performance of the manufacturing sector and services sector during this period and section 2.6 overviews the firm-specific characteristics such as firm size and firm ownership in Vietnam. Finally, section 2.7 concludes the chapter.

2.2. Highlights of Vietnam's economy

The modern history of Vietnam's economy is a long but interesting story. Vietnam became independent on 2 September 1945 after 80 years under French colonization. In 1946, French forces regained control over Vietnam and Vietnam experienced a nine-year war from 1946 to 1954. French control ended in 1954 when the Vietnamese army defeated the French force at Dien Bien Phu. After the war, the 1954 Geneva conference left Vietnam a divided country. Between 1954 and 1975, there was the Democratic Republic of Vietnam in North Vietnam and the Republic of Vietnam in South Vietnam. The Vietnam War continued until North Vietnamese army forces defeated South Vietnamese forces in 1975. In 1976, Vietnam was officially reunified and renamed the Socialist Republic of Vietnam.

The nine-year war with French forces (1946-54) and the two-decade Vietnam War between North Vietnam and South Vietnam (1954-75) negatively affected the income of the Vietnamese people. After World War II, Vietnam's income per capita was well above that of China and close to that of Thailand, Indonesia and South Korea

(Maddison, 2001). After three decades of the war (1946-75), Vietnam's per capita income was far behind those countries, as shown in Table 2.1.

Table 2.1: Per capita income in Vietnam, 1950-85
(as a percentage of incomes in selected Asian countries)

Source: Arkadie and Mallon (2003)

Table 2.1 illustrates the fact that Vietnam's income per capita was equal to more than 80 percent of that of Thailand and South Korea in 1950. Between 1950 and 1975, Vietnam's income per capita significantly declined, accounting in 1975 for only 36.2 percent and 22.5 percent of that of Thailand and South Korea, respectively. Thanks to significant reforms since 1986, Vietnam's income rose sufficiently to put Vietnam in the lower middle-income group, as defined by the World Bank classification (based on income data from Vietnam's General Statistics Office, 2011). In the past, the international community might not have known much about Vietnam except for the Vietnam War. From 1986 onwards, under the reform process which is known as Doi Moi ('renovation' in Vietnamese), Vietnam has no longer only been associated internationally with the Vietnam War. In the next sections, the author describes Vietnam's economy before and after 1986, the year in which Doi Moi was introduced.

2.2.1. Vietnam's economy from 1954 to 1986

As stated above, between 1954 and 1975, there was the Democratic Republic of Vietnam in North Vietnam and the Republic of Vietnam in South Vietnam. In 1954, the model of a centrally planned economy was introduced in the Democratic Republic of Vietnam in North Vietnam. It should be noted that the Republic of Vietnam maintained a free-market economy in South Vietnam between 1954 and 1975. After the reunification of the country in 1975 the centrally planned system was expanded by the government of North Vietnam to the south of Vietnam. From 1975 to 1985 Vietnam was essentially a closed economy that was centrally planned by the government.

In principle, this economic model emphasizes the dominance of state-owned enterprises (SOEs) and the private sector was eliminated in the north and the south of Vietnam in 1954 and 1976 respectively. Basically, Vietnam followed the centrally planned Soviet model, an economic system which is highly controlled by the government. In a centrally planned system, all activities of the SOEs were controlled by the central government. In the Vietnamese centrally planned economy, the agricultural sector was collectivized by the government, resulting in cooperative production and distribution. The prices of consumer and intermediate goods were determined by non-economic methods. During this period, Vietnam mainly participated in international trading activities with the former Soviet Union, China and other communist countries.

After the reunification of the country in 1975, to construct a centrally planned economy, the government implemented two five-year economic development plans[2] in 1976-80 and 1981-85, respectively. Vo (1990) and Arkadie and Mallon (2003) state that these two five-year economic development plans did little to contribute to economic growth in that period. GDP grew annually at only 0.4 percent during the period 1976-80. Given that population grew by 2.3 percent each year, real income per capita dropped. During that period inflation was more than 20 percent annually. Vo (1990) and Arkadie and Mallon (2003) discuss that owing to central planning which did not regard economic results, human and financial resources were underutilized, and hence production dropped significantly, particularly in the state sector. The share of state enterprises in total output actually declined from 27.7 to 19.7 percent between 1976 and 1980. In 1981-85, the situation deteriorated as inflation accelerated. Annual inflation increased from 30 percent in the early 1980s to 587.2 percent in 1985, reaching up to 774.7 percent in 1986. After one decade of Vietnam's centrally planned economy (1975-85),[3] Vietnam's per capita income was far behind those countries, as shown in Table 2.1. Between 1975 and 1985, Vietnam's income per capita significantly declined, accounting in 1985 for only 30 percent and 16 percent of that of Thailand and South Korea, respectively.

Unlike in the case of many Eastern European countries, the centrally planned system was not deeply rooted in Vietnam. Due to the lack of a strong administrative institution, collectivization and centralization were not fully implemented. Arkadie and Mallon (2003) claim that a number of centralized policies were never fully operative in

[2] The five-year economic development plan was a series of economy-wide centralized economic plans that was implemented under the guidelines of the Communist Party of Vietnam (CPV) for economic development.

[3] The economic model of central planning is described in more detail in section 2.2.1.

practice. In addition, there still existed a black market that was not officially acknowledged by the government. In contrast to the stagnating SOE sector under the planning system, the existence of the informal market sector eventually forced the Vietnamese to recognize that the model of central planning had not performed well. This recognition has been further strengthened by the significant achievements of the neighbouring fast-growing East Asian economies.

2.2.2. Vietnam's economy from 1986 to 2010

In 1986 Vietnam began Doi Moi ('renovation').[4] The aim of the Doi Moi process was to establish the basic elements of a market-oriented economic system, including: (i) implementing market-oriented policies, (ii) developing the private sector, and (iii) opening to foreign trade. The Doi Moi reforms were further strengthened following the collapse of the Soviet Union and Eastern European communist countries in the late 1980s and the early 1990s. In 1985 and 1986, inflation accelerated to more than 700 percent. The unemployment rate soared to more than 20 percent in the mid-1980s. As a result of a number of these changes in the mid-1980s, country-wide imbalances could provide great challenges to Vietnam's economic and political system. The government recognized the urgent need for the transformation of the central planning system towards a market-oriented economy so that they could stabilize the financial system and restore macroeconomic balance. Domestic observers considered Doi Moi, launched in 1986, to be a milestone in the transition from a centrally-planned economy to a market-oriented economy.

[4] Doi Moi was initiated by the leaders in the Sixth Vietnam's Communist Party Congress in 1986.

The Doi Moi started with two major reforms that the government introduced in the agricultural and monetary sectors in the late 1980s. The first reform was the policy of transformation from cooperative production to family farming in the agricultural sector. This reform had a significant impact on the majority of the population as more than 80 percent of Vietnam's population lived in the countryside at that time. The second major reform was the policy of pricing that was implemented in order to make a shift from administrative prices to market-determined prices so that the government could stabilize the financial system. As a result of price reforms, from 1990 onwards, commodity prices were mainly market determined, providing a market-oriented financial environment for economic development. After these two major reforms, the next important reforms involved opening policies for export development, trade liberalization and international integration.[5]

As a result of the market-oriented reforms from 1986 onwards, there has been significant progress in areas such as rapid economic growth, export expansion and foreign direct investment (FDI) attraction. Table 2.2 shows Vietnam's GDP growth rates during more than two decades of reforms (1986-2009), compared to the preceding decade (1976-85). Although the economy grew slowly in the first years of Doi Moi, economic growth significantly accelerated from the early 1990s. As a result of Doi Moi, Vietnam has maintained an average annual economic growth rate of 7 percent and higher from 1990 onwards.

[5] The author outlines Vietnam's trade liberalization and export performance in the next sections.

Table 2.2: Growth rates of GDP and sectors, 1976-2009 (percent per annum)

Source: General Statistics Office (GSO, 2010)

Figure 2.1: Annual GDP growth and labour productivity 1990-2007[6] (percent)

Source: The Asian Productivity Organization (2010)

In line with economic growth, labour productivity also increased each year in Vietnam over the period 1991-2007. Figure 2.1 shows that GDP and labour productivity growth remained at high rates from 1990, reaching 9 percent and 7 percent at the peak in 1995, respectively. The growth rates slightly declined in 1997-99

[6] Labour productivity is defined as constant-price GDP divided by the number of workers (total employment). Labour productivity is estimated by the Asian Productivity Organization (2010).

owing to the Asian economic crisis. GDP and labour productivity growth, however, significantly recovered and increased from 2000 onwards.

Since Doi Moi was introduced in 1986, significant achievements have also occurred in terms of trade flows and FDI flows in Vietnam. Trade expanded rapidly and FDI increased significantly which has in turn accelerated Vietnam's economic growth. The share of exports in GDP expanded each year, increasing from about 6 percent in 1986 to about 75 percent in 2005. The share of exports in total trade also increased from 36 percent in 1986-90 to 46 percent in 2001-05. In 1986-2005, the average growth rate of exports was 21.2 percent per annum. Export value increased 40-fold from US$789 million in 1986 to US$32.4 billion in 2005. The value of imports also increased from US$2.1 billion in 1986 to US$37 billion in 2005, implying a 16-fold increase in terms of import value. Before 1989, international trade activities were controlled only by some authorized SOEs. In 1985, there were 40 SOEs participating in direct trading activities. The number of trading firms increased to 20,000 by 2005. Figure 2.2 shows that Vietnam's share of trade values in GDP increased from 52 percent in 1991 to 170 percent in 2008.

The Doi Moi process was followed by participation in the Association of Southeast Asian Nations (ASEAN) in 1995 and by the accession to WTO in 2007. This international integration has enhanced the rapid expansion in capital formation and in FDI. The FDI plays a very important role in expanding trade. Alongside strong FDI expansion, the export share of foreign-invested firms in total exports increased each year, rising from an annual average of 17.1 percent in 1991-95 to averages of 31.5 percent and 42.8 percent in 1996-2000 and in 2001-05, respectively. Vo (2005) and Le (2006) show that the integration process has boosted the diffusion of

innovation, productivity growth and human capital development in Vietnam, implying that trade liberalization and integration has been a key facilitator of economic growth.

It is noteworthy that during the process of Doi Moi, most of the government's reforms were done cautiously and step by step (Arkadie and Mallon, 2003). Interestingly, such cautious reforms brought significant progress as stated above. There are some possible explanations for this. The reforms during the Doi Moi process greatly improved trade performance and FDI accumulation in Vietnam, especially from 1990 onwards. Vo (2005) suggests that trade growth and FDI expansion can significantly contribute to overall economic development. In addition, Arkadie and Mallon (2003) claim that the timing of Doi Moi may have influenced the results of the reforms. The government introduced the Doi Moi in 1986, anticipating the decline of communism in Europe in the late 1980s and early 1990s. The modern history of Vietnam showed that there was no major socioeconomic crisis in Vietnam following the sudden collapse of the former Soviet Union and other European communist countries which significantly subsidized Vietnam's economy until 1986. In addition, in the 1980s, neighbouring fast-growing countries were searching for opportunities to take advantage of the relatively cheap but highly educated labour force in Vietnam. This can explain why FDI flows into Vietnam boomed in the several years after Doi Moi was introduced.

To sum up, from the time that the Doi Moi process was introduced in 1986, Vietnam enjoyed significant achievements in terms of GDP growth and export expansion. The experience of Vietnam shows that there is a close association between GDP growth and export expansion. The share of exports in GDP significantly increased under the Doi Moi process.

Figure 2.2 Vietnam's economic and trade growth, 1991-2008 (percent per annum)

Source: GSO (2010)

Doi Moi alone did not account for the significant progress in Vietnam. Many exogenous factors influenced the impact of Doi Moi on Vietnam's development (Arkadie and Mallon, 2003). In other words, Doi Moi might not bring such significant changes if it was introduced in other countries. These exogenous factors may include the timing of Doi Moi as well as Vietnamese geographic, social and economic characteristics. Doi Moi, however, is considered as a turning point for Vietnam's development. In the next section, the author focuses on the trade liberalization process in Vietnam.

2.3.Trade liberalization in Vietnam

As stated above, trade liberalization is the essential element of Doi Moi. In the story of Doi Moi, trade liberalization is a facilitator of rapid economic growth in Vietnam. The purpose of this section is to provide the highlights of trade liberalization under the Doi Moi process.

An important achievement of the trade liberalization was the complete transformation of trade policy from inward-oriented import substitution to outward orientation. Before 1986, the Soviet Union and the countries in the Council for Mutual Economic Assistance (CMEA)[7] were Vietnam's main trading partners. Trading licences and quotas were established for shipment-by-shipment trading activities based on mutually agreed prices that were normally different from international prices.

Since the introduction of Doi Moi in 1986, Vietnam has taken major steps towards liberalizing trade and reducing import protection. In 1988, a tariff system was introduced for the first time. The tariff system saw major reforms with the introduction of the Harmonized System (HS) in 1992.[8]

Vietnam began multilateral and bilateral relations with many other countries. There have been two major stages of trade liberalization in Vietnam. In the first stage in the 1990s, as a result of multilateral and regional trade agreements, Vietnam joined ASEAN and the ASEAN free trade area (AFTA) in 1995. ASEAN countries have made significant progress in lowering intra-regional tariffs through the Common

[7] The Council for Mutual Economic Assistance (CMEA) was an economic organization headed by the former Soviet Union. This organization comprised Eastern European communist countries and many communist countries elsewhere in the world during 1949-91. CMEA was disbanded in 1991.

[8] Vietnam's Harmonized System was constructed based on the internationally standardized Harmonized System.

Effective Preferential Tariff (CEPT) scheme for AFTA. The agreement on the CEPT scheme for AFTA required that tariff rates were scheduled to be reduced to less than 5 percent by 2003 for the six original countries.[9] All other non-tariff barriers were also removed between ASEAN countries at the same time. In 1995 Vietnam made a commitment to reduce its CEPT to no more than 5 percent by 2006. Table 2.3 shows CEPT rates during the period 1996-2006. The average CEPT rate was scheduled to reduce from 12.7 percent in 1996 to 3.0 percent in 2006.

The second stage of liberalization began with Vietnam's bilateral trade agreement with the US in 2000 and with the entry of Vietnam into the WTO in 2007. Following the trade agreement with the US, Vietnam made a commitment to reduce tariff rates on about 250 items over a period of three years from 2001. In the negotiation process leading up to Vietnam's WTO accession, one-third of all tariff rates were reduced according to WTO accession requirements. During the WTO accession negotiations (1995-2006), Vietnam was engaged in unilateral trade reforms, the reform of the trade regime and bilateral trade negotiations. Thanks to significant efforts to liberalize the economy, Vietnam became an official member of the WTO in 2007.

Table 2.3: CEPT rates, 1996-2006

Source: Nguyen and Yoon (2007)

[9] The six original members of ASEAN are Brunei, Indonesia, Malaysia, Philippines, Singapore and Thailand.

Note that since the late 1990s Vietnam has begun to liberalize the services sectors. Foreign firms were allowed to participate in financial intermediation and business service activities, although strict market access limitations still existed in some sectors such as news agency and telecommunication sectors. As a result of trade liberalization in the services sector, Vietnam achieved high growth rates of exports and imports in the services sector. The annual growth rate of services trade in volume was 24.1 percent during the 1991-2008 period.[10]

As a result of various trade reforms, the share of total trade value in Vietnam's GDP boomed in the 2000s from 94 percent of GDP in 2000 to 170 percent in 2008. Owing to trade liberalization commitments, Vietnam also achieved significant progress with regards to both tariffs and non-tariff barriers.

2.3.1. Tariff reforms

The present rates of import duty applied by Vietnam are divided into three categories. First, preferential (Most Favoured Nation - MFN) rates apply to goods imported from countries with which Vietnam have an MFN trade agreement. Second, special preferential rates apply to goods imported from countries with which Vietnam have trade agreements such as the CEPT. Third, normal rates of duty apply to goods originating from other countries. Normal rates are applied uniformly at 150 per cent of the MFN rate. The value of imports under this category was only 1 percent of the total import value in 2002.

[10] More details on trade performance of the services sector are provided in section 2.5.

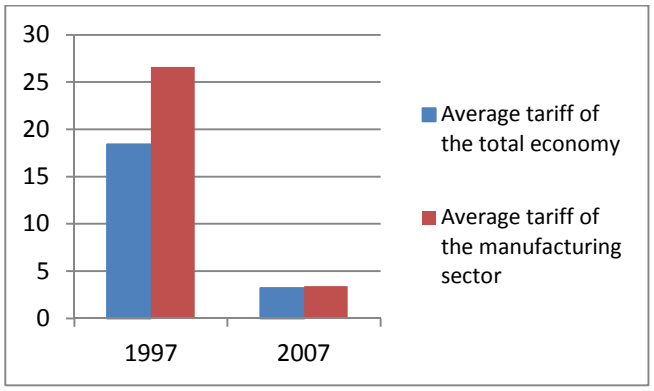
As a result of a number of tariff reforms following Vietnam's trade commitments under the AFTA and WTO agreements during the 1990s and the early 2000s, tariff protection fell significantly from levels set in 1988. The average import-weighted tariff[11] was down from 19 percent in 1997 to around 16 percent in 2002. The dispersion in tariffs that is measured as the standard deviation from the mean declined from 131 to 116 percent between 1997 and 2002 (World Bank, 2003b).[12] The highest tariff rates were applied by the Vietnamese government to some goods since the tariff system was introduced in 1988.[13] The highest tariff rate, however, declined from 200 percent in 1997 to 120 percent in 2001 and then to 100 percent in 2005. Only 1 percent of total tariff lines had rates above 50 percent in 2005. In contrast, zero tariff rates that accounted for 30 percent of tariff lines in 2005 were applied to a number of goods, particularly intermediate goods. The majority of Vietnam's import tariffs rates had fallen to within a range of 0-20 percent by 2005.

In the manufacturing sector, import tariffs were considerably reduced. The average import-weighted tariff for the manufacturing sector was reduced from 27 percent in 1997 to around 4 percent in 2007 (IE, 2001; Bui and Kiyoshi, 2012). Import tariffs on final goods are generally higher than those on intermediate goods. In Chapter 5 import tariff reduction in Vietnam from 2000 to 2003 is described in more detail. As a result of declining protection, a wide range of foreign goods including intermediate inputs became available in Vietnam. Domestic consumers and producers began to have

[11] The average import-weighted tariffs use the weights of each import tariff based on the value of imports.
[12] The dispersion in tariff rates is measured as the coefficient of variation (CV).
[13] These high tariff rates are mainly in beverages, spirit and tobacco sectors, vehicles and other transport.

access to a greater variety of final and intermediate goods. This has generated significant incentives to accelerate economic growth.[14]

Figure 2.3: Import-weighted average tariffs, 1997 and 2007



Sources: compiled from Institute of Economics (2001), Bui and Kiyoshi (2012)

2.3.2. Non-tariff barriers

Vietnam had significant non-tariff barriers in the form of prohibitions, quotas and import licences in the 1990s. Decree 57/1998/ND-CP[15] regulated the list of goods that were subject to import restrictive quotas such as petroleum, sugar, fertilizer, etc. This decree also included a list of goods, such as weapons, narcotics, cigarettes and toxic chemicals, banned from importation for security, safety, social and cultural reasons. Vietnam, however, has made significant progress in removing many of these quantitative import restrictions and prohibitions. All quantitative restrictions on imports were eliminated by 2003 with the exception of petroleum products and sugar.

[14] Chapter 3 and Chapter 4 explain the association between tariff reductions and productivity growth in more detail.
[15] Decree 57/1998/ND-CP was issued by the Vietnamese government in 1998.

Import restrictions for sugar were also abolished in 2005. Many prohibitive restrictions have been ended with the exception of some that were retained for public policy purposes. For example, many banned items such as narcotics, toys, cigarettes and motorcycles with engine capacities over 175cc have been moved to the list of licensed goods in the early 2000s, so they may only be imported under license and quantities are restricted.

In addition, the trade licensing system was established by the government in 1990. The aim of licensing procedures was to maintain the dominant position of SOEs in trade since SOEs had privileged access to trading licences. The entry into international trade activities was restricted by a list of requirements on sufficient capital, foreign trade contract, experience in foreign markets and business licences. From 1990 to 1998 only licensed trading firms that met these requirements were allowed to engage in importing and exporting. However, Decree 57/1998/ND-CP has made a significant change in the licensing system since 1998 by stipulating that the firm that has a business licence was allowed to participate in international trade activities. The licensing system was further relaxed in 2001 as part of the trade liberalization reforms. Decision 46/2001/QD-TTg issued by the Vietnamese government in 2001 abolished the business licence requirement, allowing all firms to import and export all goods, except goods restricted by quota, prohibited goods and goods under government management, as no licence was needed.

Administrative rigidities and delays in the customs administration have continued to be important non-tariff barriers in Vietnam. The barriers have made firms spend lengthy periods on clearing customs procedures (Hopkins, 2002). Another non-tariff barrier that affects private and foreign firms has arisen from the fact that SOEs

have retained a significant role in trading activities. This can be considered as a barrier to trade development for private and foreign firms (Vo, 2005), since the privileged access of SOEs to trade quotas and trade restrictions can hinder the involvement of private and foreign firms in trade.

In this section, the study has highlighted the process of Doi Moi and trade liberalization in Vietnam. The story of Vietnam's trade liberalization shows that the tariffs were significantly reduced, particularly in the manufacturing sector. As shown in Table 2.3, between 1997 and 2007, the tariff rates in the manufacturing sector declined by 87 percent, faster than the average tariff rates for the whole economy. In the next section, this study argues that Vietnam's firm performance experienced substantial development under the process of trade liberalization, implying the association between tariff cuts and firm performance in Vietnam.

2.4. Firm performance in Vietnam

2.4.1. Performance of manufacturing firms

Since the Doi Moi was introduced in 1986, Vietnam has experienced a number of important steps in the development of the manufacturing sector. In the late 1980s and early 1990s, the government implemented a number of reforms such as fiscal reforms and opening policies, as stated in section 2.2. This provided a market-oriented environment for the development of manufacturing firms. Since the Enterprise Law was introduced in 2000, the firm sector has experienced significant changes. The Enterprise Law was an aspect of the legislative reforms that provided an institutional environment for private business. The aim of the Enterprise Law was to consolidate

the regulatory framework for a number of business entities, such as joint-stock firms and private firms, in order to simplify the new firm registration procedures and construct mechanisms for investor protection (Arkadie and Mallon, 2003).

As shown in Figure 2.4, the share in GDP of manufacturing sectors increased from 22.7 percent in 1990 to more than 40 percent in 2008. During 2000-08, the manufacturing sector on average accounted for about 40 percent of GDP.

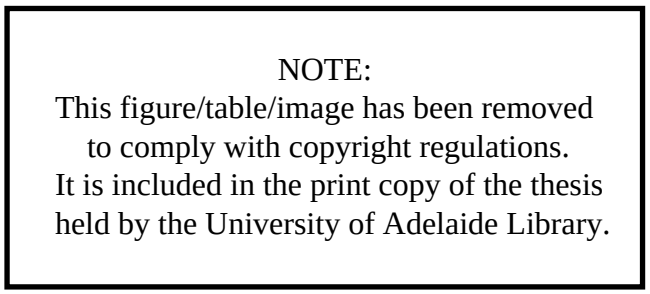
Figure 2.4: Share of manufacturing output in GDP, 1990-2010 (percent)

Source: GSO (2010)

The rapid growth of the manufacturing sector has been attributed to the substantial development of manufacturing firms in Vietnam. Doi Moi brought about significant achievements mainly because it provided an effective environment in order to develop the entrepreneurship sector, especially private firms and foreign-invested firms. Reforms affecting firms in the Doi Moi process comprise the acknowledgement of private firms, encouragement of foreign-invested firms and reforms of SOEs (Vo, 2005).

Basically, in the period 1975-86 all registered firms were state enterprises and state cooperative units. The private sector was not officially approved by the government although there were still black markets (Vo, 1990; Pham and Pham, 2005). Since the introduction of Doi Moi in 1986, private firms were acknowledged in the government's laws and official documents. However, SOEs were still dominant in most sectors during the 1990s (Arkadie and Mallon, 2003). The reform process of SOEs was introduced in 1992, and was accelerated from 2000 onwards. As a result, 2,000 SOEs were equitized in the period from 2000 to 2005. The development of private firms was strongly boosted after the introduction of the Enterprise Law in 2000. The number of new private firms significantly increased each year, from about 14,500 new firms in 2000 to about 36,000 newly registered firms in 2004. In 2006, manufacturing firms accounted for 20 percent of the total number of firms in the Vietnamese economy, growing faster than the firms in the overall economy. Although the share of such firms in the overall firms was around 20 percent during 2000-07, manufacturing firms accounted for more than 40 percent of the total GDP.

Table 2.4: Number of manufacturing firms, 2000-07



Source: GSO (2010)

Table 2.5 shows the distribution by sector of manufacturing firms from 2000 to 2007. The food manufacturing and beverages sector comprised the largest share of the

total manufacturing firms, accounting for around 20 percent in 2007**,** followed by fabricated metal products (12.1 percent), wood and wood products (around 7.7 percent), furniture and other manufactures (7.6 percent) and wearing apparel (7.6 percent). The shares of the tobacco products, office accounting and computing machinery sectors were very small.

Table 2.5: Share of the number of firms by sector, 2000-07 (percentage)

Source: GSO (2010)

Table 2.6: Turnover per worker of manufacturing firms, 2000-08 (VND million)

Source: GSO (2010). VND is Vietnam's Dong

Table 2.5 shows that firms that produce office accounting and computing machinery accounted for 0.13 percent of the total manufacturing firms in 2007. The share of the number of firms increased considerably in the fabricated metal products,

printing and publishing and wearing apparel sectors while the share of food and beverages, and non-metallic mineral products declined.

The performance of manufacturing firms experienced a significant growth, especially in the early 2000s. As shown in Table 2.6, turnover per worker of manufacturing firms significantly increased between 2000 and 2008. Turnover per worker for tobacco, motor vehicle and chemicals and chemical products is highest whereas that for wearing apparel and leather and footwear is moderate.

2.4.2. Performance of services firms

As shown in Table 2.2, the services sector grew at relatively high rates during 1986-2008. On average the services sector grew annually at 6.92 percent in the period 1986-2008, at a slightly higher rate than that of the entire economy which had an average annual growth of 6.87 percent. There have been several stages in the development of the services sector since the Doi Moi. In the first stage between 1986 and 1990, the average growth rate of the services sector was lower, at about 5.77 percent annually. Services growth, however, was higher than the average growth of the whole economy between 1991 and 1995, the second stage. This period saw the significant growth rate of service activities reaching as high as 9.83 percent in 1995. Thanks to the high growth rates of the services sector, its share of total GDP remained very high in this period, reaching 44 percent of GDP in 1995 as shown in Table 2.8.

Table 2.7: Share of services sectors in GDP in selected countries, 2005-09 (percentage)

Source: GSO (2010)

Table 2.8: Share of services sectors in GDP in Vietnam, 1986-2008 (percentage)

Source: GSO (2009)

In the third stage, in the period 1996-2005, the growth of the services sector was slightly lower than that of the entire economy. As a result, the services share in total GDP has gradually declined since 2000 partly because of the rapid growth of the manufacturing sectors. However, the services sector recovered after 2006, growing faster than the entire economy at that time. Between 1986 and 2008, the share of service activities in total GDP increased from 33 percent in 1986 to about 38 percent of total GDP as shown in Table 2.8. Table 2.7 provides a comparison of Vietnam's services sector share with that of some other Asian countries. As shown in Table 2.7, Vietnam's share of the services sector in GDP was similar to that of Indonesia and slightly smaller than that of China, Thailand and Malaysia between 2005 and 2009.

Table 2.9 shows that an increasing number of new private firms have registered between 2000 and 2006. The number of service firms rapidly increased in the business services, health, and education sectors. Table 2.9 shows that the trade and repair sector

accounted for the largest share of the total number of services firms in 2006, accounting for 65.35 percent, followed by real estate, transport and tourism, and hotels and restaurants, with between 6.37 and 13.75 percent. The shares of other services sectors were very small.

Table 2.9: The number of services firms by sectors in Vietnam, 2000-06
(percent)

Source: GSO (2010)

The performance of services firms experienced a significant growth, especially in the early 2000s. As shown in Table 2.10, turnover per worker of services firms significantly increased between 2000 and 2008. Turnover per worker for trade and repair of motor vehicles and financial intermediation is highest whereas that for science and technology is moderate.

In the next section, this study outlines the export performance of manufacturing and service firms since Doi Moi was introduced. The study argues that export performance in the period of Doi Moi experienced substantial changes not only in the

manufacturing sector but also in the services sector, in parallel with firm development in both sectors. As shown in Table 2.2, manufacturing and service sectors grew at about 10 percent and 7 percent respectively between 1990 and 2009, whereas the growth rate of the agricultural sector was less than 4 percent, implying that manufacturing and services were the main drivers of export-led growth in Vietnam.

Table 2.10: Turnover per worker of services firms, 2000-08 (VND million)

Source: GSO (2010)

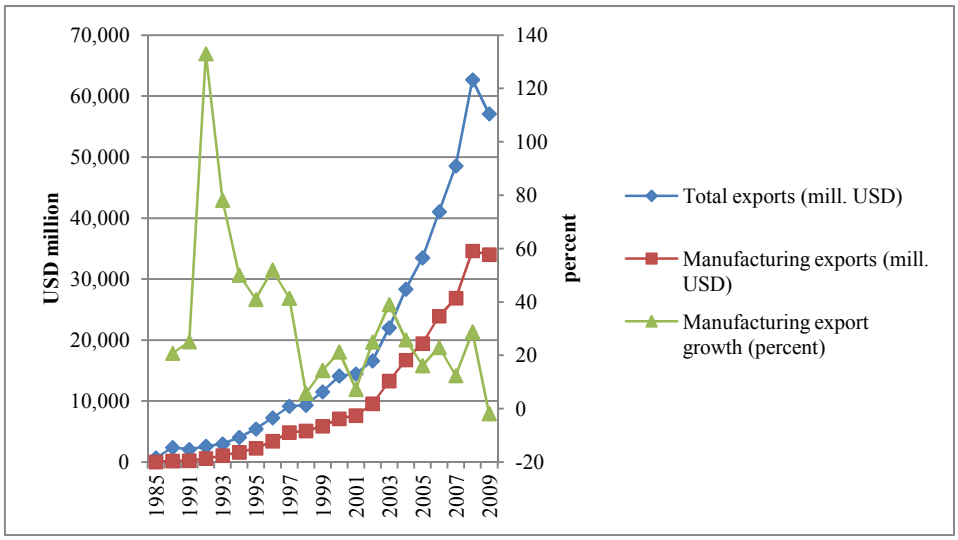
2.5. Trade performance in manufacturing and services sectors in Vietnam

2.5.1. Trade performance in the manufacturing sector

As discussed above, one of the most important achievements of the Doi Moi policy was a rapid annual average growth rate of 21 percent in terms of the total value

of exports over the period 1985 to 2010. This export growth has been a key factor in GDP growth, poverty reduction and macroeconomic stabilization. As shown in Figure 2.5, the total value of exports tripled, from US$700 million to US$2.4 billion, between 1985 and 1990. Export growth has maintained high rates, reaching US$57 billion in 2009. Manufacturing exports also experienced significant growth for more than two decades (1985-2009), increasing from around US$43 million in 1985 to US$57 billion in 2009. The share of manufacturing exports in Vietnam's GDP increased from 5 percent in 1987 to 59 percent in 2009.

Figure 2.5: Vietnam's export performance, 1985-2009

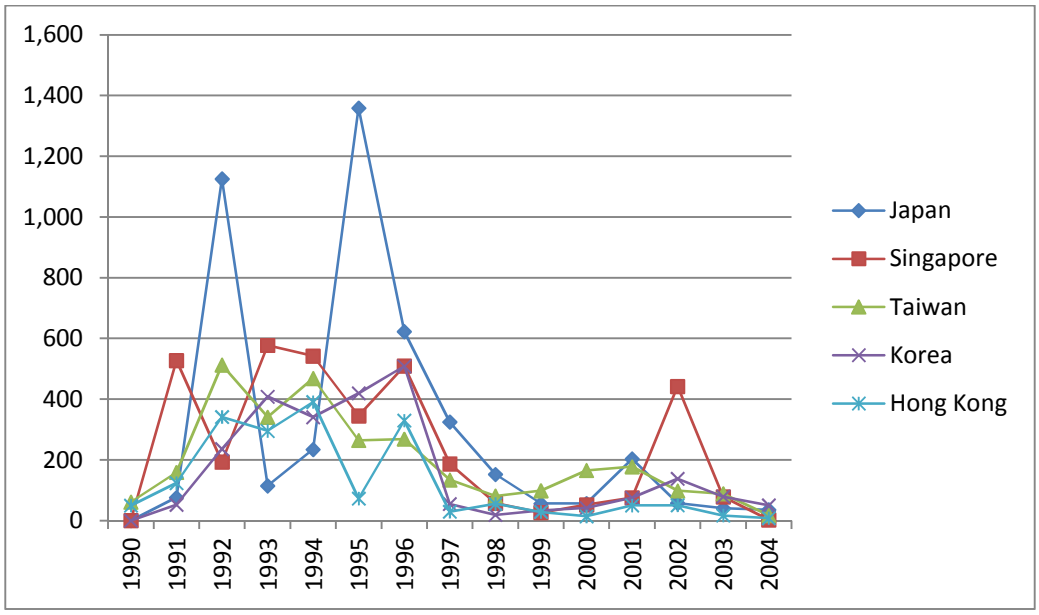


Source: The trade data of the GSO (2006, 2010).

Although Vietnam's export composition heavily relied on the export of crude oil products before 1993, the share of crude oil in total exports was significantly reduced from 30 percent in 1993 to 20 percent in 2000. Non-oil exports reached

US$26 billion in 2005 thanks to a rapid growth of Vietnam's agricultural exports (e.g. rice, coffee and rubber) and industrial exports such as garments, textiles and footwear.

Figure 2.6: The top five FDI source countries for Vietnam[16] (US$ million)



Source: FDI data from the GSO (various issues)

Note that Vietnam's exports and imports were focused on inter-industry trade (i.e. based on factor endowment differences) rather than intra-industry trade. In general, Vietnam mainly exports industrial materials and labour-intensive manufactured goods, and imports technology-intensive and capital-intensive products from foreign markets. Export products in labour-intensive sectors such as garments and textiles, leather products, wood and plastic products still accounted for about 70 percent of total manufacturing exports in 2005. However, the share of high-technology

[16] Share of the five countries including Japan, Singapore, Taiwan, Korea and Hong Kong (China) in Vietnam's total FDI was about 54 percent over the period 1990-2005.

exports such as office machinery, machinery and transport equipment in the total manufacturing exports of Vietnam also increased from 5 per cent in 1992 to 18 per cent in 2005 thanks to the significant export growth of office machinery, semiconductors, and telecommunication products.

It is also noteworthy that the rapid export growth of Vietnam also largely relied on foreign-invested firms. The export share of foreign-invested firms in total exports significantly increased from 9 percent in 1993 to about 56 percent of Vietnam's total exports in 2005. Figure 2.6 shows FDI from Japan, Singapore, Taiwan, Korea and Hong Kong for the period 1990-2004. These countries were the top five FDI source countries in Vietnam as their share in total FDI was about 54 percent over the period 1990-2005.

According to the Japan External Trade Organization Jetro (2006), 50 percent of Japanese-owned manufacturing firms in Vietnam exported about 70 percent of their products overseas, implying the export-oriented nature of Japanese FDI in Vietnam. Fujita (2005) also suggests that FDI from Taiwan was strongly correlated to Vietnam's total manufacturing exports to Taiwan. Foreign investors promote new exporting activities, rather than producing import substitutes for the domestic market. In FDI projects in Vietnam, they have a strategy to produce for the world market.

On the import side, the annual average growth rate of imports in the period 1986-2005 was more than 15 percent. The ratio of imports to GDP between 1986 and 2005 was 51 percent. The imported intermediate inputs and capital goods accounted for 87 percent of total imports from 1986 to 1990 and 94 percent from 2001 to 2005. The ratio of consumer goods was 13 percent and 6 percent respectively.

2.5.2. Trade performance in services sectors

As a result of Vietnam's participation in bilateral and regional trade agreements such as the ASEAN Framework Agreement on Services in 1995 and Vietnam-US Bilateral Trade Agreement in 2002, Vietnam's trade in services experienced significant development in exports and imports. The annual growth rate of total services trade by volume was 24.1 percent during the period from 1991 to 2008. From 1991 to 2008, services exports and imports increased by 22.6 percent and 25.9 percent respectively.

Table 2.11 shows that Vietnam's exports of services increased rapidly from US$182 million in 1990 to US$7 billion in 2008. This means that the value of services exports was almost 40 times greater during the period from1990 to 2008. The share of services exports in total exports increased from 7 percent in 1990 to about 30 percent in 1995 at its peak. This share however declined to 10 percent in 2008 due to the strong growth of manufacturing and agricultural trade. During 2001-08, the annual growth rate of services exports was more than 12 percent, lower than that of goods exports which was above 20 percent. During the same period, Vietnam's services imports followed a similar trend, increasing from US$126 million in 1990 to US$7.9 billion in 2008. As a result, the services trade deficit expanded, from US$61 million in 1996 to US$819 million in 2008.

Regarding the structure of trade, in 1998 the four largest export sectors in terms of value were tourism, air transportation, shipping, and finance, accounting for around 93 percent of total services exports. On the import side, the largest import sectors were

insurance and freight for imported goods that contributed more than 50 percent of total services imports in 2008.[17]

Table 2.11: Trade in services, 1990-2008 (US$ million; percent)

Source: GSO (2010)

To sum up, this section described the export performance in the manufacturing and services sectors under the Doi Moi process. The section showed that export performance made significant progress in the period of Doi Moi, in parallel with a substantial development of firms in Vietnam, implying the relationship between exporting and firm performance in Vietnam.

[17] The Appendix provides more details on exports and imports by services sectors.

2.6.Conclusion

As discussed above, the trade liberalization process has been accompanied by significant developments. The chapter provides a background for the association between trade liberalization and firm performance in the manufacturing sector under Vietnam's Doi Moi. Tariffs in the manufacturing sector were substantially changed and manufacturing firms achieved significant development during the period of trade liberalization, implying an association between trade liberalization and the performance of manufacturing firms in Vietnam.

However, the question of how the firms can respond to the import tariff cuts in Vietnam can be raised with reference to Vietnam's development experience. Trade liberalization can force domestic firms to face tougher competition in Vietnam due to increased levels of imports (Vo, 2005). As a result of tougher import competition, more efficient firms can expand their market share while the least efficient firms may be forced to exit. Vo (2003) also claims that there has been a kind of dualism in Vietnam's economy since the introduction of Doi Moi in 1986. The highly productive export-oriented sector co-exists with the sluggish import-substitution and domestic-oriented sector that was mainly dominated by the SOEs.

In addition, tariff cuts can result in the increased availability of foreign intermediate inputs in the domestic market. This can boost firms' technology transfer, innovation and learning processes owing to their greater access to a variety of foreign inputs. Section 2.4 shows the significant firm developments in terms of the increasing number of firms and firm performance. This raises the question of whether there is any association between import tariff cuts and firms' productivity in term of total factor

productivity (TFP) in Vietnam. This study examines this research question in Chapter 5.

In addition, the story of Doi Moi provides a strong impression of export-led growth in Vietnam (Arkadie and Mallon, 2003). The share of exports in GDP rapidly increased in line with high rates of GDP growth after Doi Moi was introduced. The story of Vietnam's export expansion and firm development has shed light on the relationship between exports and firms' performance in Vietnam. In Chapters 3 and 4, the research outlines the theoretical and empirical literature on this relationship. The literature suggests that there is a two-way relationship between exports and firm productivity. On the one hand, the relatively more productive firms are more likely to export whereas the less productive firms serve the domestic market only (Melitz, 2003). This is the self-selection mechanism referred to in the literature. On the other hand, exporting can boost firm productivity through learning by exporting. In light of the current literature, Chapters 6 and 7 examine whether the self-selection mechanism or learning-by-exporting effect or both can occur in Vietnam.

Although Doi Moi has brought significant achievements, reforms have not kept pace with economic development (Vo, 2005). There were shortcomings in the period of Doi Moi that can hinder the reform process. Since the introduction of Doi Moi in 1986, SOEs have continued to be dominant in both the manufacturing and services sectors. Although the government subsidizes inefficient SOEs for political and social reasons, this harms the overall Vietnamese economy as human and financial resources cannot be used efficiently. Research on the effects of firms' state ownership could lead to implications for further reforms of SOEs. In addition, the experience of Vietnam shows that FDI is essential for Vietnamese capital formation and economic growth.

The effect of FDI is not only from the inflow of physical capital but also from advanced management, new technology, modern business and production methods. Given that the literature does not pay much attention to the role of SOEs and foreign-invested firms in influencing the association between tariff cuts and firm productivity, this study integrates firm ownership into the empirical frameworks in the thesis.

In addition, section 2.4 and section 2.5 point out the increasing importance of the services sector in Vietnam. Vietnam's service activities accounted for less than 40 percent of GDP in 2008, implying that this sector has room to develop. Given that the literature has paid little attention to the link between exports and firm productivity in the services sector, the research examines the two-way relationship between exports and firm productivity in both the manufacturing and services sectors.

In summary, this chapter describes the Doi Moi process and firm development in Vietnam. The story of Doi Moi indicates the association between trade liberalization and firm development. In addition, the experience of Vietnam also suggests the close correlation between trade expansion and firm development in Vietnam. These issues thereby introduce the background for research questions in the thesis. In the next two chapters, the study presents the theoretical and empirical linkages for the research questions.

Chapter 3 Theories of trade and productivity

3.1. Introduction

Trade theory has a long history, dating back to the very first models of absolute advantage (Adam Smith) and comparative advantage (Ricardo). The models of Adam Smith and Ricardo set a starting point for robust theoretical development in international trade that continues to this day through Samuelson, Grossman, Helpman, Krugman, Melitz, and many others.

In trade theory, the existence of gains from trade has long been a major focus in the theoretical models. From the first trade models (Ricardo, 1817) to the recent theoretical models (Melitz, 2003),[18] the central proposition of these models generally rests on whether a country engaged in international trade is better off than in autarky or whether freer trade is better than restricted trade. Although there is still some scepticism on the positive effects of trade,[19] a number of trade theorists agree that a country can benefit from international trade (Ricardo, 1817; Heckscher-Ohlin model, 1933; Krugman, 1980; Melitz, 2003).

One of the most important gains from trade in the literature is the productivity gain stemming from international trade. The association between international trade and productivity has been examined over two centuries, going back to the Ricardian model of comparative advantage. Countries can expand their efficiency when participating in international trade using their relative comparative advantage (Ricardo,

[18] Section 3.2 describes these models in more detail.
[19] Rodrik (1988) argues that firms do not necessarily benefit from trade since their market size can decline owing to the relaxed trade protection.

1817) or their different endowments of production factors (Heckscher-Ohlin model, 1933). Since these models treat firms as homogeneous and assume that there is no intra-sectoral trade, Krugman (1980) and Melitz (2003), among others, constructed trade theoretical frameworks to allow for intra-sectoral trade and firm heterogeneity, respectively.[20] A number of the trade models that were developed on the basis of the Krugman and Melitz framework also examine the productivity gains that arise from international trade (such as Bernard et al., 2003 and Helpman et al., 2004).

In this chapter the author reviews theoretical models of trade and productivity with a particular emphasis on the impact of trade liberalization on productivity and the association between exporting and productivity. The objective of the chapter is to introduce some theoretical background for research questions in the thesis. First, the author outlines various schools of trade theories from the very first models of Adam Smith and Ricardo, to the Krugman (1980) and Melitz (2003) trade models. Next, the chapter focuses on the related theoretical models that examine the association between trade liberalization and firm productivity as well as the link between exporting and firm productivity. It is noteworthy that the impact of trade liberalization on firm productivity and the association between exporting and productivity might be explained in a number of theoretical studies. Thus, to separate the theoretical mechanisms through which trade liberalization can affect firm productivity and theoretical channels of the two-way relationship between exporting and firm productivity, the author considers the implications of the trade theories for each research question in the thesis.

[20] Section 3.3 reviews these models in more detail.

The rest of the chapter is organized as follows. Section 3.2 highlights the theories of trade, productivity and the firm. Section 3.3 introduces related theoretical models. Section 3.4 describes the implications of the trade theories for research questions in the thesis. Finally, section 3.5 concludes.

3.2. Highlights of theories of trade and productivity

This section highlights the theoretical models that examine the linkage between trade and productivity. As shown in Table 3.1, older trade theories such as those of Ricardo and Heckscher-Ohlin consider the pattern of trade across industries based on differences in productivity (Ricardo) and differences in factor intensity (Heckscher-Ohlin, or H-O).[21]

Table 3.1: Highlights of trade theories and firm productivity

NOTE:
This figure/table/image has been removed
to comply with copyright regulations.
It is included in the print copy of the thesis
held by the University of Adelaide Library.

Source: Bernard et al. (2007)

[21] Section 3.2.1 reviews Ricardo and H-O model in more detail.

The older trade theories however do not explain why trade can take place within an industry. The trade theories initiated by Krugman (1980) fill this gap by considering the mechanism of intra-industry trade. The models developed on the basis of the Krugman framework have been known in the literature as 'new' trade theories. In these models, firms, however, are homogeneous. Melitz (2003) integrates firm heterogeneity into the theoretical model, assuming that firms are heterogeneous in terms of productivity within industries, that is, firms are different in the marginal cost of production. The Melitz model is extended by Bernard et al. (2003) and others.[22]

3.2.1. Old trade theories

The theory of international trade has a long history, going back to the 17th century with Adam Smith's famous book, *The Wealth of Nations*. In his book, Adam Smith developed the idea of absolute advantage as a main driver of trade.[23] In the model of absolute advantage, each country can participate in international trade using their absolute advantage in labour productivity. The principle of absolute advantage, however, does not explain why countries that have no absolute advantage can engage in trade.

[22] Section 3.3 describes the models that extended the Melitz (2003) model in more detail.
[23] Absolute advantage refers to the ability of a country to produce a good with fewer resources than another country.

The model of comparative advantage is first described by Ricardo.[24] In contrast to the principle of absolute advantage, the model of comparative advantage provides the rationale for the country that may have no absolute advantage to engage in trade. The Ricardian model examined the comparative advantage model of two countries that produce two goods. Even if a country has absolute advantage in all goods, two countries still benefit from international trade based on its relative efficiency of production. In the Ricardian model there is the assumption that the production is subject to constant returns to scale[25] and labour is the only production factor. In addition, the Ricardian model focused on homogeneous goods within industries and inter-industry trade across countries

Unlike in the Ricardo model, the H-O model is focused on the intensity of the endowment of production factors. The H-O model assumes a world economy with two countries that produce and trade two goods using two production factors, labour and capital. The model is sometimes referred to as the Heckscher-Ohlin-Samuelson (HOS) model as it has been further developed by Samuelson.

The H-O model assumes perfect competition[26] in goods and factor markets. In the H-O model, production factors are perfectly mobile within a country and consumer preferences are homothetic across countries. As in the Ricardian model, the H-O model focused on homogeneous goods within industries and inter-industry trade across countries. In addition, the H-O model assumes constant returns to scale. By this

[24] Comparative advantage refers to the ability of a country to produce a good at a lower marginal and opportunity cost.
[25] Constant returns to scale: output increases by the same proportional change as all of the inputs.
[26] Perfect competition is a form of market in which there are many firms that sell identical goods. Every firm is a price taker.

assumption, the firm can double its output by using double the amount of capital and labour. By definition, the constant returns to scale assumption does not support production specialization. There is also an assumption that both countries have identical technology, that is, the same quantity of a good can be produced using the same amount of capital and labour in both countries. In the H-O model, the two countries differ in their endowment of production factors and that is the main driver of international trade.

As stated in the H-O model, given relative goods prices, each country that owns a relatively abundant factor will produce and export the good in the sector that uses this abundant factor intensively. This means that a country will export a labour-intensive good if it has relatively abundant labour. Thanks to trade, two countries can take advantage of their combinations of the endowments of production factors. The H-O model suggests that a country that has a relatively abundant factor can achieve a higher efficiency in its factor-intensive sector through international trade. The H-O framework is further developed by Vanek (1968) in the Heckscher-Ohlin-Vanek model that allows for many goods and factors.

3.2.2. New trade theories

The H-O model explains the patterns of trade by considering different endowments of production factors. The H-O model, however, cannot explain some modern stylized facts. First, competition is far from perfect in reality. The nature of

production is more commonly in the form of monopolistic competition,[27] oligopolies or monopolies.[28] Second, increasing returns to scale are common in most industries.[29] Next, in general goods are not homogeneous, but differentiated. Finally, the older trade theories did not consider intra-industry trade for reasons of simplicity. Intra-industry trade in differentiated goods, however, is a dominating pattern of trade in many developed countries (Grubel and Lloyd, 1975). Countries that have similar characteristics can export and import within the same sector.

The Krugman (1979, 1980) model is the first attempt to integrate increasing returns to scale and monopolistic competition into trade models. In his model, increasing returns to scale allows a firm to lower its average costs as its production increases. As the product is differentiated, each firm produces and exports its unique variety of that product.

Krugman (1979, 1980) suggests that there is a love-for-variety preference across consumers[30] and varieties of the same differentiated good can be traded. In the Krugman (1979, 1980) model, identical consumers have symmetrical demand for all of the varieties, and trade can occur within industry since the consumers prefer a wide range of goods. As suggested in Krugman's (1979, 1980) model, gains from trade can be obtained from the increased product diversity.

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[27] Competition is monopolistic when there is a large number of firms and goods are differentiated.
[28] Oligopoly exists when there are a small number of sellers who dominate in the market whereas monopoly is a form of market in which the market is controlled by a single person or firm.
[29] Increasing returns to scale assumes that output increases by more than a proportional change in all inputs.
[30] This means that the consumers prefer to choose from a wide variety for each good.

3.2.3. Theories of trade and the heterogeneous firm

The newer trade theories examine the patterns of intra-industry trade. However, the new trade models do not consider firm heterogeneity within sectors. The modern stylized facts show that firms are heterogeneous within sectors. In trade, only some firms can export. Exporters have also been shown to be more productive and larger than non-exporters as suggested by Roberts and Tybout (1997) and Bernard and Jensen (1999).

Melitz (2003) is the first model to formally integrate firm differences and fixed entry costs into a model of international trade. In the Melitz model, all firms face the same fixed costs. Firm heterogeneity in terms of productivity is represented by the difference in the marginal cost of production. The Melitz (2003) model is similar to Krugman's (1980). The only difference is firm heterogeneity in terms of productivity. In the Krugman (1980) model, demand is characterized by constant elasticity of substitution (CES) as well as increasing returns to scale. In the Melitz (2003) model,[31] each firm produces its own variety whereas labour is the only production factor in the model.

In summary, the existing literature has been motivated by the work of Krugman (1980) and Melitz (2003), there are a number of theoretical models that were constructed on the basis of these frameworks. In section 3.3, the author outlines the related models that examine the association between trade and productivity.

[31] The study outlines the Melitz (2003) model in section 3.3.

3.3. Theories of trade and firm productivity

In this section, the study outlines the theoretical models related to the research questions in the thesis. First, the research presents the related theoretical literature that examines the association between trade liberalization and firm productivity as well as the two-way relationship between exporting and firm productivity. These models, however, treat firms as homogeneous. Second, the study describes the related trade models that examine the link between international trade and productivity in the presence of firm heterogeneity within industries. The implications of those models provide the theoretical background for the next chapters in the thesis.

3.3.1. Theories of trade and productivity

The relationship between trade and productivity was first examined centuries ago. Since the very first trade models such as Ricardo's, an increase in productivity has been considered as a gain from international trade. Countries can improve their efficiency by using their relative advantage in technology (Ricardo) or different intensity of the endowment of factors (Heckscher-Ohlin models). In this section, the author focuses on the related theoretical models that were developed on the basis of the frameworks initiated by Krugman (1980) and Melitz (2003).

Krugman (1987) constructs a learning-by-doing model.[32] In the Krugman (1987) model the world economy consists of two countries. K_i is an index of cumulative experience. Relative productivity of the home country (H) to the foreign one (F) is the function of K_i:

$$\frac{A_i^H(t)}{A_i^F(t)} = \left(\frac{K_i^H(t)}{K_i^F(t)}\right)^{\varepsilon} \tag{3.1}$$

where A is productivity in each industry and $0< \varepsilon <1$.

Krugman (1987) suggests that the home country can learn by doing owing to trade with the foreign country. Depending on the experience index, the relative productivity can increase over time. This means that a firm can obtain a productivity gain through the learning process from its export participation. The learning-by-doing effect also can take place through the firm's access to foreign technology embodied in imported inputs. This can shed light on the positive effects of trade liberalization that may result in a greater availability of foreign inputs in the domestic market.

In addition, Ethier (1982) develops the model on the basis of the Krugman (1980) framework. The Ethier model examines trade in intermediate inputs, assuming increasing returns to scale for the production of inputs. As suggested by Ethier (1982) firm productivity can rise since trade liberalization may increase the variety of intermediate inputs. This allows firms to take advantage of their combination of intermediate inputs more efficiently in order to use the desired technology or product specifications. As in the Ethier model, Romer (1990) also claims that a greater variety of intermediate inputs can have a larger effect on production expansion than a greater

[32] Learning by doing refers to increased productivity that is gained through practice. The learning-by-doing model is begun with the work of Arrow (1962).

quantity of intermediate inputs. Trade liberalization that helps the firms to access a variety of foreign inputs at a lower cost through import tariff cuts can expand the firm's production and market share.

Rivera-Batiz and Romer (1991) examine the R&D models[33] of knowledge spillover from international trade. Rivera-Batiz and Romer (1991) consider two models: the knowledge-driven model and 'lab equipment' model[34] that assume that there is trade in intermediate inputs. Rivera-Batiz and Romer (1991) suggest that international trade in intermediate inputs can increase the variety of inputs and enhance the accessibility to the better inputs. As a result, the knowledge embodied in inputs can raise the productivity in research that in turn can further contribute to growth. This can shed light on the effect of trade liberalization as well as the learning effect from exporting to foreign markets since trade liberalization or exports can allow the firm to have a greater access to knowledge diffusion.

Grossman and Helpman (1991) extend the Rivera-Batiz and Romer (1991) model to the case of asymmetric countries and more than one final good. Grossman and Helpman (1991) suggest that international trade increases the variety of intermediate inputs and access to foreign knowledge. This in turn stimulates domestic innovation and productivity growth.

[33] In the models of R&D, knowledge is accumulated as firms maximize their profits. Research activities undertaken by a firm can bring positive spillovers to other firms in the same activities.

[34] The 'lab equipment' model is the kind of model in which research activities use final output instead of labour as an input.

In the Grossman and Helpman (1991) model, output y is produced with the CES production function:[35]

$$y = \left[\sum_{i=1}^{N} x_i^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \quad (3.2)$$

where x_i is the quantity of input variety i = 1,…,N. X is the aggregate amount of the intermediate input, so X ≡ Nx. σ is elasticity of substitution ($\sigma > 1$).

If inputs are all priced equally in equilibrium, then their quantities are also equal, $x_i = x$, then the production function is

$$y=N^{\sigma/(\sigma-1)}x=N^{1/(\sigma-1)}X$$

This equation shows that increases in the variety of inputs (N) raises output y since $\sigma > 1$. $N^{1/(\sigma-1)}$ can be considered to represent technological progress, implying that productivity in the final good industry increases due to the expansion of differentiated intermediate inputs. The model suggests that free trade in the intermediate inputs can stimulate transfer of knowledge across countries. Owing to trade liberalization, a greater variety of inputs can raise productivity through international spillovers of knowledge. Grossman and Helpman (1991) imply that free trade or subsidies to R&D have effects on the growth rate of both countries.

Feenstra (1994) develops the model by constructing a measure of input variety for the CES production function. The variety of intermediate inputs is correlated with productivity growth:

[35] The constant elasticity of substitution (CES) production function is first introduced by Arrow, Chenery, Minhas and Solow (1961).

$$TFP = \frac{1}{(\sigma-1)} ln\left(\frac{\lambda_{t-1}(I)}{\lambda_t(I)}\right) \quad (3.3)$$

TFP is total factor productivity. λ_t (I) is a ratio of period t expenditure on the inputs in the set I relative to the total expenditure. λ_t (I) can be interpreted as a ratio of one minus the expenditure on new inputs (not in the set I), relative to the total expenditure. In the model, international trade can raise the variety of new inputs. Expanding variety in new inputs that leads to a fall in value of λ_t (I) thereby will increase TFP of the firm or industry using these inputs. Thus, trade liberalization that results in a greater variety of new foreign inputs in the domestic market can increase domestic firm TFP.

Clerides et al. (1998) constructs the model to measure productivity gains from exposure to foreign markets. They claim that as firms face one-off sunk costs (F) to enter the foreign market, firms may decide to continue to export even if firm profit is less than the annual fixed costs of exporting (M). This is because if they stop altogether, and then decide to recommence exporting they will have to pay the entry costs of F again. Firms can make forward-looking decisions, taking future costs and foreign demand into account. Clerides et al. (1998) suggests that if learning effects occur, marginal cost depends on the previous value of a dummy indicating whether the firm exports or not. In other words, learning effects from exporting depend on a firm's previous exporting status.

To sum up, this section outlines the related theoretical models. In these models, trade liberalization can increase the firm productivity by boosting the variety of foreign inputs in the domestic market. In addition, as argued by the trade models the learning-

by-doing or learning effect from exporting can occur through the greater exposure to foreign markets.

3.3.2. Theories of trade and productivity in the presence of firm heterogeneity

Trade models discussed in section 3.3.1 explain the relationship between trade liberalization and productivity by assuming that firms are homogeneous within sectors. The stylized facts, however, show that firms are not identical in the same sector.[36] Melitz (2003) is the first seminal paper that formally examines the relationship between trade and productivity in the presence of firm heterogeneity. Melitz (2003) finds that the fixed cost of entry for exporters and the superiority of exporters to non-exporters in terms of productivity are the two key drivers of whether firms will trade. This thesis uses these findings as the theoretical background for the empirical framework. In the Melitz (2003) model, CES demand and aggregate price are set up with product variety ω as follows:

$$U = \left[\int_{\omega \in \Omega} q(\omega)^{\rho} d\omega \right]^{1/\rho} \tag{3.4}$$

$$P = \left[\int_{\omega \in \Omega} p(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}} \tag{3.5}$$

where elasticity of substitution $\sigma = 1/(1-\rho) > 1$. Given aggregates, optimal consumption and revenue can be derived in the following forms:

$$q(\omega) = Q\left[\frac{p(\omega)}{P} \right]^{-\sigma} \tag{3.6}$$

[36] Tybout (1997) and Bernard and Jensen (1999) find that owing to the sunk costs, only some firms can export. Exporters are likely to be more productive and larger than non-exporters.

$$r(\omega) = R\left[\frac{p(\omega)}{P}\right]^{\frac{1}{1-\sigma}} \tag{3.7}$$

Labour is the only production factor. Then the amount of labour needed for production is:

$$l = f + q/\varphi \tag{3.8}$$

where φ is productivity.

The firm follows the pricing rule:

$$p(\varphi) = \frac{\psi}{\rho\varphi} \tag{3.9}$$

where ψ is the common wage rate. Firm profit is

$$\pi(\varphi) = r(\varphi) - l(\varphi) = \frac{r(\varphi)}{\sigma} - f \tag{3.10}$$

where f is fixed costs of entry to serve the domestic market.

Melitz also assumes that there is a standard iceberg cost τ and a per-period exporting fixed cost of f_x in the presence of international trade. Profits from domestic and exporting sales are equal to, respectively:

$$\pi_d(\varphi) = \frac{r_d(\varphi)}{\sigma} - f \tag{3.11}$$

$$\pi_{ex}(\varphi) = \frac{r_x(\varphi)}{\sigma} - f_x = \frac{\tau^{1-\sigma} r_d(\varphi)}{\sigma} - f_x \tag{3.12}$$

where r(φ) is the revenue function. The firm's profit function is increasing with its productivity level.

Free entry and zero cut-off profit (ZCP) conditions determine the productivity level (φ^*) under which firms exit the domestic market, that is,

$$\pi(\varphi^*) = 0 \tag{3.13}$$

In the open economy, the ZCP condition lies above the closed economy one, as a higher cut-off productivity does affect total average profit.

The Melitz model suggests that cut-off marginal cost declines as a result of trade liberalization. As shown in Figure 3.1, when the ZCP line shifts upwards, the new cut-off marginal cost declines (that is, $\varphi^* > \varphi_a^*$). Cut-off marginal cost declines because real wages rise.[37] The least productive firms thereby exit as they cannot make positive profits any more. In other words, the exposure to trade will reallocate market shares from less productive to more productive firms while the least productive firms will exit. The average industry productivity thereby increases. The market share of the most productive firms also increases.

The Melitz model also implies that the exporting firms face fixed entry costs when exporting in foreign markets. The cut-off productivity for exporting firms is φ_x^* such that $\pi(\varphi_x^*) = 0$. In equilibrium conditions in the presence of international trade, φ_x^* can be written as a function of φ^*:

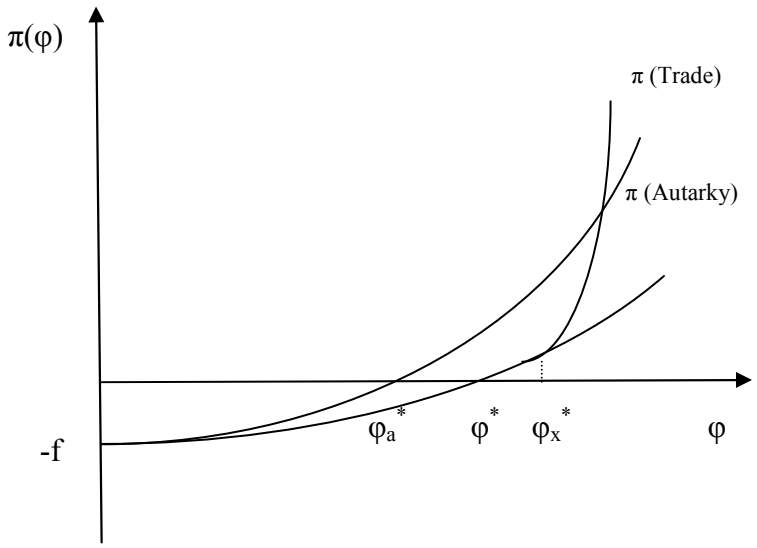
$$\varphi_x^* = \varphi^* \tau \left(\frac{f_x}{f}\right)^{\frac{1}{\sigma-1}} \tag{3.14}$$

[37] Real wage rises because the demand for labour increases. Highly productive firms employ more workers to expand their production. International trade also can encourage the setting up of new firms to serve domestic markets or to export. This increases the real wage rate.

In the Melitz (2003) model, $\tau^{\sigma-1}f_x > f$, so $\varphi_x^* > \varphi^*$ as shown in Figure 3.1. Melitz (2003) suggests that firms can export if their productivity is greater than the cut-off productivity for exporting firms, that is, $\varphi > \varphi_x^*$. In other words, only highly productive firms are self-selected into the export market.

In addition, Melitz (2003) suggests that as a result of trade liberalization, the most productive exporters can expand their market share owing to increased competition in the product market whereas the least productive domestic firms exit. Average industry productivity thus rises.

Figure 3.1: Reallocation of profits in the Melitz (2003) model



Source: Melitz (2003)

Bernard et al. (2003) develop a model with Bertrand competition,[38] CES preferences and use of inputs integrated into the production function. As in the Melitz (2003) model, heterogeneity of firms is the difference in terms of productivity. Firms produce and export their unique variety of a given product. Bernard et al. (2003) also state that trade liberalization can result in higher average industry productivity through reallocation of resources to highly productive exporters owing to increased competition and cheaper intermediate inputs. Exporters are also shown to be more productive and larger than non-exporters in the Bernard et al. (2003) model.

The Helpman et al. (2004) model extends Melitz (2003) by integrating firm difference in the choice of FDI into the model. Similar to Melitz (2003), firms are different in terms of marginal costs of production. Helpman et al. (2004) develop a model of firm choice between exporting and FDI). Firm productivity can influence a firm's decision to serve the domestic market, export or invest abroad. They find that the least productive firms serve the domestic market only while more productive firms can serve foreign markets through exports. This is due to the significant sunk entry costs associated with exporting. Since setting up a foreign subsidiary may be more costly than exporting, only the most productive firms can invest abroad.

Head and Ries (2003) also extend the Melitz model by introducing heterogeneity across foreign countries in terms of labour costs. Foreign markets can offer low or high wages to workers. Head and Ries (2003) suggest that less productive firms can obtain positive profits if they invest abroad in the low-wage foreign markets.

[38] Bertrand competition is a mode of competition in which there are interactions between firms that compete by setting their prices and consumers that make their choice in terms of quantities and prices.

Both relatively high and low productive firms can set up a subsidiary in the lower-cost foreign market that offers relatively low wages. Less productive firms, however, are unlikely to engage in FDI if the country in which they are considering investment offers high wages. Hence, highly productive firms can invest in a wide range of countries whereas less productive firms can invest in low-cost countries only.

Yeaple (2005) integrates firm differences in choice of technology and type of worker into his trade model. Yeaple (2005) finds that exporters are larger than non-exporters. The firms that export also pay higher wages than non-exporters. The exporter's output per worker is larger than that of non-exporters as workers for the exporting firm are generally more skilled than workers employed at a non-exporting firm. As in the Melitz (2003) model, Bernard et al. (2007) also integrate firm heterogeneity into their trade model. Unlike Melitz, Bernard et al. (2007) consider firm differences in the H-O model. They consider the world economy of two countries that use two production factors in two sectors, similar to the approach of Helpman and Krugman (1985). Bernard et al. (2007) suggest that trade liberalization raises the zero-profit productivity cut-off in all industries. As a result, the most productive firms can expand their production and market share whereas the least productive firms exit. Bernard et al. (2007) suggest that an exporter's productivity gain is stronger in the industry in which the country has a comparative advantage.

To sum up, the overview of the theoretical models in this section suggests that only the most productive firms can export and survive. In addition, as argued by Melitz (2003) exporters are in general more productive than non-exporters, implying the two-way relationship between exporting and firm productivity. As shown in this

section, the association between trade liberalization and productivity and the link between exporting and productivity can be explained by a number of models. Thus in the next section, the author describes the implications of theoretical models for each research questions in more detail. The aim of the section is to provide a theoretical background for each of the research questions in the thesis.

3.4.Trade theories and their implications to research questions in the thesis

As discussed in section 3.3, the theoretical models suggest that trade can lead to an increase in productivity. Productivity gain may be a consequence of increased learning-by-doing effects as in the Krugman (1987) model. Productivity also can arise as trade liberalization can increase international R&D and knowledge diffusion as suggested in the R&D models (such as Grossman and Helpman, 1991). In addition, highly productive firms can export and survive in the market as argued by Melitz (2003), as opposed to less productive firms who cannot survive in the export market. Exporting in turn helps exporting firms to improve their technology and productivity as suggested by Clerides et al. (1998). In this section, the author focuses on the implications of the theoretical models to each research question of interest in the thesis. The purpose of section 3.4 is to examine the theoretical mechanisms through which the hypotheses can occur. There are three sub-sections in which the author presents the implications of the trade theories for each of three research questions.

3.4.1. Trade liberalization and firm productivity

In this sub-section, the author outlines the theoretical mechanisms through which trade liberalization can increase firm productivity. As stated above, the theoretical linkage between trade and productivity growth has long been discussed, going back to the classical school of thought, represented by Adam Smith who believed that international trade may improve productivity by exploring the absolute advantage. This argument was subsequently enriched by the works of Ricardo, Torrens, James Mill and John Stuart Mill. More recent seminal theoretical works (see for example Krugman, 1987; Rivera-Batiz and Romer, 1991; and Grossman and Helpman, 1991) have provided a framework to recognise and analyse the relationship between trade liberalization and productivity growth. According to these theoretical models, trade liberalization can lead to productivity gains. In the trade theories there are three major mechanisms through which trade liberalization can affect productivity growth as follows.

First, trade liberalization might lead to tougher competition in the product markets. On the one hand, Krugman (1979) points out that exposure to foreign competition raises productivity through increasing the elasticity of demand faced by domestic producers and forcing them to lower their average costs of production in order to remain competitive. Tougher competition also can force domestic producers to increase their efficiency by using inputs more effectively (Holmes and Schmitz, 2001). On the other hand, Grossman and Helpman (1991) suggest that as a result of trade liberalization, knowledge spillovers can boost domestic innovation. Boone (2000) used a theoretical model to show that domestic firms can foster new and innovative processes in order to compete with foreign firms. Yeaple (2005) also suggests that

increased competition forces the domestic firm to adopt new technology in order to remain competitive. Finally, a number of theoretical models show that increased competition can improve firm productivity through its favourable effect on economies of scale and other positive externalities such as more highly skilled labour and improved management skills, and learning by doing (Krugman, 1987).

Second, as a result of the removal of trade barriers the firms can have access to a greater variety or a higher quality of intermediate inputs. Firm productivity in turn can be increased by the access to cheaper inputs, higher quality, foreign technology (Grossman and Helpman, 1991) and a greater variety of intermediates (Ethier, 1982; Feenstra et al., 1992; Feenstra, 1994). Grossman and Helpman (1991) also show that higher quality and more varieties of intermediate inputs leads to productivity gains through the firm's innovation process and learning effects. The reduction of tariffs on inputs may reduce the cost of intermediate goods and increase the accessibility to better inputs (Romer, 1990; Rivera-Batiz and Romer, 1991).

The third mechanism, in addition to the intra-firm effects, Melitz (2003) suggests that owing to trade liberalization domestic firms can face tougher competition which in turn forces inefficient firms to exit the market. The resource thus is reallocated to the more efficient firms. As a result, the average industry productivity increases. The selection effects suggested by Melitz (2003), however, do not raise within-firm productivity.

In summary, as suggested in the literature, trade liberalization can raise firm-level productivity through the competition effect (Helpman and Krugman, 1985, and

Melitz, 2003) and the effect of the access to a greater variety of inputs (Grossman and Helpman, 1991; Feenstra et al., 1992; and Feenstra, 1994).

3.4.2. Productivity, self-selection and exporting

In this sub-section, the author outlines the theoretical mechanisms of the link between productivity and exporting. The association between exporting and productivity has been widely investigated by traditional trade theories such as the theory of Ricardo, the H-O model of comparative advantage for inter-industry trade and the theory of horizontal product differentiation for intra-industry trade (Helpman and Krugman, 1985). In those trade theories firms are homogeneous. However, it is observed that only some firms can export and that the firm's decision to export is determined by a range of factors.

Recent theoretical models of trade suggest the self-selection of the relatively more productive firms to export into foreign markets. The role of sunk entry costs is formally examined in a consistent explanatory framework suggested by Melitz (2003). He states that there are sunk entry costs associated with exporting activity, which is higher than that for participation in the domestic market. The models also suggest that firms are heterogeneous in terms of productivity. Therefore only the most productive firms can afford sunk costs that include costs associated with trade barriers and other trade costs to export. Melitz (2003) provides a general equilibrium model showing that firms self-select in terms of whether to participate in export markets. In the models, exporting firms are more productive than non-exporting firms. The model of Melitz (2003) is highly tractable and is extended by many other theoretical studies (e.g.

Helpman et al., 2004). Helpman et al. (2004) extend the Melitz model by developing a model in which the firm heterogeneity in terms of productivity is a key factor in the firm's choice whether to export or engage in FDI. Helpman et al. (2004) suggest that the least productive firms serve only the domestic markets while more efficient firms serve foreign markets both through exports and FDI. The most efficient firms serve foreign markets only through foreign affiliates as suggested by Helpman et al. (2004). Head and Ries (2003) extend the Melitz (2003) model allowing for heterogeneity in terms of factor costs between countries. They show that less productive firms may also engage in FDI in the low-cost countries that offer low wages but not in high-cost countries. Highly productive firms may export and engage in FDI in a broad range of countries.

Alongside productivity and sunk cost, the decision to enter the export market is determined by a range of other factors. Yeaple (2005) indicates that the more productive firms could employ more skilled workers. As a result, more productive firms that are likely to export tend to pay higher wages. Besides, there is also a correlation between firm size and firm wage. Exporters are likely to be larger than non-exporters as argued by Yeaple (2005).

Finally, the literature suggests the positive effect of foreign ownership on a firm's exporting. Exporting involves fixed entry costs (Melitz, 2003; Helpman et al., 2004). These might include research about the foreign market, the establishment of distribution networks, or advertising. In addition, Helpman et al. (2004) suggest that the least productive firms serve only the domestic markets, the more productive firms export, and the most productive firms can invest abroad. Hence, foreign-invested firms

(FIEs) in Vietnam, i.e. those receiving investment from foreign investors, are likely to be the most productive firms. This means that the FIEs can have advantages in dealing with the sunk entry costs associated with exporting.

To sum up, the literature suggests that a firm export decision can be affected by a range of factors such as firm productivity and the sunk costs of entry into the export market. The overview of the literature undertaken in this section shows that only highly productive firms can export owing to the presence of the sunk entry costs. This is known in the literature as the self-selection mechanism.

3.4.3. Learning effects from exporting

As stated above, theoretical models suggest the self-selection of more productive firms into foreign markets. Melitz (2003) and Bernard et al. (2003) argue that there are sunk entry costs for exporting to a foreign market that are higher than the costs associated with sales in the domestic market. The studies also suggest that firms are heterogeneous in terms of productivity. Hence, only the most productive firms can afford to cover the sunk costs that include trade barriers and other trade costs to export. In addition to the self-selection effect, the literature also suggests the role of learning-by-exporting (Clerides et al., 1998). Clerides et al. (1998) suggest that if the learning-by-exporting effect occurs, learning effects depend on the firm's previous participation in exporting. Anticipating future costs and foreign demand, exporters make forward-looking decisions with current available information on productivity and export status. Clerides et al. (1998) find that firm productivity increases as exposure to export

markets rises. Whereas the self-selection mechanism emphasizes the link between productivity and exporting, i.e. that increased productivity increases exporting activity, the learning-by-exporting hypothesis focuses on the relationship in the opposite direction, from exporting activity back to its impact on productivity. The self-selection hypothesis and the learning-by-exporting hypothesis are not mutually exclusive, meaning that both effects can sequentially play a role, before and after firms start exporting.

In addition, endogenous growth models (Grossman and Helpman, 1991) claim that the tougher competition in export markets forces firms to improve the quality of products and production processes so that they can remain competitive in the export market. Grossman and Helpman (1991) also point out that knowledge spillover can occur when firms participate in trading activities with foreign partners. Information and knowledge acquired from foreign markets can help exporting firms to improve the technology, product design, and the production process. Exporters also can increase their productivity by learning from technical expertise from buyers in foreign markets. As foreign buyers expect high quality and low cost goods, the buyers may be willing to transmit their superior knowledge to suppliers. Exporters thereby can explore the advanced source of foreign knowledge and technology that is not available in the domestic market. The access to superior foreign knowledge and technology helps to boost the productivity of exporting firms. Exporters can learn more as they export to the more developed markets. Finally, scale effects also play a role (Krugman, 1979, 1980). When exporters expand their sales in foreign markets, the profits from exporting can then be used to invest in R&D and innovation, which then further increases firm productivity.

3.5. Conclusion

Two centuries of trade theories since the very first model suggested by Ricardo have significantly improved our understanding of the association between trade liberalization and productivity. In addition, the overview of trade theories undertaken in the chapter shows that firm heterogeneity in productivity can explain why only some firms can export and whether firm productivity gains can result from learning by exporting.

In particular, this chapter reviews the related theories of trade and productivity and their implications for research questions in this thesis. In those models, trade liberalization can raise firm productivity thanks to the mechanisms of tougher competition and greater variety of intermediate inputs. The theoretical models also suggest that the most productive firms self-select into export markets owing to the existence of sunk entry costs. Exporters are superior to non-exporters in terms of productivity, size, etc. In addition, exports can raise firm productivity through learning by exporting. Superiority of exporters to non-exporters can be attributed to the self-selection effect or the learning effect from exporting or both.

Motivated by the theoretical models, a number of empirical studies examine the impact of trade liberalization and the association between exports and productivity. In Chapter 4, the author will present the related empirical studies. The objective of the next chapter is to provide the empirical background for the research questions in the thesis.

Chapter 4 Literature review

4.1. Introduction

In Chapter 3 the author outlines the theoretical linkages between international trade and firm productivity. In these theoretical models, trade liberalization can increase firm productivity through the mechanisms of tougher competition and greater access to a variety of intermediate inputs (Krugman, 1979; Grossman and Helpman, 1991). The theoretical literature also suggests the two-way relationship between exports and firm productivity (Clerides et al., 1998; Melitz, 2003). Motivated by the theoretical models, there are a number of empirical studies that examine these effects in both developing and developed countries. In this chapter the author introduces the related empirical background for the research questions. It should be noted that although there are a number of empirical studies in the literature, there are just a few studies that examine these effects in the transition from a centrally planned to a market oriented economy. This chapter also points out some gaps in the literature that the author will consider empirically in the next chapters.

The rest of the chapter is organized as follows. Section 4.2 gives a review of the related empirical studies that examine the linkage between trade liberalization and firm productivity. Section 4.3 describes the empirical literature that examines the determinants of firms' export decisions. Section 4.4 outlines the related studies that empirically consider learning effects from exporting. Finally, section 4.5 concludes.

4.2.Trade liberalization and firm productivity

As discussed in Chapter 3, the theoretical linkage between trade and productivity growth have been discussed for over two centuries, since the classical trade models, suggested by Adam Smith, Ricardo, Torrens, James Mill and John Stuart Mill, to more recent seminal theoretical works (Krugman, 1987; Rivera-Batiz and Romer, 1991; Grossman and Helpman, 1991; and Young, 1991). According to these theoretical models, trade liberalization might lead to firm-level productivity gains through two main mechanisms: tougher import competition (Krugman, 1979; Helpman and Krugman, 1985) and access to cheaper inputs and a greater variety of intermediates (Grossman and Helpman, 1991; Feenstra et al., 1992). Melitz (2003) also suggests that tougher competition can change the composition of firms in the market towards a higher concentration of more efficient firms. The least productive firms exit whereas highly productive firms expand their market sales. The average industry productivity thereby increases.

In contrast to the above models, some theoretical models of trade do not predict aggregate increases in productivity all the time. Bolaky and Freund (2004) and Hoekman and Javorcik (2004) suggest that trade liberalization does not lead to productivity growth unless complementary policies support the reform properly. In particular, the effect of trade reforms depends on the business regulation in a country. The positive effect of trade can be restricted in highly regulated countries as the resource is not utilized efficiently because the resources are not free to move between the sectors (Bolaky and Freund, 2004).

Motivated by the theoretical models, there are a number of studies that examine the effects of trade liberalization. Although a number of the macro-level empirical studies show that more trade liberalization may lead to a faster economic growth rate (Dollar, 1992; Frankel and Romer, 1999), some authors such as Rodriguez and Rodrik (2000) are sceptical about the robustness of this result. As argued by Rodriguez and Rodrik (2000), the effects of trade liberalization might depend on the heterogeneity across countries such as the cross-nation differences in income and size. On the other hand, they point out the important role of firm-level studies to provide the microeconomic evidence on the relationship between trade and firm productivity.

The micro-level evidence on the positive effects of trade liberalization on firm productivity is empirically examined by a number of firm-level studies (Schor, 2004; Fernandes, 2007; Amiti and Konings, 2007). The association between trade liberalization and firm productivity has been found in both developed and developing countries. While Trefler (2004) investigate data for Canada and the United States, more evidence however has been found in developing countries, such as Schor (2004) for Brazil and Amiti and Konings (2007) for Indonesia. Table 4.1 shows major related studies in the literature.

Many of these studies follow an approach that estimates two equations. First, these studies estimate a production function equation using the methodology of Olley and Pakes (1996) or Levinsohn and Petrin (2003)[39] to obtain consistent productivity gains. Next, they examine a productivity equation in which there is the correlation between trade openness and productivity.

[39] Chapter 5 of the thesis provides more details of the Levinsohn and Petrin (2003) method.

Using data on Chilean plants in the manufacturing industry from 1979 to 1986, Pavcnik (2002) also finds evidence of a 19 percent aggregate increase in firm productivity. At the firm level she finds that the effect of trade liberalization was in a range between 3 and 10.4 percent for this period. Schor (2004) considers the impact of tariff reduction on TFP of Brazilian firms from 1986 to 1998. Schor's results show that a 10 percentage point tariff cut could result in up to 2.7 percent productivity gains. Muendler (2004) also investigates the effect of trade liberalization on firm productivity in Brazilian manufacturing sectors. He finds that the effect of increased competition is to raise firm productivity significantly.

Using the output tariff as a proxy for trade openness Fernandes (2007) examines the impacts of trade liberalization on firm productivity for Columbian manufacturing firms from 1977 to 1991. Employing the Levinsohn and Petrin (2003) method to construct TFP measures, she shows that a 10 percentage point tariff cut increases productivity in a range between 0.8 and 2.9 percent. Her results also suggest that the effect of tariff cuts is greater for firms that use a higher share of imported intermediate inputs thanks to greater access to foreign innovations.

Amiti and Konings (2007) is one of the seminal studies examining the role of an output tariff (i.e. nominal tariffs) and input tariff.[40] Amiti and Konings (2007) run a fixed-effect regression to test the effect of trade liberalization on Indonesian manufacturing firm productivity from 1991 to 2001. To estimate the TFP they employ an extended Olley and Pakes technique (1996) to avoid unobserved productivity

[40] Input tariffs are constructed as a weighted average of output tariffs, where the weight is based on the cost shares in total production cost. Chapter 5 describes the definition and calculation of input tariffs in more detail.

impacts on the use of inputs.[41] Their results show that firm productivity increases at 1-6 percent with a 10 percentage point change in the output tariff. The impact on the input tariff, however, is larger and significantly negative. A 10 percentage point decrease in input tariffs can lead to a 12 percent productivity gain. Amiti and Konings (2007) indicate that trade liberalization and tariff cuts can have the same role in increasing firm productivity as a reduction in the price of international outsourcing.

Using input tariff and output tariff data, Topalova and Amit (2011) also finds a positive correlation between tariff cuts and firm productivity among Indian firms from 1987 to 2001. She constructs measures of firm-level TFP using the Levinsohn and Petrin methodology (2003). Levinsohn and Petrin (2003) use a firm's material inputs as a proxy for the unobservable productivity shocks, controlling for the simultaneity bias in the estimation of the production function.[42] Consistent with the Amiti and Konings study, Topalova and Amit (2011) shows that greater access to foreign inputs has larger effects on firm productivity than competition mechanisms. As a result, the coefficients of input tariffs are larger than those of output tariffs in terms of absolute values. A 10 percentage point decrease in input tariffs can lead to a 5 percent productivity gain whereas productivity increases by 1.6 percent as a result of a 10 percent output tariff reduction.

[41] Olley and Pakes (1996) suggest the use of investment to control for unobserved productivity shocks in the estimation of the production function. More details of the approach are further described by Olley and Pakes (1996).

[42] Simultaneity bias can occur if the firms change their choice in production factors such as labour and capital. Chapter 5 describes the simultaneity bias in the estimation of the production function in more detail.

Table 4.1: List of major studies on trade liberalization and productivity

Papers	Country	Measures of productivity	Methodology	Results
Fernandes (2007)	Columbia	total factor productivity	Levinsohn and Petrin (2003)	10% decrease in nominal tariffs can lead to 0.7%-2.9% increase in productivity
Pavcnik (2002)	Chile	total factor productivity	Olley-Pakes (1996)	10% decrease in trade orientation can lead to 19% increase in productivity at sector level 3%-10% increase in productivity at firm level
Amiti and Konings (2007)	Indonesia	total factor productivity	Olley-Pakes (1996)	10% decrease in output tariffs can lead to 1%-6% increase in productivity input tariffs can lead to 2%-12% increase in productivity
Goldberg et al. (2008)	India	total factor productivity	Olley-Pakes (1996)	10% decrease in input tariffs can lead to 4.5% increase in productivity
Muendler (2004)	Brazil	total factor productivity	Olley-Pakes (1996), extended	nominal tariffs can lead to 1.3%-6.1% increase in productivity
Schor (2004)	Brazil	total factor productivity	Olley-Pakes (1996)	10% decrease in nominal tariffs can lead to 0.4%-1.3% increase in productivity, input tariffs 1.5%-2.7% increase in productivity
Topalova and Amit (2011)	India	total factor productivity	Olley-Pakes (1996)	10% decrease in nominal tariffs can lead to 0.2%-1.6% increase in productivity

Source: Author's summary from previous studies.

Goldberg et al. (2008) also paid much attention to the role of input tariffs. Decline in input tariffs by 10 percentage increases TFP by 4.5 percent as stated by Goldberg et al. (2008). Muendler (2004) also find that trade liberalization have the positive effects on firm productivity. Using Brazil's manufacturing firm data from 1986 to 1998; Muendler (2004) suggests that a 10 percent decrease in nominal tariffs increase firm productivity by 1.3-6.1 percent.

The impact of the Canadian-US FTA on productivity is studied by Trefler (2004). His study finds that the short-run costs are offset by the long-run benefits of the country-specific changes in FTA tariff concessions. He finds that tariff concessions show long-run gains owing to increased labour productivity of 8-15 percent for Canada and 4-14 percent for the US. The empirical results suggested by Trefler (2004) also shows that 15 percent increase in labour productivity can be achieved from import competition effects.

In the case of Vietnam, Pham et al. (2009) examines the effect of applied tariff cuts on the firm technical efficiency in 2003 in Vietnam. They find that tariff cuts have a positive effect on firm efficiency in 2003. As suggested by Pham et al. (2009), a 10 percent decrease in tariff can lead up to a 1.5 percent increase in firm's technical efficiency.[43] Their study, however, focuses on the cross-section analysis only.

In sum, the existing literature pays little attention to the association between trade liberalization and firm productivity through output tariff and input tariff reductions in Vietnam, so this research examines this effect using Vietnam's firm data.

[43] In Pham et al. (2009) study, they use the stochastic frontier approach to measure the technical efficiency. See also Pham et al. (2009) for their calculations of the technical efficiency.

In the market-oriented economy in Vietnam, the government tends to maintain the dominance of SOEs, particularly in some important sectors related to power, construction materials and textiles.

In addition, the government also supports FDI-oriented policies, particularly in export-oriented sectors. Given that the literature puts little emphasis on the role of firm ownership structure associated with the effect of trade liberalization, this thesis takes these firm characteristics into account when examining the effect of trade policy reforms on firm productivity in Vietnam.

4.3.Productivity, sunk costs and exporting

The linkage between exports and productivity has been widely investigated by traditional trade theories from the theoretical models of Ricardo, Heckscher and Ohlin of comparative advantage for inter-industry trade to the model of intra-industry trade such as Helpman and Krugman (1985). These models treat firms as homogeneous, but there is evidence of the differences between exporters and non-exporters in terms of productivity and size as shown in Bernard and Jensen (1999).

Recent theoretical models of trade suggest the self-selection of more productive firms into foreign markets (Melitz, 2003). As argued by Melitz (2003), only the most productive firms can afford a sunk cost including trade barriers and other trade costs to export. The model of Melitz (2003) is highly tractable and is extended by many other theoretical studies (e.g. Helpman et al., 2004).

The effect of productivity on exporting has been widely investigated in a number of empirical studies. In the seminal study, Roberts and Tybout (1997)

investigate the role of sunk entry costs in the case of Colombian manufacturing firms from 1981 to 1989. They develop a dynamic model of the export decision for a profit maximizing firm that has to deal with significant sunk costs for their participation in foreign markets. They suggest that the current participation in the export market could be influenced by past exporting experience, indicating that the sunk entry costs increase the firm's probability to export by 60 percent. Roberts and Tybout (1997) also find that the plant size and plant age positively affect a firm's decision to export.

Bernard and Jensen (1999) also examine the effects of sunk costs, firm productivity and exporting on a firm's export decision. Using US plant-level data from 1984 to 1992, they suggest the evidence that given the sunk entry cost for exports, only more productive firms can participate in export markets. As stated by Bernard and Jensen (1999), the exporting decision of US manufacturing firms is positively influenced by firm size, wage, capital intensity and productivity. Effects of firm size and average wage are found to be positive and significant in their studies. The firm that has higher capital intensity is also more likely to export as the US firms export products that rely on capital-intensive technology.

Using firm-level data, Clerides et al. (1998) also find that plants that own a large capital stock and have low marginal costs are more likely to export in the case of Colombia, Mexico, and Morocco, implying that manufacturing firm export decisions can be affected by a number of factors.

Following seminal studies of Roberts and Tybout (1997), Clerides et al. (1998) and Bernard and Jensen (1999), a number of empirical studies such as Alvarez and Lopez (2005) for Chilean manufacturing firms, Arnold and Hussinger (2005) for

German manufacturing firms and Farinas and Marcos (2007) for Spanish manufacturing firms also find strong evidence of positive effects of the sunk cost alongside firm size, age, and productivity on firm export behaviour. These results are consistent with the self-selection hypothesis of more productive firms into foreign markets. As suggested in these empirical studies, exporting firms are more productive than non-exporting firms, i.e. more productive firms self-select into export markets. Exporters show superior performance, and superior performing firms self-select into export markets.

In addition, focusing the role of industrial agglomeration, Greenaway and Kneller (2003) suggest the role of sunk cost, firm size, wages, productivity and industrial agglomeration in determining the likelihood that manufacturing firms in the UK will export. Alvarez and Lopez (2005) also find that selection effects of most productive firms into export markets may be a conscious process as firms improve their productivity in order to prepare for exporting. Emphasizing the role of firm size, Aaby and Slater (1989) show that larger firms are more likely to export. Firm size also has a significant role in influencing the attitudes of the firm managers toward exporting.

Finally, the effect of foreign ownership and FDI on firm exporting probability is also examined in the empirical literature. Sjoholm and Takii (2003) suggest that the firm's foreign ownership and the membership of foreign networks could affect firm exporting decisions for the case of Indonesian manufacturing firms. Kneller and Pisu (2004) find that foreign firms in the UK are more likely to export than domestic firms. Using the data of manufacturing firms in the UK, Greenaway et al. (2005) find that multinationals not only increase the likelihood of domestic firms to export, but also

export intensity. The foreign invested enterprises (FIEs) can have the advantages in dealing with the sunk cost as they already have knowledge and experience in foreign markets. Aitken et al. (1997) also illustrate that foreign investors have informational advantages regarding exporting, implying that firm foreign ownership has a positive effect on firm exporting decision. The foreign-invested firms also can have advantages in accessing to international markets and using modern technology.

In the case of Vietnam, Kokko and Sjoholm (2005) find that exporting firms have higher labour productivity than non-exporters. Exporting firms, however, are mainly in sectors using cheap labour and raw materials such as garments, textiles, non-metallic products, and wood and wood products. There is also a close correlation between innovation and exporting in Vietnam. Nguyen et al. (2008) find that process innovation and product innovation are major determinants of firm exporting. Nguyen (2008) using Vietnam manufacturing data finds the evidence that the presence of foreign firms in Vietnam has a positive effect on the decision of domestic firms to export and their export share through horizontal and forward linkages. His results are still consistent when allowing for other control factors such as ownership of domestic firms, the technology of domestic firms and geographical proximity to foreign firms. Pham et al. (2009) also find evidence of positive effects of export participation on firm technical efficiency in 2003 in Vietnam. Pham et al. (2009) study, however, does not suggest any causality between exports and productivity in Vietnam.

In addition, it is noteworthy that although the effects of learning-by-exporting are widely investigated for manufacturing firms, very little is known about the role of export performance to firm productivity in service firms in the literature (Love and Mansury, 2009; Vogel, 2010). Love and Mansury (2009) suggest that there might be

differences between service and manufacturing firms' internationalization due to the characteristics of services such as intangibility,[44] inseparability between production and consumption, perishability and heterogeneity.

There are just a few studies that examine the relationship between exporting and firm productivity in service sectors. Gourlay et al. (2005) examine the determinants of export behaviour for a panel of UK services firms from 1988 to 2001. Their results indicate that firm size, research intensity, average director's pay and the variance of the exchange rate all increase the probability of becoming an exporter. Love and Mansury (2009) find the positive link from firm performance to exporting for the US business firms, but they do not find any effect of size or of productivity on the export intensity. Using German data for services firms, Vogel (2010) also finds evidence to support the self-selection hypothesis for German services firms.

To sum up, although the positive effects of firm productivity and sunk entry costs, among other things, on firm export behaviour, have been shown in a number of studies, there are just a few studies that examine this mechanism in services firms. Furthermore, notably fewer studies examine this mechanism in the services sector of a transitional country going from a centrally planned to a market-oriented economy. In addition, although the literature also considers the role of foreign ownership in determining firm exporting, few studies examine the different effects of various foreign ownership country origins in the presence of sunk entry costs. In light of the literature, the research examines the effect of firm productivity and sunk costs, among

[44] As argued by Love and Mansury (2009), intangibility means that services are in general not in physical goods.

other things, on firm export participation using Vietnam's manufacturing and services firm data, controlling for the different country origins of foreign investment.

4.4. Learning effects from exporting

As discussed in section 4.3, recent theoretical models support the self-selection mechanism (Melitz, 2003; Bernard et al., 2003). In addition, the literature also supports the role of learning-by-exporting (e.g. Clerides et al., 1998 and Grossman and Helpman, 1991). Whereas the self-selection mechanism takes place through the linkage from productivity to exporting, the learning-by-exporting hypothesis considers effects from exporting to productivity. The self-selection hypothesis and the learning-by-exporting hypothesis are not mutually exclusive, meaning that both effects can sequentially play a role, before and after firms start exporting.

Empirically, while the self-selection hypothesis has been confirmed by various authors (Roberts and Tybout, 1997; Clerides, 1998; Bernard and Jensen, 1999; Wagner, 2002; Bernard and Jensen, 2004a), the evidence on the learning hypothesis has been not clear. Bernard and Jensen (1999), Delgado et al. (2002) and Arnold and Hussinger (2005) find no evidence on learning effects from exporting in various countries. In particular, Bernard and Jensen (1999) consider the relationship between exporting and productivity in terms of labour productivity and TFP. Using the US firm data from 1984 to 1992, they find no evidence of the learning-by-exporting effect in terms of the increased productivity growth whereas the self-selection effect is confirmed in their study. Delgado et al. (2002) apply non-parametric methods using data for Spanish firms. Their results provide evidence that supports the self-selection

mechanism of highly productive firms into exporting whereas the learning effect is found to be insignificant. Using German's firm-level data from 1999 to 2000, Arnold and Hussinger (2005) find no evidence of learning by exporting.

However, there is an increasing number of studies that confirm the learning-by-exporting effects. Greenaway and Kneller (2004) find that firms boost their productivity advantage after being exporters for UK manufacturing firms. Baldwin and Gu (2003) also find that product specialization and the exploitation of scale economies act as major drivers of productivity growth owing to export participation in the case of Canadian manufacturing plants from 1974 to 1996. Baldwin and Gu (2003) show that participation in foreign markets increase labour productivity and TFP by 6 percent and 2 percent, respectively. As indicated in Baldwin and Gu (2003) study, export starters are 21 percent more productive than non-exporters. Allowing for self-selection effects of the most productive firms into export markets, Girma et al. (2004) finds 1.6 percent productivity gains one year after the firm's entry into export markets for UK manufacturing firms from 1988 to 1999. Table 4.2 shows the list of key studies in the related literature.

Wagner (2007) conducts a survey of the results of 45 studies in 33 countries and concludes that exporters are more productive than non-exporters. Applying a joint testing methodology to the manufacturing industry the study by the International Study Group on Exports and Productivity (ISGEP, 2008), consisting of 14 country teams, also suggests that exporting itself does not necessarily improve productivity. However significant learning-by-exporting effects occur generally in low- or middle-income countries. Learning effects from exporting can be made through knowledge transfers from international buyers, incentives for innovation and organizational improvements

due to tough competition in foreign markets. This channel may be more important for firms in developing countries as there might be much more for exporters from developing countries to learn from more developed foreign markets.

An increasing number of studies have found evidence for the learning effect from exporting in developing countries. Kraay (1999) for Chinese firms, Blalock and Gertler (2004) for Indonesian firms, Van Biesebroeck (2005) for nine African countries and De Loecker (2007) for Slovenia have found that firms obtain significant productivity gains after entering the export markets. In particular, Kraay (1999) examines the link between exports and firm productivity for China's manufacturing firms from 1988 to 1992. As suggested by Kraay, a 10 percent increase in export to output ratio can lead to a 13 percent increase in labour productivity and 2 percent in TFP. Using the matching technique for Turkey firm from 1990 to 1996, Yasar and Rejesus (2005) also find the positive effects of learning-by-exporting in Turkey, suggesting that the firms TFP and labour productivity increase by 2 percent and 3 percent, respectively, two years after entry into export markets. As suggested by Blalock and Gertler (2004), Indonesia's firms can increase TFP by from 3 to 5 percent after they enter the export markets in the period 1990-96. For the case of Slovenia, De Loecker (2007) also finds evidence for the learning-by-exporting hypothesis using firm data from 1994 to 2000. As suggested by De Loecker (2007) the export starters gain more than 8 percent in productivity immediately after entry into the export market, using a matching technique. The learning effect for exporting is larger for exports to high-income countries than exports to low-income countries.

Table 4.2: List of major studies on the learning-by-exporting effect

Studies	Country	Methodology	Learning-by-exporting
Aw and Hwang (1995)	Taiwan	Translog production function	No learning-by-exporting
Clerides et al. (1998)	Columbia, Mexico, Morocco	Cost functions	No learning-by-exporting in Columbia and Morocco. Higher productivity of exporting firms in Mexico
Kraay (1999)	China	Dynamic panel	Yes
Bernard and Jensen (1999)	US	Linear probability with fixed	No learning-by-exporting
Delgado et al. (2002)	Spain	Nonparametric analysis	No learning-by-exporting
Castellani (2002)	Italy	Cross-section	Yes
Wagner (2002)	Germany	Panel data; matching	No learning-by-exporting
Baldwin and Gu (2003)	Canada		Yes
Blalock and Gertler (2004)	Indonesia	Translog production function	Yes
Girma et al. (2004)	UK	Panel data; matching	Yes
Greenaway and Kneller (2004)	UK	Panel data; matching	Yes
Yasar and Rejesus (2005)	Turkey	Panel data; matching	Yes
Arnold and Hussinger	Germany	Matching technique	No
Van Biesebroeck (2005)	9 African countries		Yes
De Loecker (2007)	Slovenia	Panel data; matching	Yes
ISGEP (2008)	14 countries	Joint testing methodology	Yes in some countries

Source: Author's summary from previous studies.

Van Biesebroeck (2005) also suggests the important role of scale economies using data for manufacturing firms in nine African countries. After allowing for the selection effect, he finds that firm productivity increases after firm entry into foreign markets, mainly through the mechanism of scale economies thanks to access to export

markets. Although there are a number of studies that examine the learning-by-exporting effects in the manufacturing sector, there has been relatively little literature that has focused on this effect in services sectors. Love and Mansury (2009) is one of few studies that consider the linkage between export and productivity using the data for US services firms in 2004. As discussed in Love and Mansury (2009) exports could lead to higher productivity even after allowing for the self-selection effect. However, they do find limited support for the impact of export intensity on firm productivity. One of the limitations as stated in Love and Mansury's study is that they use cross-sectional data in their study. Their study thereby is unable to explain whether productivity increases after the entry into exporting, i.e. the evidence of learning-by-exporting effect. Using the German data of services firms from 2003 to 2007, Vogel (2010) find that German firms in business services industries do not benefit from exporting in terms of a higher rate of profit for German services firms. In particular, Vogel (2010) finds that export starters in the business services sector are less profitable than non-exporters.

To sum up, although the empirical literature suggests that the evidence for the learning-by-exporting effect is mixed, an increasing number of studies find a positive learning effect from exports in developing countries. In addition, although a number of empirical studies examine learning effects from exporting in manufacturing, few studies such as Love and Mansury (2009) and Vogel (2010) consider this effect in the services sector. In light of the literature, the author examines the learning effect from exports in both the manufacturing and services sector using Vietnam's firm data.

4.5.Conclusion

This chapter reviews the empirical literature associated with the effects of trade liberalization on firm productivity and the two-way relationship between exports and firm productivity.

As discussed above, although a number of empirical studies find that there are positive effects of trade liberalization on firm productivity, trade liberalization can only increase firm productivity if complementary policies are implemented correctly. The positive effects of trade liberalization can be dampened in the case of excessive regulation. Vietnam's Doi Moi has brought significant progress to its economy. Reforms, however, might be hindered by the legacy of the centrally planned system since 1986 that was subsequently reflected in the government's attitude to the rights of firm ownership and in the extent of the government's control of SOEs. Vo (2005) claims that although the Doi Moi reforms were robust, the institutional reforms have been relatively slow, while economic performance has been improving.

The question of whether an economy such as Vietnam's can see improvements in economic growth as a result of trade liberalization is yet to be answered in empirical studies. Given that little attention is paid in the literature to the effect of tariff reductions on firm productivity in Vietnam, this thesis examines the effect of tariff reductions in the case of Vietnam.

The literature suggests that the evidence of a two-way relationship between productivity and exporting is mixed. Although the learning-by-exporting hypothesis is not confirmed in many countries as shown in the empirical literature, the learning effect from exporting may be more evident in developing countries. Exposure to more

developed markets can bring benefits to Vietnam's exporters. Given that the literature has paid little attention to the two-way causal relationship between exports and firm productivity in the services sector, the author examines this two-way relationship in both the manufacturing and services sectors.

In sum, following on from the literature, the author examines whether the trade liberalization can increase firm productivity using Vietnam's manufacturing firm data which are provided in Chapter 5. In Chapter 6 and Chapter 7, the research investigates the two-way relationship between exports and firm productivity using Vietnam's services and manufacturing firm data.

Chapter 5 Trade liberalization and firm productivity: Evidence from firm-level data

5.1. Introduction

The association between international trade and productivity has long been examined in trade theory. As early as Ricardo who suggested that a country or a firm can improve its efficiency by specializing in the good where it has a comparative advantage, there have been an increasing number of theoretical models that examine the impact of free trade and trade liberalization on firm productivity. More recent trade theories such as Krugman (1979, 1980) and Grossman and Helpman (1991) trade models introduce the concepts of increasing returns to scale, the variety of products and monopolistic competition. The introduction of these concepts sheds new light on the impact of trade liberalization on firm productivity. As argued by Krugman (1979) and Grossman and Helpman (1991), trade liberalization can increase firm productivity through the effects of tougher import competition and more varieties of intermediate inputs.

Motivated by the theoretical models, there are a number of empirical studies that examine the association between trade liberalization and firm productivity in both developed and developing countries (Fernandes, 2007; Amiti and Konings, 2007). Although the evidence for the positive effects of trade liberalization has been confirmed in a number of countries, little has been known about whether productivity gains can arise from trade liberalization in a country in transition from a centrally

planned to a market-oriented economy. The research contributes to the literature by examining the association between trade liberalization and firm productivity in Vietnam, a country that underwent a transformation from a centrally planned to a market-oriented economy. Using data on Vietnamese manufacturing firms from 2000 to 2003,[45] I focus specifically on whether trade liberalization following the market reform of Vietnam has led to an increase in firm productivity in the country. Given that the empirical literature pays little attention to the effect of output tariffs (i.e. applied tariffs) and input tariffs on firm productivity in Vietnam, the author examines two research questions as follows:

(i) How do output tariff reductions affect firm-level productivity in Vietnam?

(ii) Do reductions in tariffs on inputs raise firm-level productivity in Vietnam?

In the research, Vietnam's input tariffs are constructed based on output tariffs and then the study examine whether trade liberalization can increase firm-level productivity through the reduction in output tariffs and input tariffs in Vietnam.

In addition, as argued by Vo (2005) although the Doi Moi reforms introduced in 1986 were robust, reforms may have been hindered by the legacy of the model of the centrally planned economy of 1975-86, as reflected in the government's attitude to

[45] In the chapter, the sample period 2000-2003 is chosen for several reasons. First, as mentioned in Chapter 2, this period covers the first years of the second stage of the trade liberalization process. This was a robust liberalization period when a number of tariff reforms were introduced thanks to the further implementation of AFTA and the beginning of BTA with the US. Second, although the Vietnamese enterprise census has been constructed by GSO annually since 2000, the detailed information on firm-level material costs is only available for the period 2000-2003. This allows the author to construct firm-level TFP for this period using the Levinsohn and Petrin (2003) method.

the rights of firm ownership. In particular the government has continued to show favour towards SOEs, which is a hangover from the centrally planned era. Vo (2005) also claims that a dualism has existed since the introduction of the Doi Moi reforms. A number of reforms were enacted to support trade liberalization in export-oriented sectors. At the same time, the government protected the import-substitution sector in which SOEs were dominant. The study thus takes firm ownership structure into account, given that the literature has paid little attention to the role of firm ownership in affecting the firm-level productivity gain from trade policy reforms.

It is noteworthy that in this research, a measure of TFP is constructed using the Levinsohn and Petrin (2003) method to control for the simultaneity bias in the estimation of a production function. Section 5.2 describes the simultaneity bias in more detail. Subsequently, the author examines the effect of tariff reductions on firm TFP using the fixed-effect model. Alternative estimation specifications are also employed to further examine the effect of tariff changes on TFP change. Finally, the research uses the instrumental variable method to control for possible endogeneity between tariff cuts and TFP. The findings in the chapter support the evidence that tariff reductions could have increased firm productivity in Vietnam during the data period examined, from 2000 to 2003. In general, the effect of input tariffs was larger than that of output tariffs. [46]

The rest of the chapter is organized as follows. Section 5.2 reviews the methodology and data used in this chapter. Section 5.2 includes three sub-sections: 5.2.1 presents procedures to construct TFP measures; 5.2.2 provides an empirical

[46] As mentioned in Chapter 2, aside from tariff liberalization, the government also undertook the reforms of NTBs since the 1990s. The effect of NTBs however is beyond the scope of this chapter as the chapter focuses on the effect of tariff liberalization in Vietnam.

framework and econometric issues to identify the impact of trade liberalization on firm productivity; and 5.2.3 describes data used in this chapter. Section 5.3 describes the empirical results. Finally, section 5.4 concludes.

5.2. Methodology and data

In order to identify the effects of tariff reduction on firm productivity levels and growth in Vietnam using the Vietnamese firm-level panel data, the study follows a two-step estimation strategy that has become relatively standard in the literature (Pavcnik, 2002; Amiti and Konings, 2007; Topalova and Amit, 2011). The author thus employs the methodology as follows: a production function equation is estimated using the methodology of Levinsohn and Petrin (2003) to construct consistent TFP measures. Next, a productivity equation is estimated to identify the impact of tariff reductions on firm productivity in Vietnam.

5.2.1. Measuring total factor productivity

This chapter uses the Levinsohn and Petrin (2003) approach to construct consistent TFP instead of the ordinary least squares (OLS) method that might lead to a bias. Empirically, the standard approach is to estimate a Cobb-Douglas production function through OLS as shown in equation (5.1). Such estimates however suffer from simultaneity bias when error terms are correlated with capital and labour inputs. Such bias has been identified since Marschak and Andrews (1944). Olley and Pakes (O-P) developed a methodology to address simultaneity problems, and this approach has commonly been adopted in the literature ever since. This method computes TFP at the

firm level as the difference between the observed output and the predicted output function. Suppose that the technology of firm i is well described by a Cobb-Douglas production function as follows:

$$y_{it}^{j} = \alpha + \beta_l l_{it}^{j} + \beta_k k_{it}^{j} + \omega_{it}^{j} + e_{it}^{j} \quad (5.1)$$

where ω_{it}^{j} is productivity of firm i. ω_{it}^{j} is the part of the error term that is observed by the firm but unobserved by econometrician, while e_{it}^{j} is a true error that may contain measurement errors. y_{it}^{j} , l_{it}^{j} , k_{it}^{j} are the logs of value added, labour and capital stock, respectively.

The simultaneity bias problem might happen if productivity shocks across firms are correlated with inputs k_{it} and l_{it}. To address simultaneity bias, the O-P approach uses observed investment decisions as a proxy for unobserved productivity shocks.

Levinsohn and Petrin (2003) developed a methodology on the basis of the O-P framework by using the intermediate input demand function to control for productivity shocks. Levinsohn and Petrin (2003) assume that TFP exogenously follows the first-order Markov process, that is

$$\omega_t = E[\omega_t|\omega_{t-1}] + \xi_t \quad (5.2)$$

The process means that a higher current TFP leads to expectation of future realizations of higher TFP. In other words, a firm with higher productivity is expected to use more intermediate inputs in order to achieve higher productivity in the future. Thus intermediate input demand is an unknown function of productivity and capital:

$$m_{it}^{j} = f(\omega_{it}^{j}, k_{it}^{j}) \quad (5.3)$$

Assuming that m is monotonic in productivity, the inverted form of equation (5.3) is

$$\omega_{it}^{j} = f^{-1}(m_{it}^{j}, k_{it}^{j}) \quad (5.4)$$

To identify a consistent estimate of l_{it}^{j}, this method substitutes equation (5.4) in the production function in order to control for productivity shocks, thus:

$$y_{it}^{j} = \alpha + \beta_l l_{it}^{j} + \lambda_{it}^{j} + e_{it}^{j} \quad (5.5)$$

where

$$\lambda_{it}^{j} = \beta_k k_{it}^{j} + f^{-1}(m_{it}^{j}, k_{it}^{j}) \quad (5.6)$$

To construct TFP measures, a two-stage estimation process is employed.[47] The purpose of the first stage is to obtain the estimated $\widehat{\beta_l}$. In the second stage, the estimated $\widehat{\beta_k}$ is identified.

After two stages of estimation, estimated $\widehat{\beta_l}$ (from stage 1) and $\widehat{\beta_k}$ (from stage 2) are fitted into equation (5.7) to get the log of estimated TFP:

$$\omega_{it}^{j} = y_{it}^{j} - \widehat{\beta_l} l_{it}^{j} - \widehat{\beta_k} k_{it}^{j} \quad (5.7)$$

This research uses the Stata levpet[48] command to get measures of TFP. In this chapter, the production function is estimated separately for each two-digit VSIC sector.

[47] The Appendix provides more details on the two estimation stages of the Levinsohn and Petrin (2003) method.
[48] Petrin, Levinsohn and Poi (2004) provide further information on this programme.

5.2.2. Empirical framework

After obtaining the log estimated TFP, a productivity equation is estimated to identify the impact of output tariffs and input tariffs. First, all the regressions have been conducted with firm, industry and year fixed effects. Next, the methodology follows Amiti and Konings (2007) to employ alternative empirical specifications to examine the impact of trade liberalization on the growth of firm productivity.

The main estimating equation in this study is:

$$TFP_{it}^{j} = \alpha_0 + \alpha_1 (\text{output tariff})_t^j + \alpha_2 (\text{input tariff})_t^j + \alpha_3 (\text{output tariff})_t^j * herf^j + \beta X_{it} + \mu_i + I^j + \lambda_t + \nu_{it}^j \quad (5.8)$$

where TFP_{it}^{j} is total factor productivity of firm i in industry j at time t . $(\text{output tariff})_t^j$ and $(\text{input tariff})_t^j$ are output tariffs and input tariffs for industry j at time t. $(\text{output tariff})_t^j * herf^j$ is the interaction term between output tariffs and the Herfindahl index for industry j. X_{it} is other control variables for firm i at year t such as firm foreign ownership and the Herfindahl index, μ_i is firm fixed effects, I^j is industry fixed effects, λ_t is year fixed effects, ν_{it}^j is an idiosyncratic effect.

To estimate the productivity equation (5.8) the research takes several econometric issues into account. First, the government can enact an import protection policy that differs across industries. To control for unobserved time-invariant industry characteristics such as industry-specific import protection policies, the chapter includes the industry fixed effects in the estimation equation (consistent with Goldberg and Pavcnik, 2005).

In addition to industry fixed effects, to control for unobserved firm-specific time-invariant effects such as firm location, the firm fixed effects are also used in the

estimation equation. Year fixed effects are included to control for any time-variant effects. Thus the error term is divided into four components: (1) firm-specific fixed effects to control for time-invariant factors such as a firm's location; (2) year-specific fixed effects to control for firm-invariant factors such as other macro policy changes, (3) industry-specific fixed effects, and (4) an idiosyncratic effect.

In addition, Hausman tests are undertaken to compare fixed with random effects. In the chapter, the empirical framework is estimated with robust standard errors. The standard Hausman test is not valid in this case (Wooldridge, 2002). The author thus undertakes both standard Hausman tests and robust versions of Hausman tests.[49]

In equation (5.8), the main variable of interest is trade policy measures. Harrison (1996) suggests that the use of tariffs is the useful way to identify the impact of trade liberalization. Furthermore, a number of studies that examine Vietnam's trade liberalization process have used import weighted tariff rates (particularly, Nguyen, 2002, and Bui and Kiyoshi, 2012). In this chapter, the study also employs import weighted tariffs (i.e. output tariffs in equation (5.8)) applied at the four-digit VSIC industries as a measure of trade policy. Section 5.2.3 describes the output tariffs in more detail.

As discussed in Chapters 3 and 4, the literature suggests that a fall in the output tariff is positively correlated with productivity thanks to import competition effects (Krugman, 1979; Helpman and Krugman, 1985; and Melitz, 2003). In addition, a reduction in input tariffs can lead to a greater variety of imported inputs used for

[49] The research uses Stata xtoverid programme in the case of robust standard errors. Schaffer and Stillman (2006) provide further information on this programme.

production. Subsequently, the availability of foreign inputs can increase productivity through the embodied technology gain transferred from more advanced economies (Grossman and Helpman, 1991; Feenstra et al., 1992; and Feenstra, 1994). To separate the impacts of output and input tariff reductions, tariffs on inputs are included in equation (5.8). Tariffs on inputs are calculated from the output tariffs and I-O table.[50]

In addition, the research includes the Herfindahl concentration index as a control variable. This chapter follows Amiti and Konings (2007) in constructing the Herfindahl index by using firm output. In particular, the Herfindahl index is constructed as the sum of the squares of output share in the industry. The Herfindahl index reflects the extent of domestic competition at the industry level. A higher value of the Herfindahl index implies a high level of industry concentration, thus less competition. Following Fernandes (2007), this research uses the Herfindahl index in 2000 for the estimation equation. The aim of the Herfindahl index as used in this chapter is to examine how firm productivity responds to tariff liberalization between the most concentrated sectors and less concentrated ones. In other words, the author examines the association between the extent of domestic competition and tariff liberalization in Vietnam. In addition, firms in the most concentrated sectors are likely to charge higher mark-ups than other firms, as stated in Amiti and Konings (2007). The Herfindahl index is included to check whether productivity rises stem from the increase in real efficiency or just mark-up changes. If productivity gains accrue from mark-up changes, this would be reflected more in the more highly concentrated sectors.

[50] Details on the calculation of tariffs on inputs are provided in section 5.2.

To further identify the effects of tariff reduction, the Herfindahl index is used with the indicator dummy for the most highly concentrated sectors (with a Herfindahl index in the 75th percentile). Amiti and Konings (2007) suggest that the positive effect of output tariff reductions on the productivity of domestic producers accrues to the less concentrated sectors because output tariff reductions can affect firm productivity in the Vietnamese firms through tougher competition.

Previous work also suggests that foreign-invested enterprises (FIEs) have relative high productivity compared to non-FIEs. Therefore, a dummy of FIEs is included in the estimation equation to examine FIEs' TFP.

In addition to the fixed-effect models, this study follows Amiti and Konings (2007) to employ alternative econometric specifications. In particular, the estimation framework is converted to first-differences to assess the impact of a tariff change on a firm's productivity. This differencing could wipe out unobserved firm heterogeneity. Next all variables are included in two-period and three-period differences in order to further examine the effect of the changes in tariffs on TFP changes.

Alternative specifications can be written as follows:

$$\Delta TFP_{it}^{j} = \alpha_0 + \alpha_1 \Delta(\text{output tariff})_t^j + \alpha_2 \Delta(\text{input tariff})_t^j + \Delta\lambda_t + \Delta v_{it}^j \qquad (5.9)$$

5.2.3. Data

5.2.3.1. Firm-level data

Vietnam's General Statistics Office (GSO) has undertaken the annual Enterprise Census since the Enterprise Law was introduced in 2000. The GSO's provincial offices are responsible for data collection through interviews with enterprise

managers. As the questionnaires are completed and verified by enterprise managers, the data are nearly the same as the official information reported to the tax offices. In addition, the GSO also constructs the input-output table using this census. The census provides the firm-level information on revenue, profit, capital stock, labour, exports, imports,[51] firm ownership status and investment.

In the GSO's enterprise census project, the GSO undertakes an annual survey that is an integrated part of the census. The purpose of this survey is to provide an understanding of the cost structure of the firms in Vietnam. In the survey there is rich information on business and production intermediate costs, e.g. information on the raw materials, instruments, spare parts, business and labour costs. As the surveys are conducted annually, they can be merged in order to construct the balanced panel data using the firm's tax file number that has been included in the latest versions of the dataset thanks to changes in the GSO's regulations. All estimations conducted in this study use this enterprise survey to measure firm productivity and tariff impacts on firm productivity.

The balanced panel database includes 1,840 manufacturing firms during 2000-03 (7,360 observations) for all manufacturing sectors. This is a representative sample of the Vietnamese firms. Although the period for which firm data are available cannot cover the whole trade liberalization process, the chapter focuses on the stage of robust tariff liberalization with the implementation of both AFTA and the Vietnam-US BTA. In addition, there could be the incidental parameters problem that was first considered by Neyman and Scott (1948). To avoid the incidental parameters problem, fixed effect

[51] The enterprise census provides information on firm-level imports for data for 2000 only.

estimation that sweeps out the firm fixed effects is employed. Table 5.1 provides the descriptive statistics of the variables used in the estimation equation.

Table 5.1: Descriptive statistics (2000-03)

Source: The Vietnamese enterprise survey (GSO)

Except for labour, all other variables are deflated at constant 1994 prices. Firms are classified into two-digit sectors based on the firm's main sector in the census. For example, a company producing steel will be predominantly in the manufacturing sector but may also have interests in the services sector, but its dominant activity is metal production, so this is its 'main sector'. The average output share of the main sector for the firms in this dataset is 0.981[52] over the period, suggesting that the share of production that firms not accounted for in the main sector is very small.

5.2.3.2.Tariff data

Data on all types of tariff rates including MFN, other preferential and normal rates at the eight-digit HS level are mainly collected from Vietnam's General Department of Customs. Data on recorded import values is also collected from

[52] The average output share of main sector is the ratio of the main sector's output over total output.

Vietnam's General Department of Customs. The I-O table 2000 was constructed by GSO in 2001.

Table 5.2: Output tariffs by two-digit sector, 2000-03[53]

	Sectors	2000	2001	2002	2003
15	Food manufacturing and beverages	23.9	23.8	22.3	20.2
16	Tobacco	33.2	33.5	34.4	35.4
17	Textiles	31.6	31.3	30.7	29.9
18	Wearing apparel	47.9	47.2	46.5	45.2
19	Leather products and footwear	19.3	19.1	18.7	17.6
20	Wood and wood products	6.4	6.2	5.2	4.6
21	Paper and paper products	17.1	16.9	16.5	16.4
22	Printing and publishing	9.4	9.3	9.1	8.8
24	Chemicals and chemical products	5.4	5.2	4.8	4.5
25	Rubber and plastics products	14.5	14.9	14.8	14.2
26	Non-metallic mineral products	20.3	19.9	19.5	18.4
27	Basic metals	4.9	5.1	5.1	4.8
28	Fabricated metal products	6.1	6.7	6.6	6.2
29	Machinery and equipment	5.6	5.4	5.1	4.3
31	Electrical machinery	8.2	8.3	9.1	9.3
32	Television and communication	6.6	7.1	7.5	7.9
33	Medical and optical equipment	3.9	3.8	2.9	2.2
34	Motor vehicles	50.2	45.4	44.2	43.6
35	Other transport equipment	15.8	16.5	15.2	14.2
36	Furniture and other manufactures	20.9	20.7	19.8	18.3
	Weighted average of manufacturing sectors[54]	22.6	22.3	21.4	20.3

Source: Author's calculation from the data of all types of tariffs that are collected from General Department of Customs.

In the study, output tariffs are import weighted averages of all types of tariffs. Table 5.2 presents the output tariffs in Vietnam from 2000 to 2003. As shown in Table 5.2, the tariff was highest for motor vehicle and wearing apparel, textiles and garments, and tobacco products. Food products, rubber and plastic products, footwear and furniture manufacturing come next. Tariffs in the sectors of chemical products and

[53] Output tariffs by two-digit sector are value added-based weighted averages of output tariffs.
[54] Average tariffs of all manufacturing sectors are the averages of output tariffs that are weighted based on value added by sector.

medical and optical equipments were relatively modest. It is worth noting that tariffs tend to be higher on final goods than on intermediate manufactured goods. While the tariff for sectors producing intermediate goods were moderate, that for sectors producing consumer goods were rather high, implying that Vietnam's tariff system followed an escalating structure.

In addition to output tariffs, this method uses tariffs on inputs in the estimation equation. Input $tariff_t^k$ of industry k is a weighted average of output tariffs of all inputs in the production of a good in industry k. In other words, Input $tariff_t^k$ is computed as follows:

$$\text{Input tariff}_t^k = \sum_j a_{ij} \text{ output tariff}_t^j \quad (5.10)$$

Output tariffs are import weighted tariff rates of industry j to produce a good in industry k. a_{ij} is cost share of industry j in the production of a good in industry k. a_{ij} is collected from the input-output table in 2000. To compute output $tariff_t^j$, the study maps the tariffs into 112 industries of the I-O table in 2000. Calculation of input tariffs is based on the I-O table at basic prices. In the I-O table in 2000, three types of prices including producers' price, consumers' price and basic price are used in order to construct the I-O table. Producers' price equals consumers' price minus trade costs and transport costs. Basic price equals producers' price minus production taxes.

Like output tariffs, input tariffs are highest for wearing apparel and motor vehicles. Input tariff rates are lowest for rubber and plastics products.[55] While output tariffs are higher than input tariffs for most industries during the period 2000-03, both

[55] The Appendix reports the details on input tariffs by industry.

tariff rates experienced a decline over this period in Vietnam. The correlation between output tariffs and input tariffs is 0.56.

5.3.Empirical results

5.3.1. Total factor productivity

As discussed in section 5.3, the Levinsohn and Petrin (2003) methodology is used to construct firm productivity measures. In this chapter, the production function is estimated separately for each of 19 manufacturing sectors[56] using the Levinsohn and Petrin (2003) methodology. As there are just a few observations in tobacco; coke and petroleum products; computer and office equipment; and recycled products, these sectors are merged into food manufacturing and beverages; chemicals and chemical products; electrical machinery; and furniture and other products, respectively, for the estimation of the production function.

The results from estimating the production function for each two-digit sector are presented in Table 5.3. As shown in Table 5.3, the estimated coefficients of labour and capital are from 0.60 to 0.80 for labour and from 0.27 to 0.56 for capital. It is noteworthy that the total output elasticity is close to one suggesting that the sector operates with constant returns to scale. The Wald test results suggest that the assumption of constant returns to scale cannot be rejected at 10 percent for all sectors. As shown in Table 5.3, the estimated coefficients of labour are higher than that of capital in most sectors. The estimation results are consistent with the results given in previous studies.

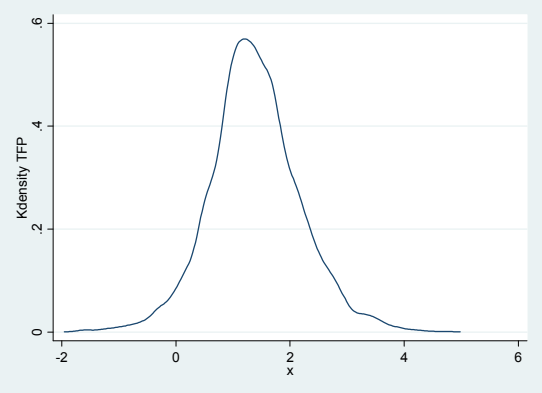
[56] Manufacturing sectors in this research are classified according to the Vietnam Standard Industrial Classification (VSIC) 1993. More details of VSIC are reported in the Appendix.

Table 5.3: Coefficients of the production function

Variables	Labour	Capital	Observations	CRTS p value
Food manufacturing and beverages	0.593***	0.377***	2,612	0.505
	(0.028)	(0.043)		
Textiles	0.617***	0.421***	196	0.819
	(0.089)	(0.156)		
Wearing apparel	0.748***	0.312**	332	0.627
	(0.061)	(0.137)		
Leather products and footwear	0.791***	0.303**	176	0.527
	(0.088)	(0.153)		
Wood and wood products	0.706***	0.377**	372	0.535
	(0.067)	(0.147)		
Paper and paper products	0.692***	0.271**	232	0.749
	(0.085)	(0.123)		
Printing and publishing	0.540***	0.396***	176	0.687
	(0.093)	(0.152)		
Chemicals and chemical products	0.493***	0.481***	332	0.837
	(0.072)	(0.130)		
Rubber and plastics products	0.656***	0.251***	340	0.329
	(0.088)	(0.056)		
Non-metallic mineral products	0.587***	0.422***	1,128	0.911
	(0.059)	(0.066)		
Basic metals	0.570***	0.477*	60	0.832
	(0.162)	(0.256)		
Fabricated metal products	0.686***	0.299**	360	0.919
	(0.086)	(0.137)		
Machinery and equipment	0.608***	0.419***	120	0.841
	(0.079)	(0.157)		
Electrical machinery and office equipment	0.574***	0.418***	196	0.962
	(0.088)	(0.161)		
Television and communication	0.468***	0.459**	72	0.717
	(0.177)	(0.228)		
Medical and optical equipment	0.418**	0.504**	52	0.766
	(0.185)	(0.223)		
Motor vehicles	0.522***	0.415**	96	0.759
	(0.117)	(0.176)		
Other transport equipment	0.485***	0.563***	148	0.804
	(0.139)	(0.152)		
Furniture and other manufactures	0.642***	0.416**	360	0.732
	(0.063)	(0.175)		

Notes: CRTS is constant returns to scale. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Figure 5.1: Kernel density estimate of TFP (2000-03)



Source: TFP is constructed using the Vietnamese enterprise survey (2000-2003)

Le (2010) estimates a production function for Vietnam's SMEs. He suggests that the production of Vietnam's SMEs is labour intensive, showing that the estimated coefficients of labour, capital and intermediate inputs are in a range of 0.14-0.17, 0.02-0.03 and around 0.8, respectively. His study also shows that the total output elasticity is close to one, suggesting that there are constant returns to scale in Vietnam's manufacturing SMEs.

Vu (2003) also examines TFP growth of manufacturing enterprises at the aggregate level in Vietnam during 1976-1998. His study finds that the estimated coefficients of capital and labour are in a range from 0.2 to 0.21 and from 0.19 to 0.23, respectively, while the estimated coefficients of intermediate inputs is from 0.5 to 0.55.

Based on the estimated coefficients of labour and capital, the TFP estimates are constructed from equation (5.7). Figure 5.1 shows the Kernel density estimate of TFP that is constructed using the Levinsohn and Petrin (2003) method.

After obtaining TFP measures, equation (5.8) is estimated using Vietnam's balanced panel data with industry, firm and year effects. Next, alternative specifications are used in order to examine the impact of trade liberalization on changes in productivity.

5.3.2. Results

The estimation results for 1,840 firms from 2000 to 2003 are presented in Table 5.4. The main variables are output tariffs and input tariffs while firm foreign ownership and the Herfindahl index are control variables. Firm, year and industry fixed effects are also included in the estimation equation. In the research, standard Hausman tests and robust versions of Hausman tests are conducted in order to compare fixed with random effects. All results of the Hausman tests indicate the dominance of the fixed effect estimation method as shown in Table 5.4.

The result from column 1 of Table 5.4 shows that the coefficient for the output tariffs is negative and significant. The negative coefficient indicates that a lower output tariff leads to higher firm-level productivity.[57] In particular, the magnitude of the coefficient suggests that a decrease in the output tariffs of 10 percentage points increases productivity by 0.2 percent. This result is consistent with the findings suggested in Amiti and Konings (2007) who examine the effect of output tariffs on

[57] It should be noted that there is a possibility of endogeneity between productivity and tariff liberalization, as suggested in some studies such as Amiti and Konings (2007). The next section of this chapter will further consider this endogeneity.

Indonesia's firm productivity, although the effect of output tariffs is larger for Indonesia than for Vietnam.[58]

Table 5.4: Average impact of tariff reduction on firm productivity

Variables	(1) tfp	(2) tfp	(3) tfp	(4) tfp	(5) tfp
Output tariff	-0.0211***	-0.0150***	-0.0203***	-0.0170***	-0.0165***
	(0.0022)	(0.0025)	(0.0015)	(0.0017)	(0.0016)
herf2000			-0.200**	-0.693***	-0.686***
			(0.0796)	(0.100)	(0.0958)
intariff		-0.0290***		-0.0383***	-0.0331***
		(0.0065)		(0.0061)	(0.00581)
Output tariff *herf				0.0079***	0.0065***
				(0.0011)	(0.0011)
fies					0.501***
					(0.0237)
Firm FEs	Yes	Yes			
Year FEs	Yes	Yes	Yes	Yes	Yes
Industry FEs			Yes	Yes	Yes
Observations	7,360	7,360	7,360	7,360	7,360
Number of firms	1,840	1,840	1,840	1,840	1,840
R-squared	0.078	0.085	0.371	0.382	0.425
Hausman tests p-value	0.000	0.000	0.000	0.000	0.000
Hausman tests p-value (Robust standard errors)	0.000	0.000	0.000	0.000	0.000

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is TFP which is obtained by using the Levinsohn and Petrin (2003) approach with value added as the dependent variable. Output tariffs are the weighted output tariff rates. Input tariff rates (intariff) are computed from output tariffs and the I-O table. fies is foreign-invested enterprises. herf2000 is Herfindahl index in 2000. Output tariff*herf is the interaction of output tariff and herf2000.

As shown in column 1, a reduction in output tariffs increases firm productivity. In addition to the effect of output tariffs, the literature suggests the impact of tariffs on the use of inputs. Firms can increase their productivity through increased access to

[58] Amiti and Konings (2007) show that firm productivity increases by 1-6 percent with a 10 percentage point change in output tariffs, using Indonesian manufacturing firm productivity from 1991 to 2001.

relatively cheap intermediate inputs (Grossman and Helpman, 1991). Therefore, in columns 2, 4 and 5 tariffs on inputs are included in the estimation equation.

The results in columns 2, 4 and 5 show that the sign of the coefficient of output tariffs did not change after input tariffs were included in the productivity equation. The coefficients for both tariffs are negative and highly significant, suggesting the role of the availability of imported inputs in enhancing the firm productivity. It is noteworthy that the magnitude of the effects of output tariffs slightly declines once the tariff on inputs is included. The results from columns 2, 4 and 5 indicate that a decrease in the output tariff of 10 percentage points increases productivity by only 0.15-0.17 percent. In contrast, a 10 percentage point decrease in the input tariff increases productivity by more than 0.3 percent.

In addition, the level of the Herfindahl index is taken into account to control for the industry concentration in the market.[59] A higher Herfindahl index reflects a higher level of concentration (i.e. less competition) in an industry. As stated in section 5.2, the initial year's Herfindahl index is used. The results from columns 3, 4 and 5 show that the coefficient of the output tariff still negative and significant. The negative coefficient for Herfindahl index suggests that the firms in highly concentrated industries have lower productivity levels. To examine further the competition effects of output tariff reduction, the author interacts the output tariff with the Herfindahl index indicator dummy of very highly concentrated sectors. Many studies such as Fernandes (2007) and Amiti and Konings (2007) suggest that the industry concentration can affect the association between tariff liberalization and firm productivity. The chapter includes the interaction term as it is possibly an important

[59] The Herfindahl index is constructed as the sum of the squares of output share in the industry.

omitted variable. As shown in columns 4 and 5 the positive and significant coefficient of the interaction term suggests that a reduction in output tariffs did not lead to a productivity rise in the most concentrated sectors. In other words, when the interaction term is added, the results show that firm productivity generally rises following tariff liberalization but the firms in the most concentrated sectors (i.e. the least competitive sectors) experience a decline in productivity due to tariff reductions, implying that productivity gain stemmed from tariff liberalization accrues only to less concentrated sectors (i.e. more competitive sectors) in Vietnam. Facing increased competition driven by tariff cuts, firm productivity in the most concentrated sectors may arise if these firms can increase their efficiency by using inputs more effectively (Holmes and Schmitz, 2001) or adopting new and innovative technology (Boone, 2000; and Yeaple, 2005). Amiti and Konings (2007) however report the opposite result. The question as to whether firm productivity in the most concentrated sectors can increase following tariff cuts remains to be answered in empirical studies, as there are just a few studies that have examined this to date. In the case of Vietnam, the empirical results show that the firms in the most concentrated sectors experienced a decline in productivity due to tariff reductions. This may reflect that these firms are inefficient in using inputs and modernizing production processes when facing increased competition from foreign firms. In addition, previous studies suggest that FIEs have higher productivity than non-FIEs (Le, 2010). Therefore, the author includes a dummy of FIEs as shown in column 4.[60] The result from Table 5.4 suggests that the coefficient of foreign ownership is significantly positive. The outcome thereby is consistent with other studies' findings that firm productivity for FIEs is generally higher than that for non-

[60] Foreign-invested firms are firms that have more than 10 percent of total investment from foreign investors.

FIEs in Vietnam. FIEs might have advantages in capital, technology and knowledge. Another reason is that foreigners could invest in highly productive domestic firms. It should be noted that the author uses a 2-step estimation approach to examine the effect of tariff liberalization on firm TFP. In the second step, the dependent variable is TFP estimates. Although the estimated TFP is not true value (that is, they are the estimates obtained from the first step), they may be measured with random error in the linear regression model and therefore the error term can include this. In addition, to check the robustness of using the TFP estimates as the dependent variable, following Amiti and Konings (2007), the author changes the dependent variable in equation (5.8) (i.e. TFP estimates) to be the value added per worker. The results that are reported in the appendix show that the positive and significant effect of tariff liberalization is maintained.

In sum, the findings shown in Table 5.4 support the evidence that trade liberalization can increase firm productivity in Vietnam. As argued by the literature, trade liberalization can lead to firm productivity gains through two effects: the competition effect (Krugman, 1979; Helpman and Krugman, 1985) and effects of foreign quality and greater variety of inputs (Grossman and Helpman, 1991 and Feenstra et al., 1992).

5.3.3. Trade liberalization and firm-specific characteristics

As suggested in section 5.3.2, the empirical results show that trade liberalization can increase firm productivity. Firms, however, are heterogeneous in

response to trade policy reforms. This section considers whether different firms can respond to trade liberalization differently.

Table 5.5: Trade liberalization and firm size

Variables	(1) tfp	(2) tfp	(3) tfp
	Large and medium firms vs. small firms		
Output tariff *large	-0.0155***	-0.0131***	-0.0137***
	(0.0027)	(0.0038)	(0.0019)
Output tariff *small	-0.0223***	-0.0155***	-0.0141***
	(0.0026)	(0.0030)	(0.0015)
Intariff*large		-0.0165*	-0.0239***
		(0.0098)	(0.0062)
Intariff*small		-0.0312***	-0.0351***
		(0.0074)	(0.0060)
herf2000			-0.324***
			(0.0734)
fies			0.489***
			(0.0240)
Observations	7,360	7,360	7,360
R-squared	0.079	0.086	0.427
Number of tn1	1,840	1,840	1,840
Hausman tests p-value	0.000	0.000	0.000
Hausman tests p-value (Robust standard errors)	0.000	0.000	0.000

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is TFP, obtained by using the Levinsohn and Petrin (2003) approach with value added as a dependent variable. Output tariffs are the weighted output tariff rates. Input tariff rates (intariff) are computed from output tariff and the I-O table. fies is foreign-invested enterprises. outputtariff*large, outputtariff*small, intariff*large, intariff*small are interactions of output tariff and input tariffs with a dummy of large firms and small firms, respectively. herf2000 is Herfindahl index in 2000.

Firms are classified into medium and large firms and small ones. Small firms are the firms that have less than 200 employees while medium and large firms have more than 200 employees.[61,62] Following Fernandes (2007), firm classification in 2000 is used to construct two firm groups, namely a medium and large firm group, and a

[61] Firm size is defined according to the Government's Decree No. 56/2009/ND-CP
[62] The firms are grouped by employment for both manufacturing and services firms. This enables the classification of firms to be consistent throughout the thesis.

small firm group. In order to examine the effects of tariff reductions on firm productivity in the two groups, the interaction of output tariffs and input tariffs with the dummies of large firms and small firms is also included in the estimation equations.

In Vietnam's transition economy, the government in general supports the dominance of SOEs in manufacturing industries. This may be reflected in the government's policies including trade policy reforms. In other words, trade might be liberalized in favour of SOEs. To examine whether the productivity gain arises from trade liberalization suggested in section 5.3.2 for both SOEs and non-state firms, the effects of trade liberalization are estimated for non-state enterprises and SOEs separately.

Table 5.6: Trade liberalization and firm ownership (1)

Variables	(1) tfp	(2) tfp	(3) tfp	(4) tfp	(5) tfp	(6) tfp
	State-owned firms			Non-state firms		
Output tariff	-0.0199***	-0.00970	-0.0113**	-0.0213***	-0.0156***	-0.0150***
	(0.0053)	(0.0060)	(0.0052)	(0.0024)	(0.0028)	(0.0017)
intariff		-0.0412**	-0.0742***		-0.0277***	-0.0348***
		(0.0168)	(0.0185)		(0.0071)	(0.0065)
herf2000			-0.507***			-0.174*
			(0.136)			(0.0934)
Observations	784	784	784	6,576	6,576	6,576
R-squared	0.066	0.078	0.511	0.080	0.086	0.355
Number of firms	196	196	196	1,644	1,644	1,644
Hausman tests p-value	0.000	0.000	0.000	0.000	0.000	0.000
Hausman tests p-value (Robust standard errors)	0.000	0.000	0.000	0.000	0.000	0.000

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is TFP, obtained by using the Levinsohn and Petrin (2003) approach with value added as a dependent variable. Output tariffs are the weighted output tariff rates. Input tariff rates (intariff) are computed from output tariff and the I-O table. herf2000 is Herfindahl index in 2000.

Finally, as FDI attraction policy is a major element of the reform process in Vietnam, trade liberalization might be FDI-oriented. Foreign-invested enterprises might obtain some productivity gain owing to their foreign ownership status. To rule out this possibility, the study also examines the effect of trade policy reforms on firm productivity in domestic firms and FIEs separately.

Table 5.7: Trade liberalization and firm ownership (2)

Variables	(1) tfp	(2) tfp	(3) tfp	(4) tfp	(5) tfp	(6) tfp
	Domestic firms			Foreign-invested firms		
Output tariff	-0.0198***	-0.0130***	-0.0139***	-0.0238***	-0.0214***	-0.0192***
	(0.0025)	(0.0029)	(0.0018)	(0.0047)	(0.0050)	(0.0024)
intariff		-0.0347***	-0.0342***		-0.0093	-0.0168
		(0.0074)	(0.0068)		(0.0128)	(0.0109)
herf2000			-0.384***			-0.167
			(0.079)			(0.192)
Observations	6,204	6,204	6,204	1,156	1,156	1,156
R-squared	0.061	0.070	0.330	0.173	0.174	0.595
Number of firms	1,551	1,551	1,551	289	289	289
Hausman tests p-value	0.000	0.000	0.000	0.000	0.000	0.000
Hausman tests p-value (Robust standard errors)	0.000	0.000	0.000	0.000	0.000	0.000

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is TFP, obtained by using the Levinsohn and Petrin (2003) approach with value added as a dependent variable. Output tariffs are the weighted output tariff rates. Input tariff rates (intariff) are computed from output tariff and the I-O table. herf2000 is Herfindahl index in 2000.

The results from estimating equation (5.8) for each firm group are presented in Tables 5.5, 5.6 and 5.7. Table 5.5 reports the results for the small firm group and medium and large firm group. Column 1 reports the effects of output tariffs while column 2 show the effects of both output tariffs and input tariffs. The dummy of foreign ownership and the Herfindahl index are included in column 3. As shown in

Table 5.5, small firms are more sensitive to trade liberalization than medium and large firms. The coefficients of the interactions of both output tariffs and input tariffs are greater for small firms than for medium and large firms.

The results from Table 5.6 show the effect of tariff reductions on state-owned and non-state firm productivity. The results in column 4, 5 and 6 of Table 5.6 suggest that the productivity gains are not just observed in SOEs as coefficients of output tariffs and tariffs on input are negative and significant for the case of non-state firms. The effect of output tariffs is smaller for state-owned firms than for non-state firms whereas the effect of input tariffs is larger for state-owned firms. The results from Table 5.7 show the effect of tariff reductions on domestic and foreign-invested firm productivity. The positive effects of tariff cuts for domestic and foreign-invested enterprises in column 4, 5 and 6 suggest that the productivity gains are not just observed in foreign-invested firms as coefficients of output tariffs and tariffs on input are negative and significant for all domestic firms. The effect of input tariff reduction on FIEs productivity is not significant. This can be explained by the fact that FIEs could acquire foreign technology and knowledge already. The effects of input tariff liberalization for FIEs through the transfer of advanced technology and knowledge embodied in inputs might be comparatively weaker, compared to non-FIEs.

5.3.4. Trade liberalization and industry-specific characteristics

This section examines the effect of tariff cuts in different industries. The industries are classified into low technology industries and medium and high technology industries. Industries are classified based on VSIC 1993 constructed by GSO. VSIC 1993 classified the industries in terms of technology used in the industries.

According to VISC 1993, D15-23 and D36-37 are low technology industries; and D24-35 are medium and high technology industries.[63] Results from Table 5.8 shows that the effects of output tariffs are positive and significant in all industries. Columns 1 and 2 report the effects of the output tariff and input tariff in low technology industries while columns 4 and 5 show these effects in medium and high technology industries. The Herfindahl index and a dummy of foreign ownership are included in columns 3 and 6.

Table 5.8: Trade liberalization and industry-specific characteristics

Variables	(1) tfp	(2) tfp	(3) tfp	(4) tfp	(5) tfp	(6) tfp
	Low technology industries			Medium and high technology industries		
Output tariff	-0.0200***	-0.0122***	-0.0108***	-0.0213***	-0.0174***	-0.0189***
	(0.0033)	(0.0034)	(0.0018)	(0.0029)	(0.0037)	(0.0023)
intariff		-0.0462***	-0.0670***		-0.0159*	-0.0089
		(0.0105)	(0.0099)		(0.0083)	(0.0069)
herf2000			-0.183**			-0.601***
			(0.0877)			(0.124)
fies			0.429***			0.576***
			(0.0362)			(0.0316)
Observations	4,456	4,456	4,456	2,904	2,904	2,904
R-squared	0.051	0.061	0.247	0.126	0.129	0.562
Number of firms	1,114	1,114	1,114	726	726	726
Hausman tests p-value	0.000	0.000	0.000	0.000	0.000	0.000
Hausman tests p-value (Robust standard errors)	0.000	0.000	0.000	0.000	0.000	0.000

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
(Dependent variable is TFP, obtained by Levinsohn and Petrin (2003) approach with value added as a dependent variable. Output tariffs are the weighted tariff rates. Input tariff rates (intariff) are computed from output tariffs and I-O table. fies is foreign-invested enterprises.

The results from estimating equation (5.8) for different industry groups are reported in Table 5.8. The results show that a decrease in output tariffs increases firm productivity in both industry groups. Interestingly, as shown in Table 5.8 the effects of input tariffs are larger for low technology industries than for medium and high

[63] The Appendix provides more details about industry category issued by GSO.

technology industries. One possible explanation is that Vietnam has a comparative advantage in low technology industries such as textiles, garments, and wood and wood products. The dominance of these export-oriented industries can strengthen their absorption of positive effects of input tariff cuts through the increased variety of foreign inputs.

5.3.5. Results from alternative specifications

Table 5.9: Results in alternative specifications

Variables	(1) Δtfp	(2) Δtfp	(3) Δtfp	(4) Δtfp	(5) Δtfp	(6) Δtfp
ΔOutput tariff	-0.0232***	-0.0175***	-0.0211***	-0.0163***	-0.0180***	-0.0130***
	(0.0022)	(0.0026)	(0.0024)	(0.0033)	(0.0033)	(0.0044)
Δintariff		-0.0249***		-0.0208**		-0.0220*
		(0.0063)		(0.0082)		(0.0114)
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,520	5,520	3,680	3,680	1,840	1,840
R-squared	0.043	0.047	0.037	0.039	0.026	0.028

Note: Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Dependent variable is TFP, obtained by using the Levinsohn and Petrin (2003) approach with value added as a dependent variable. Output tariff is the weighted output tariff rates. Input tariff rates (intariff) is computed from output tariffs and the I-O table. ΔOutput tariff, Δintariff are first-different values of output tariffs and intariff in columns (1)-(2), values in two-period differences in columns (3)-(4) and values in three-period differences in columns (5)-(6), respectively.

So far, the effect of tariffs on firm productivity using the firm, industry and year fixed effects has been estimated. In this section, the research follows Amiti and Konings (2007) to employ alternative econometric specifications. In particular, the author converts the estimation framework to first-difference, second-difference and third-difference to assess the impacts of tariff changes on the growth of firm productivity. This differencing could wipe out unobserved firm heterogeneity. After

converting to different specifications, the results in Table 5.9 show that the sign and the coefficients for both output tariffs and input tariffs are negative and significant, consistent with the results suggested in section 5.3.2.

5.3.6. Instrumental variables approach

To reduce the estimation bias caused by unobserved fixed effects, the equations (5.8) and (5.9) control for the firm and year fixed effects. However, some unobserved factors would still change across firms over time. Endogeneity problems also might happen between firm productivity and trade policy as the government wants to protect some industries or some firms might lobby the government to protect their industries. These time-varying industry characteristics could simultaneously affect both productivity and tariffs. Therefore, this study takes this issue into account by employing the instrumental variables (IV) method to address the potential endogeneity between tariffs and productivity. In particular, the study follows Amiti and Konings (2007) and Amiti and Davis (2008) by converting the empirical model to a first-differenced framework and then using tariffs from 1996[64] as an instrument for changes in tariffs as it is easier to find instruments for changes in tariffs than for levels. This IV strategy assumes that sectors with high tariffs in 1996 still have relatively high tariffs in 2000 as it is less likely for the government to change the high protection status of a sector due to the impact of domestic pressure from interest groups and government's trade commitments. Therefore while lagged tariffs may predict changes in tariffs, it is less likely to be correlated with changes in the error term. In addition, tariffs in 1996

[64] Amiti and Konings (2007) also use this methodology to control for the possible endogeneity in Indonesia.

are also less likely to have been affected by a firm's productivity than the prevailing tariffs.

Table 5.10: IV method results

Variables	(1) Δtfp	(2) Δtfp	(3) Δtfp
ΔOutput tariff	-0.0419***	-0.0450***	-0.0162**
	(0.0075)	(0.0104)	(0.0079)
ΔIntariffs			-0.0447***
			(0.0122)
Δouputtariff*herf		0.0063	
		(0.0065)	
Year FEs	Yes	Yes	Yes
Observations	5,520	5,520	5,520
Kleibergen-Paap LM statistic	84.79	98.880	83.69
p-val	0.000	0.000	0.000
Kleibergen-Paap F statistic	62.77	59.369	23.31
Anderson-Rubin Wald test p-val	6.30e-09	0.000	0.000
Number of firms	1,840	1,840	1,840

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is TFP, obtained by using the Levinsohn and Petrin (2003) approach with value added as a dependent variable. Output tariff is the weighted output tariff rates. Input tariff rates (intariff) is computed from output tariffs and I-O table. fies is foreign invested enterprises. Outputtariff*herf is interaction of Output tariff and her2000. ΔOutput tariff, Δintariffs are first-different values of output tariff and intariff, respectively.
Instruments: Column (1) and (2) use the levels of import weighted tariffs in 1996 as an instrument for the changes of TFP and tariff. Column (3) use the levels of import weighted tariffs and levels of tariffs on inputs in 1996 as instruments for the changes of output tariff and tariffs on inputs. Output tariffs and input tariff 1996 are reported in the Appendix.

Several post-estimation tests were employed to verify the validity of the instruments. As shown in Table 5.10, three tests that are common in the literature are conducted to investigate how the instruments perform. The Kleibergen-Paap (2006) Wald statistic is used to check whether the excluded instruments are correlated with tariffs. Table 5.10 shows that the null hypothesis in which the model is under-identified is highly rejected. Second, the chapter also examines whether the instruments used in the IV method are weakly correlated with tariffs. As shown in Table 5.10 Kleibergen-Paap (2006) Wald statistics reject the null hypothesis at the 1

percent level. It is noteworthy that the Cragg-Donald statistic results are well above the critical values of Stock and Yogo (2005) in all specifications. Third, regarding the Anderson and Rubin (1949) Chi-squared statistics the results strongly reject the null hypothesis in which the coefficient of the endogenous regresser is equal to zero at the 1 percent level. In all cases, the post-estimation tests show that the instruments perform well.

The estimation results in Table 5.10 show that, after controlling for endogeneity, tariff reductions still have a positive effect on a firm's productivity. In all specifications, the IV coefficients are higher in absolute value than without controlling for the endogeneity. Although the magnitudes are different from the results suggested in section 5.3.2, the key conclusion still remains, i.e. that a reduction in tariffs raises firm productivity.

5.4. Conclusion

The findings in the chapter show that trade liberalization has a positive impact on firm productivity levels and growth in Vietnam. In particular, the magnitude of the coefficient of output tariffs suggests that a 10 percentage point decrease in the tariff increases firm productivity by 0.2 percent. This result is consistent with previous findings (Fernandes, 2007; Amiti and Konings, 2007). In addition to the effect of output tariffs, the study examines the effects of the availability of foreign inputs. The author thus includes input tariffs in the estimation equation in order to separate the impacts of input tariffs and output tariffs. The result confirms that a 10 percentage point decline in input tariffs increases firm productivity by more than 0.3 percent.

Furthermore, after tariffs on inputs are included in the estimation equation, the sign of the coefficient of output tariffs did not change and the coefficients for both tariff rates are negative and highly significant. It is noteworthy that after tariffs on inputs are included, the magnitude of the effect of output tariffs is lower.

In addition, once the study takes firm ownership into account, the effect of output tariffs and input tariffs differs according to firm ownership status. Output tariffs have a larger impact on foreign-invested and non-state firms than domestic and state-owned firms, respectively. In contrast, the results show that the effect of input tariffs is larger for domestic and state-owned firms. The estimation results also suggest that the effect of input tariffs is smaller for medium and high technology industries than for low technology industries whereas there is a similar effect of output tariffs between the two groups.

Next, the study uses different estimation specifications. In particular, the estimation framework is converted to an alternative framework to assess the impact of tariff changes on the change in firm productivity. The results show that the sign and the magnitude of the tariff coefficient are similar to the results from the fixed effect models. The author also employs the IV approach to control for the possible endogeneity between productivity and trade liberalization. After controlling for this endogeneity, the results still suggest that a 10 percent decrease in tariffs leads to a 0.4 percent increase in firm productivity.

Note that, aside from tariff liberalization that is the focus of this chapter, the government also undertook the reduction of NTBs since the 1990s. NTB reforms were introduced through eliminating some import prohibitions, restrictions and licences in

the 1990s. Since 2000, the NTB reforms were further enhanced due to the implementation of AFTA and the accession to WTO. As a result of NTB reforms, many prohibited items such as narcotics, some types of toys, and cigarettes have been moved to the list of licensed goods since the early 2000s. The import licensing system was also much relaxed in this period. This enables many firms to engage in international trade. If the complete data on Vietnam's NTB reforms become available in the future, this would be an interesting topic for further research.

In summary, the findings in the chapter support the evidence that trade liberalization can increase firm productivity in Vietnam. On the one hand, this confirms the importance of the trade liberalization process in Vietnam. On the other hand, the results given in the chapter can lead to policy implications for further trade liberalization in Vietnam.

Chapter 6 Productivity, sunk costs and exporting:

Evidence from firm-level data

6.1. Introduction

In the international trade literature propounded by Krugman (1979, 1980) and Grossman and Helpman (1991) (known as the 'new international trade literature'), it has been argued that international trade has a positive effect on firm-level productivity as it encourages competition between foreign and domestic firms and leads to improvements in varieties of intermediate inputs that are available. Although there is a growing body of literature that looks at the link between international trade and firm productivity following the seminal works of Krugman, and Grossman and Helpman, much less is known about the effect of firm productivity on firm-level exporting activity. More recent works, starting from Melitz (2003), integrate firm heterogeneity into an otherwise standard general equilibrium framework of international trade. When productivity is heterogeneous across firms, and when sunk entry costs into the export markets exist, the productivity of firms is positively related to their decision to export, since only the most productive firms that can afford these sunk costs are able to access the export market (Melitz, 2003).

Motivated by Melitz (2003) and others who have developed the theoretical models on the basis of firm heterogeneity, a number of empirical studies have examined the impact of sunk entry costs and firm productivity on the firm's decision to export. As discussed in Chapter 4, although the key factors that can determine the

firm's decision to enter the export markets, such as firm productivity and the sunk entry costs, among others, haves been empirically examined by various authors (including Roberts and Tybout, 1997; Clerides et al., 1998; Bernard and Jensen, 1999; Bernard and Wagner 2001; and Arnold and Hussinger, 2005), there are few studies that identify these determinants in a country that has transitioned from a centrally planned to market-oriented economy. In addition, there are notably few studies which examine the key factors that influence services firm exports in a transition country. In light of the literature, this thesis examines the effects of firm productivity and sunk entry costs, among others, on the firm's export decision for Vietnam's manufacturing firms between 2002 and 2004; and for Vietnam's services firms during 2004-2007. In particular, the study examines the following research questions:

i. How does firm productivity affect the firm's decision to export in Vietnam?
ii. To what extent do the sunk entry costs affect the firm's export participation in Vietnam?
iii. How do country origins of firm foreign ownership affect the Vietnamese firm's export participation?

Although Vietnam has significantly liberalized the economy since 1986, many of Vietnam's firms are still inexperienced in foreign markets as the legacy of the past centrally planned economy still exists in Vietnam. Whether key factors such as productivity, firm size and firm ownership can affect firm export participation in such an economy is still an open question. The purpose of the study is to provide an understanding of the effect of Vietnam's firm productivity, among others, on firms' exporting decisions.

In addition, exporting in general involves fixed entry costs (Melitz, 2003; Helpman et al., 2004). The exporters might meet the costs for research about the foreign market, advertising and the establishment of distribution networks (Roberts and Tybout, 1997; Bernard and Jensen, 1999). The foreign-invested enterprises (FIEs) can have advantages in dealing with these costs as they already have knowledge and experience in foreign markets. The effect of the sunk entry costs, however, can differ across the different origins of firm foreign ownership since the different FIEs can have differing levels of knowledge and experience in export markets. Therefore, FIEs may respond to the sunk costs differently, conditional on their origin of firm foreign ownership. Given that the literature pays little attention to the effect of different origins of FDI, the study contributes to the current literature by investigating the effects of firm foreign ownership by the country of origin on that firm's export decisions in the presence of the sunk entry costs.

In this chapter, a probit model is used to examine the effects of key factors such as firm productivity and sunk entry costs, among others, on firm export participation. Furthermore, the study employs the Wooldridge (2005) approach for non-linear dynamic models in the presence of the sunk entry costs. The findings in the chapter suggest the positive effects of firm productivity and sunk costs, among others, on a firm's export decisions although these effects are different across industries.

The rest of the chapter is organized as follows. Section 6.2 reviews methodology and data used in this chapter. Section 6.2 includes two sub-sections: section 6.2.1 provides the empirical framework and presents the econometric issues to identify the determinants of firm export participation. Section 6.2.2 describes data used

in this chapter. Section 6.3 describes the empirical results. Finally, section 6.4 concludes.

6.2. Methodology and data

6.2.1. Empirical framework

The chapter extends the approach used in Roberts and Tybout (1997) and Bernard and Jensen (1999) to examine the effect of firm productivity, among other things, on a firm's exporting behaviour by using Vietnamese firm panel data. Roberts and Tybout (1997) use a non-structural framework to identify the role of exogenous factors and different firm-specific characteristics that may affect the firm's decision to export. Therefore, the study follows Roberts and Tybout (1997) to employ the non-structural form of the equation by including the factors that may affect the firm's probability to export in a binary choice non-structural specification, as follows:

In the absence of sunk costs:

$$EXP_{it} = \begin{cases} 1: \beta X_{it-1} + u_{it} > 0 \\ 0: \text{otherwise} \end{cases} \quad (6.1a)$$

In the presence of sunk costs:

$$EXP_{it} = \begin{cases} 1: \beta X_{it-1} - N(1 - EXP_{it-1}) + u_{it} > 0 \\ 0: \text{otherwise} \end{cases} \quad (6.1b)$$

N are the sunk costs of exporting if the firm did not export last period. Firms do not have to pay sunk costs if they export in the previous period. This means that a firm's previous export status can affect that firm's current export decision.

EXP_{it} is a binary variable indicating whether a firm exports or not in period t. X_{it-1} is the firm specific factors that could determine the firm exporting decision such

as firm productivity, firm size, firm age, and foreign ownership, and u_{it} is the error term.

In the chapter, the probit model in which the variables of interest are $productivity_{it-1}$ and exp_{it-1} (if the lagged export status is included) is constructed. Based on previous literature (particularly Robert and Tybout, 1997 and Bernard and Jensen, 1999), other variables such as firm size, capital intensity, firm age and foreign ownership dummy are included in the estimating model. The probability model of export participation can be written as follows:

$$P(EXP_{it}= 1) = \Phi (productivity_{it-1}, exp_{it-1}, size_{it-1}, lnkl_{it-1}, age_{it-1}, fies_{it-1}, dummies) \quad (6.2)$$

where $\Phi(.)$ is a normal cumulative density function, $productivity_{it-1}$ is firm-level Levinsohn and Petrin's TFP[65] for manufacturing firms and firm labour productivity for services firms. Labour productivity is measured by the sales per worker.[66] Although labour productivity focuses on the efficiency per worker only, labour productivity has been employed in a number of studies to consider the linkage between exporting and firm productivity (Wagner, 2007; Vogel, 2010).[67] The variables $size_{it-1}$ and $fies_{it-1}$ are firm size in terms of employment and firm foreign ownership dummy, respectively. Age_{it-1} and $lnkl_{it-1}$ are firm age and capital intensity (i.e. the ratio of capital to labour). Following Roberts and Tybout (1997), all variables are lagged one year. Dummies refer to time and industries dummies. In the case of sunk costs, lagged export status is included in the estimating equation.

[65] Calculation of Levinsohn-Petrin TFP is described in Chapter 5 of the thesis.
[66] As there is no information on services firms' costs in the data, firm labour productivity is measured by the sales per worker.
[67] Bartelsman and Doms (2000) find that heterogeneity in labour productivity has been found to be accompanied by similar heterogeneity in TFP in the reviewed study.

In addition, firm foreign ownership could have a positive effect on a firm's probability to export as foreign-invested firms have advantages in accessing information on international markets and using more advanced technology. However, the effect of foreign ownership may be different across country sources of FDI. In the chapter, the firm's foreign ownership is identified if the firms have at least 10 percent of total capital owned by foreigners. To examine the effect of firm foreign ownership on the firm's exporting decision, the origin of the firm's ownership is disaggregated into countries such as Japan (jp), Korea (kr), Taiwan (tw), Singapore (sin), Hong Kong (China) (hk) and other countries.

The linear probability model (LPM) could be employed to estimate binary choice equations. However there is a main weakness with the LPM as probabilities estimated from LPM could be either less than zero or greater than one, and that does not make any economic or statistical sense. Wooldridge (2002) also suggests that unless the range of observed variables is strongly restricted, the LPM cannot be regarded as a good description of the population response probability. Continually increasing variables would eventually cause the probability to be either less than zero or greater than one.

The alternative method is to employ non-linear models. Following many previous studies (e.g. Roberts and Tybout, 1997; and Arnold and Hussinger, 2005) this study uses a non-linear model to estimate equations (6.1a) and (6.1b). The pooled and random probit models are widely used to identify the determinants of firm exporting probability. It is noteworthy that in equation (6.1b), the sunk entry costs make the regression equation dynamic. The dynamic linear probability model, such as the Arellano and Bond (1991) approach could be used in this case. However, as the

information of some variables used in the study is only available for three years, it is impossible to use the dynamic linear probability model that employs the deep lagged values of variables as instruments. Thus, this model follows Roberts and Tybout (1997) and uses a dynamic non-linear model to estimate equation (6.1b).

The method that has been widely used to deal with dynamic non-linear models is the approach proposed by Wooldridge (2005) who suggests a conditional distribution of the unobserved firm heterogeneity such as firm management quality, conditional on the initial value and exogenous variables, as a generalization of the Chamberlain (1984) and Mundlak (1978) estimator for correlated random effects. Mundlak (1978) and Chamberlain (1984) suggest the specification in which the correlation between ε_i and observed characteristics in x_{it} are allowed.

This model therefore follows an alternative approach suggested by Wooldridge (2005) that assumes a distribution of the unobserved heterogeneity such as firm management quality conditional on observed covariates and the initial condition.

The dynamic model can be written as follows:

$$y_{it} = 1\,(x_{it}\beta + \gamma_1 y_{it-1} + \varepsilon_i + \nu_{it} > 0) \tag{6.3}$$

where y_{it} takes the value 1 if the firm i exports. Firm i exports if $x_{it}\beta + \gamma_1 y_{it-1} + \varepsilon_i + \nu_{it} > 0$. y_{it} takes the value 0 if the firm does not export at time t; x_{it} is a vector of explanatory variables; y_{it-1} is the one-year lagged value of y_{it}. y_{it-1} indicates the role of sunk costs N as stated above. ε_i is a firm-specific measure of unobserved heterogeneity such as firm management quality; and $\nu_{it} \sim N(0, \sigma_\nu)$ is a standard disturbance.

It is noteworthy that if the standard random effects model is used, equation (6.3) might have two problems:

- the standard random effects model assumes ε_i is uncorrelated with x_{it}

  If ε_i is correlated with x_{it}, estimation could be inconsistent and biased.

- the initial conditions problem, which implies that ε_i and y_{i0} are correlated. Assuming that the initial conditions are exogenous allows us to estimate the model, using the standard random effects model. However, if ε_i and y_{i0} are correlated, this estimator will overstate the extent of state dependence (i.e. the magnitude of γ_1).

To control for the first problem, the Mundlak (1978) and Chamberlain (1984) specification allow a correlation between ε_i and the time means of the observed time-varying variables as follows:

$$\varepsilon_i = \alpha \bar{x}_i + \alpha_i \tag{6.4}$$

where α_i is a value of unobserved heterogeneity which is independent of x_{it}. $\bar{x}_i$ are the means of the time-varying variables for each firm. Equation (6.4) allows for some correlation between ε_i and the observed time-varying variables.

To control both for the initial conditions problem and the correlation between ε_i and observed characteristics; this model follows the conditional maximum likelihood estimator proposed by Wooldridge (2005) that examines the distribution conditional on the initial value and exogenous variables. The model for α_i is specified as follows:

$$\alpha_i = \alpha_0 + \alpha_1 y_{i0} + \alpha_2 \bar{x}_i + \omega_i \quad (6.5)$$

where $\omega_i \sim N(0, \sigma_\alpha)$. Substituting equation (6.5) into equation (6.3) to obtain:

$$y_{it} = 1(x_{it}\beta + \gamma_1 y_{it-1} + \alpha_0 + \alpha_1 y_{i0} + \alpha_2 \bar{x}_i + \omega_i + \nu_{it} > 0) \quad (6.6)$$

where $\bar{x}_i$ are the means of the time-varying variables for each firm, and y_{i0} is the initial value of y_{it}.

The estimate of α_1 is of interest as it shows the association between the initial value of firm export participation and the unobserved effects.

Wooldridge (2005) suggests that estimation can be implemented by a standard random effects probit model. It is noteworthy that the pooled probit model and standard random-effect probit model are used in order to estimate the determinants of firm exporting participation in equation (6.1a) that is a standard non-linear probability model. In equation (6.1b), owing to the inclusion of the sunk costs (that is, the one-year lagged export status is included), the estimation framework becomes a non-linear dynamic model. For the reasons mentioned above, the pooled probit model and Wooldridge (2005) approach are used in this case, controlling for the initial condition problem of the non-linear dynamic model.

Thus the estimation steps are as follows. First, the pooled probit and random-effect probit models are used to identify the determinants of firm's export participation without examining the lagged export status. Next, to identify the role of sunk costs, the lagged export status is included in the estimation framework. To allow for correlations between unobserved effects and covariates and correlation between ε_i and the initial condition, the research follows the conditional maximum likelihood method proposed

by Wooldridge (2005). Thus, the pooled probit specification and Wooldridge (2005) framework are used instead of the random-effect specification for non-linear dynamic models.

To interpret the effects of firm characteristics on firm exporting probability in probit models, the research reports average partial effects (APE). The APE for a continuous variable x_i is computed by using the average values across i as follows:

$$\frac{dP_i}{dx_i} = \phi(\beta_0 + \beta_1 x_1 + ... + \beta_k x_k)\beta_i \tag{6.7a}$$

The author computes the specification at different values for x_{it}, i.e. 0 and 1 to obtain the average partial effect for a discrete variable as follows:

$$N^{-1}\sum_{i=1}^{N} \Phi[(\psi + x_{it}\beta)] \tag{6.7b}$$

In the random probit model, APE is multiplied with $(1+\sigma_a^2)^{-1/2}$ to make it comparable with APE from the pooled model.

In the Wooldridge model, APE is computed for a discrete variable as follows:

$$N^{-1}\sum_{i=1}^{N} \Phi(\hat{\psi}_a + x_{it}\hat{\beta}_a + \bar{x}_i\alpha) = N^{-1}\sum_{i=1}^{N} \Phi[(\psi + x_{it}\beta + \bar{x}_i\alpha).(1+\sigma_a^2)^{-1/2}] \tag{6.8}$$

The research computes the specification at different values for x_{it}, i.e. 0 and 1 to obtain the average partial effect. The average partial effect for a continuous variable x_i is computed by using the average values across *i* as follows:

$$\hat{\beta}_{aj}\phi(\hat{\psi}_a + x\hat{\beta}_a + \bar{x}_i\alpha) \tag{6.9}$$

6.2.2. Data

This study's database is Vietnamese Enterprise Census 2001-2004 from the General Statistical Office (GSO). The census was conducted annually by the GSO after the Enterprise Law was introduced in 2000. In the census, GSO undertakes a survey about detailed information on business and production costs in terms of inputs, e.g. information on the raw materials, instruments, spare parts, and labour costs.

The data in the survey provide a rich source of enterprise-level information including data on revenues, employment, capital stock, investments, exports, imports and establishment year. Data used in this study are the balanced panel database of 1,840 firms during 2000-04 in all manufacturing sectors. Except for labour, all other variables are deflated at constant 1994 prices. More detail on the data is provided in the data section in Chapter 5.

It is noteworthy that the study uses the balanced data from 2002 to 2004 to identify the determinants of the firms' export participation.[68] The data for 2000 and 2001 are used to compute the lagged values and initial conditions for the estimation models.

The data for services firms in the study provide the sample of services firms from the Vietnamese enterprises census in 2004-07 conducted by the GSO. It is an unbalanced panel with information of more than 10,000 services firms in all services sectors except for trade and repair of motor vehicles sector as there is no information on firms' exporting status in this sector.

[68] As there is no information on the minimum export level at which a firm is an exporter in the data, the firms are classified as exporters if in the data the firms export overseas directly (i.e. they export their products themselves).

Table 6.1: Descriptive statistics for manufacturing firms (2002-04)

Variables	Description	Observations	Mean	Std Dev.
TFP_{it-1}	The log of total factor productivity	5520	1.4197	0.7897
$Lnsize_{it-1}$	The log of firm size	5520	3.7825	1.6547
Lnw_{it-1}	The log of average wage	5520	2.1573	0.7147
$Lnkl_{it-1}$	The log of capital intensity	5520	4.3568	1.3073
$Lnage_{it-1}$	The log of firm age	5520	2.0262	0.6669
Exp_{it}	Dummy of being an exporter	5520	0.3311	0.4706
$Fies_{it-1}$	Dummy of foreign-invested enterprises	5520	0.1571	0.3639
Jp_{it1}	Dummy of Japanese-invested firms	5520	0.0228	0.1493
Kr_{it-1}	Dummy of Korean-invested firms	5520	0.0219	0.1464
Sin_{it-1}	Dummy of Singaporean-invested firms	5520	0.0105	0.1019
t_w_{it-1}	Dummy of Taiwanese-invested firms	5520	0.0603	0.2381
Hk_{it-1}	Dummy of Hong Kong-invested firms	5520	0.0036	0.0600

Source: the data of manufacturing firms (GSO)

Table 6.2: Descriptive statistics for services firms (2004-07)

Variable	Descriptions	Observations	Mean	Std Dev.
$Lnlp_{it-1}$	The log of labour productivity	52584	4.0528	1.7072
$Lnsize_{it-1}$	The log of firm size	52584	2.6541	1.2394
Lnw_{it-1}	The log of average wage	52584	2.4653	0.8507
$Lnkl_{it-1}$	The log of capital intensity	52584	3.8773	1.2089
$Lnage_{it-1}$	The log of firm age	52584	1.4680	0.9198
Exp_{it}	Dummy of being an exporter	52584	0.0998	0.2997
$Fies_{it-1}$	Dummy of foreign-invested enterprises	52584	0.0434	0.2039
Jp_{it1}	Dummy of Japanese-invested firms	52584	0.0061	0.0778
Kr_{it-1}	Dummy of Korean-invested firms	52584	0.0030	0.0549
Sin_{it-1}	Dummy of Singaporean-invested firms	52584	0.0062	0.0787
t_w_{it-1}	Dummy of Taiwanese-invested firms	52584	0.0014	0.0384
Hk_{it-1}	Dummy of Hong Kong-invested firms	52584	0.0029	0.0543

Source: the data of services firms (GSO)

The data provide a rich source of firm-level information including data on revenues, employment, capital stock, investments, exports, imports and establishment

year.[69] Except for labour, all other variables are deflated at the constant 2003 prices. Tables 6.1 and 6.2 show the descriptive statistics of the variables used in the estimating models.

6.3.Empirical results

6.3.1. Descriptive results

Before investigating the determinants of export participation, this section provides the descriptive statistics for exporters and non-exporters. Tables 6.3 and 6.4 show the average differences between exporters and non-exporters in Vietnam. The results reported in Tables 6.3 and 6.4 show that exporters are superior to non-exporter in terms of productivity and size. This is consistent with the existing literature. The average productivity of exporters is higher than that of non-exporters in both manufacturing and services sectors. The size of exporters is also found to be larger than that of non-exporters. The average wage for manufacturing exporters is higher than for manufacturing non-exporters. In the services sector the average wage is lower for exporters. Interestingly, non-exporters have higher capital intensity in both sectors. This reflects that exporters are less likely to use capital-intensive technology.

[69] It should be noted that there is no firm that stops exporting and then exports again in the data. In this chapter, a firm is classified as an exporter or a non-exporter. Even if a firm stops exporting and then exports again, the firm still has to pay the re-entry sunk costs to export as discussed in Girma et al. (2004). The role of productivity, among others, also still remains in this case.

Table 6.3: Descriptive statistics for exporters and non-exporters

in the manufacturing sector

	TFP_{it}	Lnw_{it}	$Lnsize_{it}$	$Lnkl_{it}$	$Fies_{it}$
Non-exporters	1.3003	2.1258	3.2925	4.4586	0.0780
	(0.7359)	(0.6849)	(1.4533)	(1.2385)	(0.2682)
Exporters	1.7961	2.5519	4.9010	4.3973	0.3167
	(0.8002)	(0.6929)	(1.6124)	(1.3971)	(0.4653)

Notes: TFP is obtained by the Levinsohn and Petrin (2003) approach with value added as a dependent variable. lnsize: firm size. lnkl: capital intensity (ratio of capital to employment). lnwage: average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises.

Table 6.4: Descriptive statistics for exporters and non-exporters in the services sector

	$Lnlp_{it}$	Lnw_{it}	$Lnsize_{it}$	$Lnkl_{it}$	$Fies_{it}$
Non-exporters	4.4856	2.7538	2.7343	4.2553	0.0358
	(1.2745)	(0.7866)	(1.2522)	(1.3523)	(0.1859)
Exporters	4.5155	2.6219	2.7513	4.2421	0.1123
	(3.0906)	(0.8029)	(1.4596)	(1.0962)	(0.3158)

Notes: lnlp: firm labour productivity that is the sales per worker. lnsize: firm size. lnkl: capital intensity (ratio of capital to employment). lnwage: average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises.

Note that the results only illustrate descriptive statistics of the average differences between exporters and non-exporters. The results do not identify any causal effect between exporting and firm characteristics. The literature suggests the two-way relationship between firm productivity and a firm's exporting (Bernard and Jensen, 1999). The most productive firms can choose to export through the self-selection mechanism (Melitz, 2003) whereas exporting also can increase firm productivity through learning effects from exporting (Clerides et al., 1998). The next section examines whether firm productivity, among other things, can positively affect

a firm's export decision (i.e. the self-selection hypothesis). This is the link from productivity to firm exporting. The relationship from exporting to productivity (i.e. the learning-by-exporting hypothesis) is empirically considered in Chapter 7 of the thesis.

6.3.2. Firm productivity and exporting

6.3.2.1. Firm productivity and the export participation of manufacturing firms

In this section, pooled probit and random-effect probit models are used to identify the determinants of a firm's export participation without including lagged export status. Table 6.5 reports the results of pooled and random-effect probit models for manufacturing firms in columns 1 and 3. The marginal effects of the variables of the pooled and random-effect models are presented in columns 2 and 4. The results from Table 6.5 show that the coefficients of TFP are statistically significant and positive in both the pooled and random-effect probit models, implying that firm productivity is an important determinant of the export decision in Vietnam.

Alongside firm productivity, the results for other variables are also reported. The positive effect of firm size on export participation can also be confirmed by the results. In addition, the effect of average wage on export participation is statistically insignificant in both the pooled and random probit models. Average wage is a proxy for human capital that could have positive effects on firms' export participation. However, average wage also might negatively affect a firm's export decision as wage is a factor that also influences firm profit. In addition, exporters in labour-intensive sectors can have a relatively lower average wage.

Table 6.5: Effects of firm productivity and export participation

Variables	(1) Pooled probit model	(2) Average marginal effects	(3) Random-effect probit model	(4) Average marginal effects
tfp_{it-1}	0.431***	0.113***	0.666***	0.0923***
	(0.0466)	(0.0120)	(0.0819)	(0.0157)
$lnkl_{it-1}$	-0.0908***	-0.0237***	-0.0844*	-0.0115*
	(0.0227)	(0.0059)	(0.0491)	(0.0061)
$lnwage_{it-1}$	0.0414	0.0108	0.00370	0.0005
	(0.0550)	(0.0144)	(0.0953)	(0.0147)
$lnsize_{it-1}$	0.320***	0.0837***	0.578***	0.1260***
	(0.0162)	(0.0038)	(0.0427)	(0.0242)
$lnage_{it-1}$	0.0315	0.0082	0.0861	0.0146
	(0.0316)	(0.0082)	(0.0831)	(0.0123)
fies	0.676***	0.177***	1.337***	0.2098***
	(0.0692)	(0.0176)	(0.187)	(0.0331)
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	5,520	5,520	5,520	5,520
Log-likelihood	-2561		-2153	
chi-squared	1888		504.5	
Number of firms			1,840	
rho			0.736	

Notes: columns 2 and 4 show the marginal effects of the variables of the pooled and random effect models in columns 1 and 4, respectively. exp_{it} is a binary variable indicating whether a firm exports or not in period t. tfp_{it-1} is one-year lagged TFP. TFP is obtained by the Levinsohn and Petrin (2003) approach with value added as a dependent variable. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises.

Interestingly, in contrast to the evidence in several studies (such as Bernard and Jenson, 1995; and Van Biesebroeck, 2005), the capital-labour ratio is statistically significant and negative. The results show that the firm that has higher capital intensity

(i.e. the ratio of capital to labour) is less likely to export, that is different from the findings in several developed and developing countries. However, it is consistent with the situation in manufacturing firms as there is the dominance of labour-intensive technology in Vietnam, especially in leading exporting sectors such as foods and beverages, footwear, leather products and textiles.

The results also show that firm age has a statistically insignificant effect on a firm's exporting decision, implying the role of learning-by-doing in Vietnam's firms is outweighed by other factors. Older firms can have larger resources and more experience in domestic markets, but in a transitional economy like Vietnam, some older firms could be inexperienced and inefficient in foreign markets.

6.3.2.2.Firm productivity and the export participation of services firms

In this section, the effect of firm productivity on a firm's export decision is examined for services firms. Table 6.6 reports the results from estimating the pooled and random-effect probit models for services firms in columns 1 and 3. The marginal effects of the variables of pooled and random effect models are presented in columns 2 and 4. The results from Table 6.6 show that the coefficients of labour productivity are positive and statistically significant, implying that the self-selection mechanism occurs in the services sector. Similar to the trend for manufacturing firms, capital intensity is negatively correlated with firm exporting whereas larger services firms are likely to export. Firm foreign ownership also has a positive effect on a services firm's probability to export. Similar to manufacturing firms, the coefficients of firm age are

insignificant, suggesting that there is an unclear effect of firm age on the firm's export participation.

Table 6.6: Firm productivity and export participation in services firms

Variables	(1) Pooled probit model	(2) Average marginal effects	(3) Random-effect probit model	(4) Average marginal effects
$lnlp_{it-1}$	0.0561***	0.0067***	0.207***	0.0062***
	(0.0059)	(0.0007)	(0.0254)	(0.0008)
$lnkl_{it-1}$	-0.0260***	-0.0031***	-0.116***	-0.0035***
	(0.0092)	(0.00112)	(0.0301)	(0.0009)
$lnwage_{it-1}$	0.0226	0.0027	-0.159***	-0.0048***
	(0.0156)	(0.0018)	(0.0420)	(0.0012)
$lnsize_{it-1}$	0.0706***	0.0085***	0.351***	0.0106***
	(0.0080)	(0.0009)	(0.0304)	(0.0010)
$lnage_{it-1}$	0.0137	0.0016	0.0093	0.0002
	(0.0107)	(0.0012)	(0.0402)	(0.0012)
fies	1.264***	0.152***	3.899***	0.118***
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	52,584	52,584	52,584	52,584
Log-likelihood	-11563		-8557	
chi-squared	11025		1750	
Number of firms			20,757	
rho			0.888	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 column 2 and 4 show the marginal effects of the variables of pooled and random effect model in column 1 and 4, respectively. exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. tfp_{it-1} is one-year lagged TFP. $Lnlp_{it-1}$ is firm labour productivity. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises. Japan, Korea, Taiwan, Singapore, Hong Kong (China) and others: dummies of country sources of firm foreign ownership in Vietnam.

To sum up, the results given in the chapter support the evidence for the self-selection mechanism in Vietnam's manufacturing and services sectors. This is consistent with the theoretical and empirical literature (Melitz, 20003; Bernard and Jensen, 1999). Love and Mansury (2010) indicate that the effect of productivity on firms exporting might be smaller for services firms than for manufacturing firms. Although the estimation results for manufacturing and services firms are in two different periods, the large difference in the coefficients of productivity for these two sectors can show the trend suggested by Love and Mansury (2010) to some extent.

6.3.3. Role of sunk entry costs

6.3.3.1. Role of sunk entry costs in manufacturing firms

So far, the pooled probit and random-effect models have been employed to identify characteristics that are closely related with the export decision of firms. However, this approach does not take the role of sunk entry costs into account. To control for these sunk costs, this methodology follows an approach suggested by Wooldridge (2005) that assumes a distribution of the unobserved heterogeneity conditional on the initial value and exogenous variables. First the lagged value of export status is included in the pooled probit model. Next the Wooldridge (2005) method is used to control for the initial condition and a correlation between variables and unobserved firm effects.

Table 6.7 reports the results from estimating the pooled and the Wooldridge (2005) models for manufacturing firm in columns 1 and 3. The marginal effects of the variables of the pooled and random effect models are presented in columns 2 and 4.

Table 6.7: The impact of sunk costs in manufacturing firms

Variables	(1) Pooled probit model	(2) Average marginal effects	(3) Wooldridge dynamic non-linear model	(4) Average marginal effects
tfp_{it-1}	0.310***	0.0590***	0.406***	0.0646**
	(0.0618)	(0.0117)	(0.139)	(0.0282)
$lnkl_{it-1}$	-0.0577*	-0.0110*	-0.0705	-0.0112
	(0.0308)	(0.0058)	(0.165)	(0.0318)
$lnwage_{it-1}$	0.112	0.0214	-0.168	-0.0266
	(0.0738)	(0.0141)	(0.152)	(0.0280)
$lnsize_{it-1}$	0.153***	0.0292***	0.477**	0.0759*
	(0.0226)	(0.0042)	(0.221)	(0.0437)
$lnage_{it-1}$	0.0102	0.0019	0.0141	0.0022
	(0.0475)	(0.0090)	(0.0645)	(0.0107)
fies	0.409***	0.0779***	0.466***	0.0810***
	(0.0967)	(0.0184)	(0.139)	(0.0264)
exp_{it-1}	1.749***	0.333***	1.054***	0.2275***
	(0.0622)	(0.0083)	(0.192)	(0.0772)
exp_{i0}			1.096***	0.2379***
			(0.310)	(0.0664)
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	3,680	3,680	3,680	3,680
Log-likelihood	-1277		-1260	
chi-squared	2160		615.0	
Number of firms			1,840	
rho			0.360	

Notes: column 2 and 4 show the marginal effects of the variables of the pooled and random effect model in columns 1 and 4, respectively. exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. tfp_{it-1} is one-year lagged TFP. TFP is obtained by Levinsohn and Petrin (2003) approach with value added as dependent variable. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises. Japan, Korea, Taiwan, Singapore, Hong Kong (China) and others: dummies of country sources of firm foreign ownership in Vietnam. Standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

The results from Table 6.7 show that the coefficients on past export experience are positive and statistically significant, explaining the critical effect of past export status on the future exporting participation. The results thereby suggest the important role of sunk entry costs that could determine the firm's probability to export. The

effect of the sunk costs is significant not only in the pooled probit specification but also in the Wooldridge (2005) specification. The results are consistent with findings in a number of studies. (Roberts and Tybout, 1997, Bernard and Jensen, 1999, Arnold and Hussinger, 2005)

Table 6.8: The impact of sunk costs in services firms

Variables	(1) Pooled probit model	(2) Average marginal effects	(3) Wooldridge dynamic non-linear model	(4) Average marginal effects
exp_{it-1}	2.155***	0.216***	1.040***	0.0502***
	(0.0294)	(0.0023)	(0.0971)	(0.0058)
exp_{i0}			3.677***	0.178***
			(0.250)	(0.0090)
$lnlp_{it-1}$	0.0731***	0.0073***	0.242***	0.0117***
	(0.0101)	(0.0010)	(0.0553)	(0.0026)
$lnkl_{it-1}$	-0.0012	-0.00012	-0.322***	-0.0155***
	(0.0116)	(0.0011)	(0.0816)	(0.0039)
$lnwage_{it-1}$	-0.0905***	-0.0091***	0.0227	0.0011
	(0.0200)	(0.0020)	(0.0909)	(0.0043)
$lnsize_{it-1}$	0.0912***	0.0091***	0.813***	0.0392***
	(0.0097)	(0.0009)	(0.119)	(0.0058)
$lnage_{it-1}$	-0.0251	-0.0025	-0.0026	-0.0001
	(0.0153)	(0.0015)	(0.0737)	(0.0035)
fies	1.091***	0.109***	2.646***	0.128***
	(0.0522)	(0.0052)	(0.307)	(0.0154)
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	40,699	40,699	14,556	14,556
Log-likelihood	-7492		-2401	
chi-squared	14760		917.7	
Number of firms			4,852	
rho			0.832	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 columns 2 and 4 show the marginal effects of the variables of the pooled and random effect model in columns 1 and 4, respectively. exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. tfp_{it-1} is one-year lagged TFP. $Lnlp_{it-1}$ is firm labour productivity. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises.

In addition to the role of sunk costs, the results show the positive and statistically significant coefficients of productivity and firm size. Firm productivity has a positive and significant effect on firm exporting probability while the important role of firm size is also observed. The coefficients of firm age, however, are negative and insignificant in the dynamic models. It is noteworthy that after controlling for initial conditions, the coefficient of average wage is negative and statistically insignificant, implying the unclear effect of firm age on the export decision of the firm. The capital-labour ratio is still significant and negative in the pooled framework. The results also show that the coefficient of capital intensity is negative and insignificant. The negative sign of the coefficient suggests that Vietnamese firms producing labour-intensive products or using labour-intensive technology are more likely to export. The evidence for this is widely observed in leading exporting sectors such as foods and beverages, footwear, leather products and textiles.

The coefficient of the initial export status is statistically significant and positive, implying that there is a correlation between the initial value of export participation and unobserved firm heterogeneity. This also confirms the importance of the Wooldridge (2005) approach.

6.3.3.2.Role of sunk cost in services firms

Table 6.8 reports the results from estimating the pooled and the Wooldridge (2005) models for services firms in columns 1 and 3. The marginal effects of the variables of the pooled and random effect models are presented in columns 2 and 4. For services firms, the role of sunk costs is also confirmed in all estimation models.

Coefficients of the past export status are positive and highly significant, suggesting the effect of previous export experience on current exporting behaviour. The results for other variables are consistent with those in absence of sunk costs.

Note that the research uses the unbalanced panel data for services firms. The Wooldridge (2005) dynamic non-linear approach assumes that the data are available on all cross-sectional units in all time periods. Wooldridge (2005) suggests that for unbalanced panels, his approach can be employed for the subset of observations constituting the balanced panel dataset. The data used in columns 3 and 4, therefore, are the balanced subset of the data of services firms.

6.3.4. Firm foreign ownership origins and the export participation of firms

This section examines the effects of different foreign ownership origins on firm export participation for manufacturing and services firms. Firm foreign ownership origins are broken down into different countries of origin of foreign investment such as Japan, South Korea, Singapore, Taiwan and Hong Kong (China). Fujita (1999) finds that FDI from Japan, South Korea and Taiwan increases Vietnamese exports to all of these investing countries. The evidence is more obvious in light of manufacturing countries where foreign-invested firms tend to engage in sub-contracting with local firms. Taiwanese and Korean firms tended to export the products back to the home country, but they also seemed to export parts of their products to Japan as a third country. Japanese invested firms in light industries generally depended on the Japanese market, while firms in other industries seemed to have more diversified export destinations.

6.3.4.1. Foreign ownership origins and export participation in manufacturing firms

By disaggregating the effects of country of origin of FDI, the models finds the positive effects of FDI from Japan, Korea, Taiwan, Singapore and Hong Kong (China) on the manufacturing firm's export decision in Vietnam. The results from estimating the pooled, random-effect and the Wooldridge (2005) models for manufacturing firms are presented in columns 1 and 3 of Tables 6.9 and 6.10. The marginal effects of the variables are reported in columns 2 and 4. As shown in Tables 6.9 and 6.10, the firms that received FDI from Japan, Korea, Taiwan, Hong Kong (China) and Singapore are more likely to export. The coefficients of the dummy of the country are positive and statistically significant in all model specifications.

Foreign-invested firms from advanced Asian countries such as Japan and South Korea in general move their production overseas to minimize their production costs. They usually decide to invest in developing Asian countries, especially neighbouring developing countries, taking advantage of the relatively cheap labour force in these countries. They then export their products to their home country or overseas. The trend of export-led FDI is particularly dominant in China and Vietnam.

Interestingly, in the presence of the sunk entry costs, the impacts of origin of FDI from Japan, Taiwan and Singapore are still significant and positive while the effects of ownership from Korea and other countries are insignificant. The results thereby suggest that the magnitude of the effects of foreign ownership differs across countries of origin of FDI if exporters have to face sunk entry costs.

Table 6.9: Effects of firms' ownership origins on the export participation of manufacturing firms

Variables	(1) Pooled probit model	(2) Average marginal effects	(3) Random-effect probit model	(4) Average marginal effects
tfp_{it-1}	0.444***	0.115***	0.675***	0.093***
	(0.0471)	(0.0120)	(0.0823)	(0.0159)
$lnkl_{it-1}$	-0.0912***	-0.0237***	-0.0879*	-0.012**
	(0.0228)	(0.00591)	(0.0492)	(0.0059)
$lnwage_{it-1}$	0.0454	0.0118	0.0059	0.002
	(0.0553)	(0.0144)	(0.0956)	(0.0149)
$lnsize_{it-1}$	0.320***	0.0832***	0.577***	0.124***
	(0.0163)	(0.00381)	(0.0427)	(0.0241)
$lnage_{it-1}$	0.0386	0.0100	0.0983	0.0146
	(0.0317)	(0.00825)	(0.0832)	(0.0123)
$japan_{it-1}$	1.005***	0.261***	2.075***	0.309***
	(0.147)	(0.0377)	(0.401)	(0.0575)
$korea_{it-1}$	0.571***	0.148***	1.128***	0.168***
	(0.150)	(0.0390)	(0.396)	(0.0586)
$singapore_{it-1}$	0.923***	0.240***	2.043***	0.304***
	(0.196)	(0.0507)	(0.493)	(0.0712)
$taiwan_{it-1}$	0.796***	0.207***	1.524***	0.227***
	(0.0934)	(0.0239)	(0.250)	(0.0354)
Hong Kong(China) $_{it-1}$	0.545	0.142	0.803	0.119
	(0.354)	(0.0920)	(0.567)	(0.0841)
$others_{it-1}$	0.361***	0.0939***	0.766***	0.114***
	(0.107)	(0.0276)	(0.273)	(0.0398)
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	5,520	5,520	5,520	5,520
log_likelihood	-2548		-2145	
chi-squared	1914		506.8	
Number of firms			1,840	
rho			0.735	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 columns 2 and 4 show the marginal effects of the variables of the pooled and random effect model in column 1 and 4, respectively. exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. tfp_{it-1} is one-year lagged TFP. $Lnlp_{it-1}$ is firm labour productivity. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises. Japan, Korea, Taiwan, Singapore, Hong Kong (China) and others: dummies of country sources of firm foreign ownership in Vietnam.

Table 6.10: Effects of firms' ownership origins on the export participation

of manufacturing firms in the presence of sunk costs

Variables	(1) Pooled probit model	(2) Average marginal effects	(3) Wooldridge dynamic non-linear model	(4) Average marginal effects
exp_{it-1}	1.752***	0.331***	1.073***	0.234***
	(0.0625)	(0.0083)	(0.189)	(0.0779)
tfp_{it-1}	0.318***	0.0600***	0.390***	0.062**
	(0.0625)	(0.0118)	(0.138)	(0.0281)
$lnkl_{it-1}$	-0.0604*	-0.0114*	-0.0834	-0.013
	(0.0311)	(0.0058)	(0.165)	(0.0317)
$lnwage_{it-1}$	0.117	0.0222	-0.148	-0.024
	(0.0746)	(0.0141)	(0.152)	(0.0278)
$lnsize_{it-1}$	0.153***	0.0288***	0.466**	0.074*
	(0.0227)	(0.0042)	(0.220)	(0.0435)
$lnage_{it-1}$	0.0212	0.00400	0.0299	0.0044
	(0.0478)	(0.0090)	(0.0638)	(0.0095)
$japan_{it-1}$	0.795***	0.150***	1.020***	0.153***
	(0.213)	(0.0400)	(0.307)	(0.0429)
$korea_{it-1}$	0.210	0.0396	0.172	0.0259
	(0.203)	(0.0384)	(0.270)	(0.0404)
$singapore_{it-1}$	0.963***	0.182***	1.204***	0.181***
	(0.289)	(0.0544)	(0.401)	(0.0570)
$taiwan_{it-1}$	0.513***	0.0969***	0.607***	0.0912***
	(0.131)	(0.0247)	(0.183)	(0.0261)
Hong Kong(China) $_{it-1}$	1.605*	0.303*	1.628	0.244
	(0.825)	(0.156)	(1.008)	(0.152)
$others_{it-1}$	0.0626	0.0118	-0.0137	-0.0021
	(0.147)	(0.0278)	(0.195)	(0.0292)
exp_{i0}			1.065***	0.231***
			(0.304)	(0.0659)
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	3,680	3,680	3,680	3,680
log_likelihood	-1266		-1248	
chi-squared	2182		625.4	
Number of firms			1,840	
rho			0.339	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. tfp_{it-1} is one-year lagged TFP. $Lnlp_{it-1}$ is firm labour productivity. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises. Japan, Korea, Taiwan, Singapore, Hong Kong (China) and others: dummies of country sources of firm foreign ownership in Vietnam.

Table 6.11: Effects of firms' ownership origins on

the export participation of services firms

Variables	(1) Pooled probit model	(2) Average marginal effects	(3) Random-effect probit model	(4) Average marginal effects
$Lnlp_{it-1}$	0.0576***	0.0069***	0.209***	0.0064***
	(0.0060)	(0.0007)	(0.0253)	(0.0008)
$Lnkl_{it-1}$	-0.0212**	-0.0025**	-0.108***	-0.0033***
	(0.0093)	(0.0011)	(0.0300)	(0.0009)
Lnw_{it-1}	0.0192	0.0023	-0.154***	-0.0047***
	(0.0156)	(0.0018)	(0.0418)	(0.0013)
$Lnsize_{it-1}$	0.0711***	0.0085***	0.352***	0.0109***
	(0.0080)	(0.0009)	(0.0302)	(0.0011)
$Lnage_{it-1}$	0.0144	0.0017	0.0096	0.0002
	(0.0107)	(0.0013)	(0.0399)	(0.0012)
Jp_{it-1}	1.470***	0.177***	4.416***	0.1370***
	(0.0798)	(0.0095)	(0.329)	(0.0126)
Kr_{it-1}	0.935***	0.113***	3.256***	0.1010***
	(0.132)	(0.0159)	(0.444)	(0.0149)
Sin_{it-1}	0.808***	0.0973***	2.918***	0.0902***
	(0.0937)	(0.0113)	(0.323)	(0.0110)
t_w_{it-1}	1.129***	0.136***	3.627***	0.112***
	(0.178)	(0.0215)	(0.602)	(0.019)
Hk_{it-1}	1.112***	0.134***	3.976***	0.123***
	(0.123)	(0.0148)	(0.424)	(0.014)
Oth_{it-1}	1.434***	0.173***	3.822***	0.118***
	(0.0569)	(0.0067)	(0.219)	(0.0094)
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	52,584	52,584	52,584	52,584
Log-likelihood	-11537		-8562	
chi-squared	11077		1709	
Number of firms			20,757	
rho			0.885	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. $Lnlp_{it-1}$ is firm labour productivity. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises. Japan, Korea, Taiwan, Singapore, Hong Kong (China) and others: dummies of country sources of firm foreign ownership in Vietnam.

Table 6.12: Effects of firms' ownership origins on the export participation of services firms

Variables	(1) Pooled probit model	(2) Average marginal effects	(3) Wooldridge dynamic non-linear model	(4) Average marginal effects
Exp_{it-1}	2.152***	0.216***	1.048***	0.0504***
	(0.0295)	(0.0024)	(0.0966)	(0.0058)
Exp_{i0}			3.681***	0.177***
			(0.247)	(0.0089)
$Lnlp_{it-1}$	0.0747***	0.0074***	0.246***	0.0119***
	(0.0101)	(0.00102)	(0.0553)	(0.0027)
$Lnkl_{it-1}$	0.00182	0.0002	-0.326***	-0.0157***
	(0.0117)	(0.0012)	(0.0816)	(0.0039)
Lnw_{it-1}	-0.0937***	-0.0094***	0.0200	0.0009
	(0.0201)	(0.0020)	(0.0907)	(0.0043)
$Lnsize_{it-1}$	0.0910***	0.0091***	0.815***	0.0392***
	(0.0097)	(0.0009)	(0.119)	(0.0058)
$Lnage_{it-1}$	-0.0245	-0.0024	-0.0087	-0.0004
	(0.0153)	(0.0015)	(0.0733)	(0.0035)
Jp_{it-1}	1.080***	0.108***	2.631***	0.127***
	(0.0965)	(0.0096)	(0.460)	(0.0225)
Kr_{it-1}	0.828***	0.0831***	2.496***	0.120***
	(0.159)	(0.0160)	(0.631)	(0.0308)
Sin_{it-1}	0.829***	0.0832***	2.049***	0.0986***
	(0.113)	(0.0113)	(0.453)	(0.0221)
t_w_{it-1}	1.015***	0.102***	2.542***	0.122***
	(0.222)	(0.0223)	(0.911)	(0.0440)
Hk_{it-1}	1.128***	0.113***	3.254***	0.157***
	(0.145)	(0.0146)	(0.621)	(0.0304)
Oth_{it-1}	1.237***	0.124***	2.547***	0.123***
	(0.0695)	(0.0069)	(0.354)	(0.0175)
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	40,699	40,699	14,556	14,556
Log-likelihood	-7487		-2402	
chi-squared	14770		938.1	
Number of firms			4,852	
rho			0.831	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. $Lnlp_{it-1}$ is firm labour productivity. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises. Japan, Korea, Taiwan, Singapore, Hong Kong (China) and others: dummies of country sources of firm foreign ownership in Vietnam.

6.3.4.2. Foreign ownership origins and export participation of services firms

The results of the effects of the foreign origins of firms on firms' export participation in services sectors are presented in columns 1 and 3 of Tables 6.11 and 6.12. The marginal effects of the variables are reported in columns 2 and 4. As shown in Tables 6.11 and 6.12, all firm foreign ownership origins such as Japan, South Korea, Taiwan, Hong Kong (China) and Singapore have positive effects on firm export participation in the absence of the sunk costs. The effects do not change when sunk costs are included. Among origins of countries, Japanese ownership has the largest impact on the export participation of firms.

As for other variables, the coefficients of productivity are statistically significant and positive whereas the effect of capital intensity is negative and significant. The result shows that the larger services firms are more likely to export. The role of sunk costs in the services sector is also confirmed in all model specifications.

6.3.5. Firms' export participation and industry-specific characteristics

6.3.5.1. Firms' export participation and manufacturing industry-specific characteristics

In this section, firms' export participation and firm productivity are examined in different industries. Industries are categorized by the level of technology such as low technology industries and medium and high technology industries.[70] Firms in

[70] Industry classification is defined based on GSO industry classification that is reported in the Appendix.

different industries can be different in terms of productivity, capital intensity and size. Thus, the response of firms to exporting might be also different.

The results from estimating the pooled, random-effect and the Wooldridge (2005) models for manufacturing firms are presented in columns 1 and 3 of Tables 6.13 to 6.16. The marginal effects of the variables are reported in columns 2 and 4. The results from Tables 6.13 to 6.16 show that firm productivity has a positive and significant effect on firms' decisions to export in all industries. Firm productivity in low technology industries, however, has a larger effect on the exporting decision than in the medium and high technology industries. After controlling for sunk costs, the coefficients of productivity in low technology industries are still positive and statistically significant whereas those in medium and high technology industries are insignificant. This can be explained by Vietnam's comparative advantage in low technology industries such as textiles, garments, wood and wood products. The sign of the effect of capital intensity on firm exporting is unclear as shown in Table 6.11.

As for other variables, capital intensity has a negative and statistically significant effect on firms' export participation in low technology industries whereas the coefficients of capital intensity are positive in medium and high technology industries. This reflects that the production process in medium and high technology sectors requires relatively higher capital intensity than that in low technology industries.

Table 6.13: Firm productivity and export participation in low technology industries

Variables	(1) Pooled probit model	(2) Average marginal effects	(3) Random-effect probit model	(4) Average marginal effects
tfp_{it-1}	0.566***	0.135***	0.907***	0.117***
	(0.0556)	(0.0128)	(0.113)	(0.0153)
$lnkl_{it-1}$	-0.131***	-0.0312***	-0.248***	-0.0320***
	(0.0284)	(0.0067)	(0.0638)	(0.00845)
$lnwage_{it-1}$	-0.213***	-0.0510***	-0.385***	-0.0498***
	(0.0668)	(0.0159)	(0.128)	(0.0165)
$lnsize_{it-1}$	0.347***	0.0829***	0.578***	0.0747***
	(0.0205)	(0.0043)	(0.0525)	(0.0060)
$lnage_{it-1}$	0.0515	0.0123	0.185*	0.0240*
	(0.0437)	(0.0105)	(0.112)	(0.0143)
fies	0.670***	0.160***	1.236***	0.160***
	(0.0995)	(0.0234)	(0.257)	(0.0318)
Industry FEs	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes
Observations	3,342	3,342	3,342	3,342
Log-likelihood	-1425		-1193	
chi-squared	1310		329.4	
Number of firms			1,114	
rho			0.712	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 columns 2 and 4 show the marginal effects of the variables of the pooled and random effect model in column 1 and 4, respectively. exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. tfp_{it-1} is one-year lagged TFP. $Lnlp_{it-1}$ is firm labour productivity. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises.

In contrast, the average wage across firms is positively associated with firms' export participation in medium and high technology industries whereas this effect is negative in low technology industries. Average wage might reflect the quality of human capital that may be higher in medium and high technology industries. Firm size and foreign ownership have positive effects on the firms' exporting decision in all industries.

Table 6.14: Firm productivity and export participation in low technology industries

Variables	(1) Pooled probit model	(2) Average marginal effects	(3) Wooldridge dynamic non-linear model	(4) Average marginal effects
tfp_{it-1}	0.465***	0.0802***	0.769***	0.102***
	(0.0772)	(0.0132)	(0.203)	(0.0243)
$lnkl_{it-1}$	-0.0832**	-0.0144**	-0.0195	-0.0025
	(0.0391)	(0.0067)	(0.230)	(0.0305)
$lnwage_{it-1}$	-0.0390	-0.00673	-0.700***	-0.0929***
	(0.0910)	(0.0157)	(0.214)	(0.0283)
$lnsize_{it-1}$	0.185***	0.0319***	0.467	0.0619
	(0.0286)	(0.0049)	(0.297)	(0.0391)
$lnage_{it-1}$	0.0234	0.00403	0.0700	0.0092
	(0.0664)	(0.0115)	(0.0901)	(0.0120)
fies	0.542***	0.0936***	0.629***	0.0834***
	(0.143)	(0.0246)	(0.206)	(0.0253)
exp_{it-1}	1.725***	0.298***	1.115***	0.148***
	(0.0844)	(0.0110)	(0.244)	(0.0485)
exp_{i0}			0.925**	0.123***
			(0.372)	(0.0354)
Industry FEs	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes
Observations	2,228	2,228	2,228	2,228
Log-likelihood	-702.7		-679.7	
chi-squared	1388		329.8	
Number of firms			1,114	
rho			0.336	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 columns 2 and 4 show the marginal effects of the variables of the pooled and random effect model in column 1 and 4, respectively. exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. tfp_{it-1} is one-year lagged TFP. $Lnlp_{it-1}$ is firm labour productivity. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises.

Table 6.15: Firm productivity and export participation in medium and high technology industries

Variables	(1) Pooled probit model	(2) Average marginal effects	(3) Random-effect probit model	(4) Average marginal effects
tfp_{it-1}	0.201***	0.0574***	0.352***	0.0638***
	(0.0732)	(0.0208)	(0.126)	(0.0229)
$lnkl_{it-1}$	0.0079	0.00227	0.150*	0.0272*
	(0.0396)	(0.0113)	(0.0864)	(0.0154)
$lnwage_{it-1}$	0.415***	0.118***	0.603***	0.109***
	(0.0890)	(0.0250)	(0.156)	(0.0282)
$lnsize_{it-1}$	0.279***	0.0797***	0.500***	0.0907***
	(0.0281)	(0.0074)	(0.0732)	(0.0119)
$lnage_{it-1}$	-0.0192	-0.0054	0.0217	0.00394
	(0.0463)	(0.0132)	(0.125)	(0.0227)
fies	0.554***	0.158***	1.109***	0.201***
	(0.101)	(0.0284)	(0.272)	(0.0458)
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	2,178	2,178	2,178	2,178
Log-likelihood	-1100		-914.4	
chi-squared	639.3		190.8	
Number of firms			726	
rho			0.746	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 columns 2 and 4 show the marginal effects of the variables of pooled and random effect model in column 1 and 4, respectively. exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. tfp_{it-1} is one-year lagged TFP. $Lnlp_{it-1}$ is firm labour productivity. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises. Japan, Korea, Taiwan, Singapore, Hong Kong (China) and others: dummies of country sources of firm foreign ownership in Vietnam.

6.3.5.2.Firms' export participation and services sector-specific characteristics

In this section, services sectors are classified into sector groups based on Vietnam's standard industry classification (VSIC)[71] 1993 including the hotels and

[71] More details on VSIC 1993 are provided in the Appendix.

restaurants sector, transport, the storage and communication sector, and other sectors most of which are business services sectors.

Table 6.16: Firm productivity and export participation in medium and high technology industries

Variables	(1) Pooled probit model	(2) Average marginal effects	(3) Wooldridge dynamic non-linear model	(4) Average marginal effects
tfp_{it-1}	0.0363	0.0077	0.0561	0.0081
	(0.0933)	(0.0199)	(0.215)	(0.0308)
$lnkl_{it-1}$	0.0157	0.0033	0.0962	0.0140
	(0.0539)	(0.0115)	(0.265)	(0.0383)
$lnwage_{it-1}$	0.351***	0.0748***	0.626**	0.0909**
	(0.119)	(0.0251)	(0.270)	(0.0392)
$lnsize_{it-1}$	0.109***	0.0232***	0.754**	0.109**
	(0.0386)	(0.0082)	(0.373)	(0.0534)
$lnage_{it-1}$	-0.0271	-0.0057	-0.0042	-0.0006
	(0.0687)	(0.0146)	(0.113)	(0.0164)
fies	0.307**	0.0654**	0.329	0.0478
	(0.138)	(0.0293)	(0.234)	(0.0333)
exp_{it-1}	1.757***	0.374***	0.760**	0.110*
	(0.0936)	(0.0127)	(0.307)	(0.0630)
exp_{i0}			1.711***	0.248***
			(0.557)	(0.0375)
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	1,452	1,452	1,452	1,452
Log-likelihood	-562.1		-550.8	
chi-squared	788.0		203.5	
Number of firms			726	
rho			0.528	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. tfp_{it-1} is one-year lagged TFP. $Lnlp_{it-1}$ is firm labour productivity. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises. Japan, Korea, Taiwan, Singapore, Hong Kong (China) and others: dummies of country sources of firm foreign ownership in Vietnam.

The estimation results are reported in the Appendix. The findings show that the self-selection hypothesis is not evident in the hotels and restaurants sector as the coefficients of labour productivity are negative. In addition, the self-selection mechanism takes place in transport, storage and communication sectors and the group of other services sectors. In addition, the role of sunk costs and foreign ownership are confirmed in all sectors. Capital intensity for the hotels and restaurants sector is positive and statistically significant in most cases whereas this variable is negative and significant in other services sectors.

6.4.Conclusion

In this chapter the determinants of a firm's export decision are examined using Vietnamese manufacturing firm-level data for 2002-04 and services firm data for 2004-07. Consistent with previous findings, the sunk entry costs are the most important determinant of the probability of exporting in both sectors. Evidence is also found to support the self-selection of most productive firms into export markets for most manufacturing firms except for the firms in medium and high technology sectors in the presence of the sunk costs. As for services firms, the self-selection effect also is found in most firms except those in the hotels and restaurants sector.

In addition to the role of the sunk costs and firm productivity, firm size plays a positive role, implying that larger firms are more likely to export. The results also show that Vietnam's firms using capital-intensive technology are less likely to enter export markets. The sign of the effect of capital intensity, however, is mixed if the effects of capital intensity on firm exporting by industries are considered.

By disaggregating the effects of country of origin of FDI, the chapter shows positive effects of FDI from Japan, Korea, Taiwan and Singapore on firm export decisions in Vietnam in the absence of sunk costs. Interestingly, when the sunk costs are included in the model for manufacturing firms, the impacts of FDI from Japan, Taiwan and Singapore are still statistically significant and positive while the effects of ownership from Korea and other countries are insignificant. The result suggests that the effects of foreign ownership are different across countries of origin of FDI in the presence of the sunk entry costs for manufacturing exporters. As for services firms, there is no significant difference across countries of origins of FDI. All origins of firm foreign ownership are statistically significant and positive.

In summary, findings in the chapter suggest that the effects of key factors on firms' export participation are different across industries. The self-selection mechanism is more evident in the industries where Vietnam has a comparative advantage. As for services sectors, there is no evidence for the self-selection effect in hotels and restaurants sectors whereas this effect takes place in other services sectors. The findings given in the chapter thus can lead to policy implications in Vietnam. The results support the importance of productivity, among others, in preparation for the export participation of firms.

Chapter 7 Learning effects from exporting:

Evidence from firm-level data

7.1. Introduction

One of the frequently asked questions in the trade literature is whether international trade can stimulate the economic growth of countries. Although the miracle of the economic growth in East Asian countries can often be attributed to the export-oriented economic policies (World Bank, 1993), there is no clear consensus on this issue in the literature. The macro-level evidence on the positive correlation between economic growth and exporting activity can be found in a number of studies, such as Frankel and Romer (1999). Rodriguez and Rodrik (2000), however, cast some doubt on the robustness of these results. They argue that the impact of international trade might depend on a number of factors such as country heterogeneity and different measures of trade openness.

Complementing the macro-level studies in the literature, there is an increasing number of micro-level studies that examine whether exporting can have a positive effect on productivity, hence on growth, since it is the firm, rather than the country, that benefits directly from export and trade policies. As the literature in Chapter 3 and Chapter 4 suggests, firm productivity gains can stem from exporting through knowledge transfers from international buyers, incentives for innovation and organizational improvements due to highly competitive markets. The micro-level evidence on firm productivity gains stemming from export participation (i.e. learning

by exporting), however, is still mixed as suggest by Wagner (2007). Therefore, the question of whether there are learning effects from exporting remains open to scrutiny. This chapter aims to fill in the gap by examining the learning-by-exporting hypothesis using Vietnamese firm-level data. Although Vietnam has significantly transformed from a centrally planned to a market-oriented economy since 1986, little has been discussed in the literature about the rationale of Vietnam's open-door policies,[72] especially if these policies are targeted to improving the productivity of firms through the learning-by-doing mechanism. Because Vietnam is a transitioning economy and a developing country, understanding the importance of the learning-by-doing effect as the rationale of open-door policies is useful not only for Vietnam, but also for other developing countries that have taken a step towards liberalizing their economies for international trade.

That being said, identifying the learning-by-doing fact using firm-level data is not a straightforward task. This is because the link between a firm's productivity and its decision to export is confounded by what is known as the self-selection effect. For instance, firms that are more productive also tend to be the ones that export, and this makes it hard to pin down the positive (causal) effect that gaining experience from exporting has on the productivity of a firm. If the firm's productivity growth is already nearly at the technological frontier, it is more difficult for this firm to gain productivity than the firm that has lower productivity. For the former issue, the use of the matching approach and difference-in-difference (DID) estimator can help to identify the effect of learning by exporting. The matching technique can allow for the self-selection

[72] As discussed in Chapter 2, Vietnam's open-door policies focused on the expansion of exports and international integration.

mechanism by matching exporters and non-exporters that have similar characteristics. As Heckman et al. (1997) suggest, the DID estimator may remove the unobserved firm time-constant effects. For the latter, this is not the case for Vietnam as there is some technology gap between Vietnam's firms and foreign firms (Nguyen, 2008; Pham and Pham, 2005). In light of the literature, this chapter examines the learning effect from exporting on firm performance using Vietnam's firm-level data. The study investigates whether there is any relationship at all from exporting towards productivity by employing a matching technique and the DID estimator to undertake consistent comparisons between exporters and non-exporters.

Chapter 6 gives evidence for the self-selection effect in all manufacturing industries and all service sectors except for medium and high technology industries and the hotels and restaurants sector. The descriptive statistics, however, show that exporters are still superior to non-exporters in the medium and high technology manufacturing sector as well as the hotels and restaurants sector.[73] This can shed light on the hypothesis that firms in these sectors can gain productivity through learning by exporting. In addition, the literature suggests that the self-selection effect and learning effect from exports are not mutually exclusive, implying that the learning-by-exporting hypothesis can occur in the sectors in which the self-selection effect is observed.

It should also be noted that although a number of previous studies have considered the effects of a firm choosing to export on that firm's productivity, most of the studies examines the role of learning by exporting in manufacturing sectors. Little attention has been paid to the relationship between exports and firm performance in

[73] Descriptive statistics are provided in section 7.2.

services sectors in the literature.[74] There might be differences between services and manufacturing firms' internationalization due to characteristics of services such as intangibility, inseparability between production and consumption, perishability and heterogeneity.[75] Thus the extent of the learning-by-exporting effect may be different between manufacturing and services firms (Love and Mansury, 2009).

The research contributes to the literature by examining the learning effects from exports in both manufacturing and services sectors. Allowing for the self-selection effects of the most productive firms into export markets, the study considers whether firm export participation can increase firm productivity. In addition to firm productivity, the research examines whether exports can affect firm profits and employment for Vietnam's manufacturing and services firms. The experience of Doi Moi in Vietnam provides a persuasive impression of export-led growth. This may shed light on the possible effects of exporting on firm performance in Vietnam. The aim of the research is to provide an understanding of the mechanisms of export-led growth in Vietnam.

This study thereby aims to answer two questions as follows:

i. Does exporting activity increase firm productivity in the manufacturing and services sectors in Vietnam?

ii. How does the firm's participation in export markets affect firm profit and employment in the manufacturing and services sectors in Vietnam?

[74] Empirical studies that examine the learning-by-exporting effect in the services sector are discussed in Chapter 4.
[75] These characteristics of services goods are further explained by Love and Mansury (2010).

Due to the characteristics of the data, the effects of learning by exporting are examined separately for manufacturing in 2002-04 and services sectors during 2003-07. The findings in this chapter suggest that there is evidence of learning by exporting for both manufacturing and services firms. If the matching technique is used for sub-groups separately, the learning effects from exporting are less evident. In addition, there is no evidence on the effect of exporting activity on firm profits whereas the effects on firm employment are found in some cases.

The rest of the chapter is organized as follows. Section 7.2 reviews the methodology and data used in this chapter. Section 7.2 includes two sub-sections: section 7.2.1 provides the empirical framework and presents the econometric issues to identify the learning effects from exporting; and section 7.2.2 describes data used in this chapter. Section 7.3 describes the empirical results. Finally, section 7.4 presents discussions and the conclusion.

7.2. Methodology and data

7.2.1. Empirical framework

The study investigates the effects of exporting on firm productivity by employing a matching technique to make consistent comparisons between exporters and non-exporters. In particular, the research uses a propensity score matching (PSM) technique that is emphasized by the number of recent studies such as Heckman et al. (1997).

Following the methodology of Heckman et al. (1997), the study calculates the average treatment effect on the treated (ATT) for exporting firms. ATT measures the impact of firm exporting on firm performance (i.e. learning effect from exporting).

ATT for exporters is written as:

$$E\left[y^{1}_{it+s} - y^{0}_{it+s} \mid EXP_{it} = 1\right] = E\left[y^{1}_{it+s} \mid EXP_{it} = 1\right] - E\left[y^{0}_{it+s} \mid EXP_{it} = 1\right] \quad (7.1)$$

where $EXP_{it} \in \{0,1\}$ is a dummy indicating whether firm i starts to export for the first time at time period t[76]. y^{1}_{it+s} is the outcome y[77] obtained at time t + s ($s \geq 0$) by firms that have exported. y^{0}_{it+s} is the outcome y at time t + s under the hypothesis that they did not export at time t + s. The left-hand-side term in equation (7.1) is the difference between the average outcome for firms that have exported and the average effect for the same firms if they had not exported.

Because y^{0}_{it+s} is not observed, PSM suggested by Rosenbaum and Rubin (1983) is employed to estimate the counterfactual outcome for the treated firms (i.e. export starters) using the 'nearest-neighbour' matching method. This means that the untreated firms (i.e. non-exporters) that are most similar to a treated firm in terms of firm-specific characteristics (i.e. the closest propensity score) are chosen to match with an export starter. Thus y^{0}_{it+s} is measured based on the average outcome for all chosen untreated firms.

To identify the learning effect from exporting, controlling for the self-selection effects, a two-stage methodology is employed.

[76] This variable is different from the EXP variable in the previous chapter that indicates whether a firm is an exporter or not.
[77] In this chapter, outcomes y are TFP, labour productivity, total profit and total employment.

First, the research constructs the probability of becoming a new exporter.

Assume $P(EXP_{it} = 1 \mid X_{t-1})$ is the probability of participating in export markets. As discussed above, the observations for treated firms are matched with the observations for a control group that would be the nearest neighbours in terms of the propensity score. In other words, based on PSM a comparison group is undertaken by matching export starters to non-exporters with similar values of P(X) conditional on observable pre-entry firm-specific characteristics X.

To identify the probability of entry into export markets, the research uses a probit model in which several firm-specific lagged X variables are included, as suggested by the empirical literature, particularly Girma et al. (2004) and De Loecker (2007). The following equation is then estimated:

$$\text{EXP}_{it} = \begin{cases} 1: \beta X_{it-1} + \varepsilon_{it} > 0 \\ 0: \text{otherwise} \end{cases} \quad (7.2)$$

A probit model of probability to start exporting is constructed. The one-year lagged firm-specific characteristics X_{it-1} are included in the model:

$$P(EXP_{it} = 1) = \Phi(\text{productivity}_{it-1}, \text{size}_{it-1}, \text{foreignownership}_{it-1}, \text{dummies}) \quad (7.3)$$

where $\Phi(.)$ is a normal cumulative density function, productivity_{it} is firm-level Levinson and Petrin's TFP[78] for manufacturing sectors and firm-level labour productivity (LP) for services sectors.[79] As there is no information on intermediate costs for services firms in the database, the productivity measure for services firms is the ratio of sales per worker. Although labour productivity focuses on the efficiency

[78] Chapter 5 describes the calculation of TFP in more detail.
[79] Due to characteristics of the data, the study investigates the effects of learning-by-exporting separately for manufacturing in the period of 2002-04 and services sectors during 2003-07, respectively.

per worker only, labour productivity has been employed in a number of studies to consider the learning effects from exporting (such as Wagner, 2007; and Vogel, 2010).[80]

The variables $size_{it}$ and $foreignownership_{it}$ are firm size in terms of employment and firm foreign ownership dummy, respectively. Dummies refer to time and industries.

After the probability of starting to export is constructed, the observations for treated firms are matched with the observations for the control group that would be the nearest neighbours in terms of the propensity score. The research uses the DID matching estimator to identify the learning effect from exporting. The implementation of the DID estimator is similar to the cross-section version discussed above, except that outcome y is measured in changes between pre-participation and post-participation periods instead of in levels. The DID estimator allows the researcher to compare the mean change difference in the firm performances before and after the treatment for matched groups. Heckman et al. (1997) suggest that the DID estimator may remove the unobserved firm-specific time-invariant effects.

The average impact of export market entry thereby is estimated by using the DID estimator as follows:

$$\hat{\delta}_{DID}=\frac{1}{N_S}\sum_{i}\left(\left[y^{1}_{i,t+s}-y^{1}_{i,t-1}\right]-\sum_{j\in C_i}w_{ij}\left[y^{0}_{j,t+s}-y^{0}_{j,t-1}\right]\right) \tag{7.4}$$

[80] Foster et al. (2005) show that productivity measures that use total sales and measures that use quantities are highly positively correlated.

where N_S is the number of new starters and a set C_i of control firms, N_i^C is the number of control firms in the matched sample, $w_{ij} = 1/ N_i^C$, s is the time period (0…S).

Note that the matching technique is used for the entire manufacturing sector. Firm-specific factors, however, can be different across different sub-sectors. The study thus undertakes the matching technique within each sub-sector group[81] in the next step, controlling for the heterogeneity across sub-sectors. This implies that the author estimates the probability to start exporting for each sub-sector group, separately.[82] The study uses the same method for services sector.

The 'balancing properties' of the data are tested to check the quality of matching. After the probability of entry p(X) is constructed, there should be no other variable that could be added to the conditioning set of the propensity score models that would improve the estimation. In other words, the aim of the PSM approach is to match a treated firm with untreated firms that have the most similar characteristics. Thus, after the matching is conducted, there should be no statistically significant differences between covariate means of the treatment and comparison units in the matched sample. T-tests are used in order to check this. In addition, the research also checks common support or the overlap condition of propensity score distribution between treated and untreated groups. The study also examines whether the propensity

[81] There are two sub-sector groups including low technology industries and medium and high technology industries in manufacturing sectors. For the services sector, the three sub-sector groups are: hotels and restaurants; transport and telecommunications; and business services and other services.

[82] The matching technique is employed for each industry in some studies such as De Loecker (2007). Since in the data there are some industries that have no observations for export starters during the studied period, the chapter uses the matching technique for industry groups instead of industries.

score is larger than the maximum or smaller than the minimum for the treatment and control groups. The study uses Stata psmatch2 programme developed by Leuven and Sianesi (2003) to undertake the PSM technique.

7.2.1. Data

This study's database for manufacturing firms is the Vietnamese Firms Survey 2001-04 from GSO. This is the balanced panel database of 1,840 firms during 2000-04 in all manufacturing sectors. Except for labour, all other variables are deflated at constant 1994 prices. The dataset is further described in Chapter 5. Tables 7.1 and 7.2 present summary statistics for variables used in the estimating models.

Table 7.1: Summary statistics for manufacturing firms (2003-04)

Abbreviations	Variables	Observations	Mean	Std Dev.
Tfp_{it-1}	Log total factor productivity	3,680	1.4605	0.7919
$Lnsize_{it-1}$	Log firm size	3,680	3.8084	1.6769
$Start_{it}$	Dummy that is 1 when a firm starts exporting	2,700	0.0996	0.2995
$Fies_{it}$	Dummy variable for foreign-invested firms	3,680	0.1570	0.3639

Source: the data of manufacturing firms (GSO).

Table 7.2: Summary statistics for service firms (2005-07)

Abbreviations	Variables	Observations	Mean	Std Dev.
$lnlp_{it-1}$	Log labour productivity	40,699	4.1495	1.7697
$Lnsize_{it-1}$	Log firm size	40,699	2.6563	1.2500
$Start_{it}$	Dummy that is 1 when a firm starts exporting	38,651	0.0217	0.1459
$Fies_{it}$	Dummy variable for foreign-invested firms	40,699	0.0456	0.2087

Source: the data of service firms (GSO).

The data for services firms is the sample of services firms from the Vietnamese enterprises census in 2004-07. This census is conducted annually by the GSO. The dataset is an unbalanced panel with information of more than 10,000 services firms in all services sectors except for trade and repair of motor vehicles sector as there is no

information on firms' exporting status in this sector. The dataset provides a broad range of firm-level information on revenues, employment, capital stock, exports, imports and establishment year. Except for labour, all other variables are deflated at constant 2003 prices.

Table 7.3: Starters vs. non-exporters in the low technology manufacturing sector

		tfp	lnlp	lnsize	fies
Non-exporters	Mean	1.2303	4.4545	2.9578	0.0447
	Std Dev.	0.6785	1.5636	1.3835	0.2067
Starters	Mean	1.683	5.3312	3.7174	0.1403
	Std Dev.	0.8446	1.7706	1.6711	0.3483

Source: the data of manufacturing firms (GSO). Notes: lnlp is the log of labour productivity, lnsize is the log of firm size, fies is a dummy variable for foreign ownership

Table 7.4: Starters vs. non-exporters in the medium and high technology manufacturing sectors

		tfp	lnlp	lnsize	fies
Non-exporters	Mean	1.4113	4.3508	3.8001	0.1304
	Std Dev.	0.8069	1.4512	1.4029	0.3369
Starters	Mean	1.6651	5.1001	4.3103	0.2941
	Std Dev.	0.9407	1.8547	1.5101	0.4578

Source: the data of manufacturing firms (GSO). Notes: lnlp is the log of labour productivity, lnsize is the log of firm size, fies is a dummy variable for foreign ownership

Table 7.5: Starters vs. non-exporters in the hotels and restaurants sector

		lnlp	lnsize	fies
Non-exporters	Mean	3.6652	2.3652	0.0135
	Std Dev.	1.0344	1.0641	0.1156
Starters	Mean	4.0495	2.2781	0.0153
	Std Dev.	0.8269	0.9962	0.1230

Source: the data of service firms (GSO). Notes: lnlp is the log of labour productivity, lnsize is the log of firm size, fies is a dummy variable for foreign ownership

Table 7.6: Starters vs. non-exporters in the transport and telecommunications sector

		lnlp	lnsize	fies
Non-exporters	Mean	4.7292	2.7666	0.0150
	Std Dev.	1.3874	1.2615	0.1216
Starters	Mean	5.5064	3.0358	0.0676
	Std Dev.	1.3437	1.7365	0.2516

Source: the data of service firms (GSO). Notes: lnlp is the log of labour productivity, lnsize is the log of firm size, fies is a dummy variable for foreign ownership

Table 7.7: Starters vs. non-exporters in the business services and other services sector

		lnlp	lnsize	fies
Non-exporters	Mean	4.2412	2.3635	0.0355
	Std Dev.	1.5065	1.1390	0.1852
Starters	Mean	5.7577	3.607	0.5619
	Std Dev.	1.4692	1.3563	0.4982

Source: the data of service firms (GSO).

Tables 7.3 to 7.7 show the descriptive statistics between export starters and non-exporters. As shown in these tables, export starters are superior to non-exporters in terms of productivity, size and foreign ownership for both manufacturing and services firms. In the next section, the research examines whether exports can improve firm performance, in line with the learning-by-exporting hypothesis.

7.3. Empirical results

As stated above, due to characteristics of the data, the study investigates the effects of learning by exporting separately for manufacturing in 2002-04 and services sectors during 2003-07, respectively.

7.3.1. Learning effects from exporting

7.3.1.1. The learning-by-exporting effect in manufacturing firms

In this section, the learning effects from exports are examined for manufacturing firms. PSM is undertaken for the entire manufacturing sector. Based on equations (7.2) and (7.3), the study estimates the effects of the determinants of a firm's probability to export. The study undertakes PSM for the entry year of exporting and the first year, separately. Table 7.8 shows the coefficients of factors that determine a firm's entry into export markets. The results show that highly productive manufacturing firms are likely to start exporting. Larger firms are also more likely to be exporters.

After the probability of the firms' entry into export markets is constructed, firms are matched using the nearest neighbour method. Table 7.9 shows the results of the estimated ATT (average treatment effect for the treated, i.e. $\hat{\delta}_{DID}$ in equation (7.4)), after using the PSM technique. The magnitude of the estimated treatment effects is interpreted as a percentage.

The results show that the learning effects from exports on TFP and labour productivity (i.e. estimated ATTs) are significant and positive, suggesting that there are positive effects of starting to export on firm performance in Vietnam. In particular, the exporters' TFP growth increases by 17.8 percent once they start exporting. Similarly, labour productivity growth of exporters shows a 15 percent increase one year after entry into export markets. The findings are consistent with Girma et al. (2004) and De Loecker (2007).

Table 7.8: Determinants of the manufacturing firm entry into export markets

Variables	Coefficients (std error) Learning by exporting: Entry year	Coefficients (std error) Learning by exporting: One year after entry
Lag TFP	0.2233***	0.4208***
	(0.0864)	(0.0597)
Lag Size	0.1291***	0.0840***
	(0.0398)	(0.0268)
Lag Fies	0.5086***	0.3565***
	(0.1656)	(0.1238)
Industry effects	Yes	Yes
Year effects	Yes	Yes
Log likelihood	-403.411	-816.241
Observations	1365	2700

Notes: Standard errors in parentheses. Lag TFP, lag Size and lag Fies are lagged values of TFP, firm size and the dummy of foreign-invested firms, respectively. Columns (1) and (2) report the results that are used to conduct the matching technique for the learning effect from exporting in the entry year and first year, respectively.
*** p<0.01, ** p<0.05, * p<0.1

Table 7.9: Effect of exports on firm performance

	TFP (entry year)	Labour productivity (entry year)	Labour productivity (one year after entry)
ATT	0.1779**	0.1424	0.1503**
	(0.0860)	(0.0964)	(0.0726)
The number of export starters	135	269	135
The number of non-exporters	1,230	2,431	1,230

Notes: Due to the characteristics of the data, ATT on TFP is examined for the entry year only. Labour productivity is the sales per worker. Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7.10: Effect of exporting on manufacturing firm profit

	Total profit (entry year)	Total profit (one year after entry)
ATT	0.0697	0.0105
	(0.1423)	(0.2057)
The number of export starters	269	135
The number of non-exporters	2,431	1,230

Notes: Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7.11: Effect of exporting on manufacturing firm employment

	Total employment (entry year)	Total employment (one year after entry)
ATT	0.0850*	0.1462
	(0.0488)	(0.1053)
The number of export starters	269	135
The number of non-exporters	2,431	1,230

Notes: Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

In addition to firm productivity, the effects of exports on a firm's total profit and total employment are examined. The results from Tables 7.10 and 7.11 suggest that there is no evidence that the exports can affect firm profit whereas the effect of learning by exporting on firm employment is significant in the entry year only.

As discussed above, it is essential to undertake a balancing test to examine how large the differences are between matched treated and untreated groups after matching. The t-test is used to test the covariate balancing to examine whether there are still significant differences in a given covariate between these groups. A good matching is achieved if the equality of the firm characteristics is not significantly different.

The t-test results in Table 7.12 for the balancing check show that the quality of matching is efficient. In the matched sample, there were no significant differences in the characteristics of the firms entering the export market and the matched non-exporters (as expected).

Table 7.12: The results of t-tests of balancing check for entrants and non-exporters in the matched sample[83] (learning by exporting: entry year)

Variable	Mean (Treated)	Mean (Control)	t-test p value
Lag TFP	1.5027	1.4988	0.966
Lag Size	4.0186	4.0659	0.785
Lag Fies	0.2296	0.1629	0.169

Notes: Lag TFP, lag Size and lag Fies are lagged values of TFP, firm size and the dummy of foreign-invested firms, respectively. *** p<0.01, ** p<0.05, * p<0.1

7.3.1.2.Learning-by-exporting effect in the services firms

In this section the effect of learning by exporting for service firms during 2004-2007 is examined using similar methodology to that discussed in section 7.2. Table 7.13 presents the coefficients of factors that determine a services firm's entry into export markets. Table 7.13 shows that the labour productivity, firm size and foreign ownership have a positive effect on a services firm's entry into export markets. The results imply that highly productive services firm are likely to start exporting. Larger services firms also have a greater probability of being an exporter.

[83] The Appendix further describes the balancing test results.

After the firms' probability of entry into export markets is constructed, firms are matched using the PSM approach. The results of ATT are reported in Table 7.14. Table 7.14 shows that estimated coefficients are positive and highly significant from entry to the second years of exporting, suggesting the existence of a learning-by-exporting effect in services sectors. In particular, the labour productivity growth of exporters on average increases by 13.8 percent once they start exporting and the productivity gap slightly widens as the firm continues exporting. After two years of exporting, labour productivity growth of exporters increases by 19.7 percent.

Table 7.13: Determinants of the services firms' entry into export markets

Variables	Coefficients (std error) Learning by exporting: entry year	Coefficients (std error) Learning by exporting: one year after entry	Coefficients (std error) Learning by exporting: two years after entry
Lag labour productivity	0.0578***	0.0476**	0.0302
	(0.0131)	(0.0185)	(0.0309)
Lag Size	0.0253*	0.0466**	0.1055***
	(0.0149)	(0.0212)	(0.0339)
Lag Fies	0.8475***	0.8895***	1.0409***
	(0.0694)	(0.0921)	(0.1468)
Industry effects	Yes	Yes	Yes
Year effects	Yes	Yes	Yes
Log likelihood	-3172.851	-1511.744	-538.839
Observations	38,651	20,767	3,309

Notes: Lag labour productivity, lag Size and lag Fies are lagged values of labour productivity, firm size and the dummy of foreign-invested firms, respectively. Columns (1), (2) and (3) report the results that are used to conduct the matching technique for the learning effect from exporting in the entry year, first year and second year, respectively.
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7.14: The effect of exporting on services firm productivity

	Entry year	One year after entry	Two years after entry
ATT	0.1377**	0.1589***	0.1973***
	(0.0551)	(0.0448)	(0.0533)
The number of export starters	842	408	160
The number of non-exporters	37,809	20,359	3,149

Notes: ATT in terms of labour productivity. Labour productivity is the sales per worker. Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7.15: The effect of exporting on services firm profit[84]

	Entry year	One year after entry	Two years after entry
ATT	0.0319	0.1201	0.0230
	(0.0714)	(0.1518)	(0.1465)
The number of export starters	842	408	160
The number of non-exporters	34,237	19,104	2,966

Notes: Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7.16: The effect of exporting on services firm employment

	Entry year	One year after entry	Two years after entry
ATT	0.0111	0.0583	0.1606*
	(0.0375)	(0.0559)	(0.0914)
The number of export starters	842	408	160
The number of non-exporters	37,809	20,359	3,149

Notes: Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

[84] The research drops the observations that have zero profit.

Damijan and Kostevc (2006) find that the learning-by-exporting effect is not permanent and likely to decline after the entry year. They attribute this transitory TFP gain to the increased capacity utilization owing to expanding the market. In contrast, De Loecker (2007) finds that the learning effect is sustained, and not just limited to the first year of exporting. The results in Table 7.14 suggest that the effect of learning in Vietnam's services sectors slightly increase after two years of exporting.

In addition, this study examines whether the learning-by-exporting effect can influence services firm profit and employment. The results in Table 7.15 suggest that there is no evidence for the effect on firm profit whereas the learning effect from exporting on firm employment is significant after two years of entry.

Table 7.17: Balancing test results for entrants and non-exporters in the matched sample[85] (learning by exporting: entry year)

Variable	Mean (Treated)	Mean (Control)	t-test p value
Lag Labour Productivity	4.2894	4.2392	0.499
Lag Size	2.5934	2.626	0.597
Lag Fies	0.1092	0.0973	0.424

Notes: Lag labour productivity, lag Size and lag Fies are lagged values of labour productivity, firm size and the dummy of foreign-invested firms, respectively. *** p<0.01, ** p<0.05, * p<0.1

The balancing check is also undertaken and the t-test results for entrants and non-exporters in the matched sample are shown in Table 7.17. The results suggest that the quality of matching is efficient. In the matched sample, there were no significant

[85] More results of the t-tests are reported in the Appendix.

differences in the characteristics of the firms entering the export market and the matched non-exporters.

Consistent with section 7.2, the next section presents the results for the PSM technique which is applied within sub-sector groups of the manufacturing and services sectors, controlling for the differences across sub-sector groups.

7.3.2. Learning effects from exporting and industry characteristics

7.3.2.1. Learning effects from exporting and manufacturing industry characteristics

In this section, I examine the learning effects from exporting in different industry groups (i.e. sub-sector groups).[86] In particular, manufacturing industries are classified into low technology industries and medium and high technology industries.[87] The study uses the same approach as in section 7.2 for each of two industry groups in order to examine the learning effects from exporting by sub-sector.

Table 7.18 and Table 7.21 report the estimation results of ATT in terms of productivity. It can be seen that the learning effect from exporting is significant in the case of labour productivity in the first year after the firm enters the export market. In particular, the labour productivity of exporters in low technology industries and in medium and high technology on average increases by 18.6 percent and 24.1 percent respectively in the first year of exporting. It is noteworthy that the learning-by-

[86] Since in the data there are some cases in which there are no observations for SOEs in the treated group (i.e. the group of export starters) of the matched sample during the studied period when using the matching technique for industry groups, the chapter does not use the PSM technique and DID method for private firms vs. SOEs distinction.
[87] The classification of manufacturing sectors is described in the Appendix.

exporting effect is slightly larger for medium and high technology industries than for low technology industries after two years of entry. This is in contrast to the finding for the self-selection effects that is larger for low technology industries than for medium and high technology industries, as suggested in Chapter 6.

Table 7.18: The effect of exporting on manufacturing firm productivity in low technology industries

	TFP (entry year)	Labour productivity Entry year	Labour productivity One year after entry
ATT	0.1541	0.1290	0.1862*
	(0.1261)	(0.1247)	(0.0968)
The number of export starters	69	167	69
The number of non-exporters	760	1,491	760

Notes: Labour productivity is the sales per worker. Bootstrap standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7.19: The effect of exporting on manufacturing firm profit in low technology industries

	Total profit Entry year	Total profit One year after entry
ATT	0.0188	0.1311
	(0.1247)	(0.3153)
The number of export starters	167	69
The number of non-exporters	1,491	760

Notes: Labour productivity is the sales per worker. Bootstrap standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 7.20: The effect of exporting on manufacturing firm employment in low technology industries

	Total employment Entry year	Total employment One year after entry
ATT	0.0611	0.0283
	(0.0603)	(0.1286)
The number of export starters	167	69
The number of non-exporters	1,491	760

Notes: ATT in terms of total employment. Labour productivity is the sales per worker. Bootstrap standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 7.21: The effect of exporting on manufacturing firm productivity in medium and high technology industries

	TFP (Entry year)	Labour productivity Entry year	Labour productivity One year after entry
ATT	0.0737	0.0701	0.2409***
	(0.0952)	(0.1110)	(0.0870)
The number of export starters	66	102	66
The number of non-exporters	470	940	470

Notes: Labour productivity is the sales per worker. Bootstrap standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 7.22: The effect of exporting on manufacturing firm profit in medium and high technology industries

	Total profit Entry year	Total profit One year after entry
ATT	0.0249	0.1116
	(0.2344)	(0.3835)
The number of export starters	102	66
The number of non-exporters	940	470

Notes: Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7.23: The effect of exporting on manufacturing firm employment in medium and high technology industries

	Total employment Entry year	Total employment One year after entry
ATT	0.0119	0.0237
	(0.1065)	(0.1411)
The number of export starters	102	66
The number of non-exporters	940	470

Notes: Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The study also examines the effect of exporting on firm profit and firm employment growth, controlling for the self-selection effect within sub-sector groups. Tables 7.19, 7.20, 7.22 and 7.23 report the results of the estimated ATT in terms of firm profit and employment. The results show that there is no evidence for the learning-by-exporting effect on firm profit growth and firm employment growth for both groups.

In summary, after the matching technique is undertaken for each group of industries, the learning effects from exporting are less evident than in the results given in section 7.3.1 in which the matching technique are shown for the entire manufacturing sector. This suggests the importance of industry heterogeneity in the estimation of the learning effect from exporting in Vietnam.

7.3.2.2. Learning effects from exporting and services sector characteristics

In this section, the learning effects from exports in different groups of service firms are examined. In particular, the services sector is classified into sub-sectors:

hotels and restaurants; transport and telecommunications; and business services and other services.[88] Similar to the manufacturing sector, the study uses the same approach discussed in section 7.2 for each group in order to examine the learning effects from the exporting activity of services firms.

Table 7.24: The effect of exporting on firm productivity in the hotels and restaurants sector

	Entry year	One year after entry	Two years after entry
ATT	0.1492**	0.1175**	0.2330***
	(0.0645)	(0.0561)	(0.0551)
The number of export starters	456	191	62
The number of non-exporters	7,638	4,535	742

Notes: Labour productivity is the sales per worker. Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7.25: The effect of exporting on firm profit in hotels and restaurants

	Entry year	One year after entry	Two years after entry
ATT	0.0298	0.0657	0.1037
	(0.1030)	(0.1939)	(0.3205)
The number of export starters	456	191	62
The number of non-exporters	7,312	4,421	731

Notes: ATT in terms of total profit. Labour productivity is the sales per worker. Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

[88] The classification of services sectors is based on VSIC that is described in the Appendix.

Table 7.26: The effect of exporting on firm employment

in the hotels and restaurants sector

	Entry year	One year after entry	Two years after entry
ATT	0.0312	0.1164**	0.0659
	(0.0560)	(0.0558)	(0.1258)
The number of export starters	456	191	62
The number of non-exporters	7,638	4,535	742

Notes: Labour productivity is the sales per worker. Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7.27: The effect of exporting on firm productivity in the transport and telecommunications sector

	Entry year	One year after entry	Two years after entry
ATT	0.2124	0.0870	0.0489
	(0.1477)	(0.0799)	(0.0872)
The number of export starters	266	147	65
The number of non-exporters	11,634	6,236	566

Notes: Labour productivity is the sales per worker. Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7.28: The effect of exporting on firm profit in the transport and telecommunications sector

	Entry year	First year	Two years after entry
ATT	0.0308	0.1177	0.2036
	(0.1015)	(0.1889)	(0.3128)
The number of export starters	266	147	65
The number of non-exporters	10,691	5,874	521

Notes: Labour productivity is the sales per worker. Bootstrap Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7.29: The effect of exporting on firm employment in transport, telecommunication sectors

	Entry year	One year after entry	Two years after entry
ATT	0.0104	0.1002	0.0279
	(0.0762)	(0.0908)	(0.1262)
The number of export starters	266	147	65
The number of non-exporters	11,634	6,236	566

Notes: Labour productivity is the sales per worker. Bootstrap standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7.30: The effect of exporting on firm productivity in the business services and other services sectors

	Entry year	One year after entry	Two years after entry
ATT	0.2368	0.1976*	0.1372
	(0.1653)	(0.1129)	(0.1319)
The number of export starters	120	70	33
The number of non-exporters	18,537	9,588	1,841

Notes: Labour productivity is the sales per worker. Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7.31: The effect of exporting on firm profit in the business services and other services sectors

	Entry year	One year after entry	Two years after entry
ATT	0.0122	0.0737	0.2181
	(0.1652)	(0.3256)	(0.4268)
The number of export starters	120	70	33
The number of non-exporters	16,234	8,809	1,714

Notes: Labour productivity is the sales per worker. Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7.32: The effect of exporting on firm employment in the business services and other services sectors

	Entry year	One year after entry	Two years after entry
ATT	0.1290	0.1176**	0.1278
	(0.1021)	(0.0595)	(0.3109)
The number of export starters	120	70	33
The number of non-exporters	18,537	9,588	1,841

Notes: Labour productivity is the sales per worker. Bootstrap standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Tables 7.24 to 7.26 present the results of the estimated ATTs in services sub-sectors. As shown in these tables, the learning effect from exporting in terms of productivity gain is highly significant in the hotels and restaurants sector whereas this effect is not significant in other services sectors. This can be explained by the dominance of this sector in terms of export value. As shown in Chapter 2, tourism activities accounted for more than 50 percent of total services export value between 2005 and 2008. The dominance of tourism activities in terms of export values can improve the revenue from exports and hence increase the labour productivity growth stemming from exporting. In addition, the effect of exports on the employment growth of firms in the hotels and restaurants sector, and in the business services and other services sectors, is significant in the first year of entry whereas there is no evidence for the effect of exporting on firm profit growth for all three services sub-sector groups.

7.4. Conclusion

This chapter examines the learning-by-exporting hypothesis in both manufacturing and services sectors in Vietnam. Controlling for the self-selection mechanism, it is estimated whether export starters can gain productivity through learning by exporting of manufacturing firms in the period of 2002-04 and services firms during 2004-07. The study uses the PSM techniques and DID estimators in order to identify the learning effect from exporting. This methodology can allow for the heterogeneity between exporters and non-exporters and therefore allows the research to capture effects that can be attributed to exposure to foreign markets. The chapter's findings indicate that the entry into exporting activity increases firms' productivity growth in both the manufacturing and service sectors; and this effect slightly increases as the firm continues to export.

In addition, after allowing for the self-selection mechanism within sub-sector groups, the learning effects from exporting are less evident since the evidence of productivity gain stemming from exporting of manufacturing firms is only significant in the first year of exporting. For services firms, the learning-by-exporting effect is evident in the hotels and restaurants sector whereas there is no evidence of this effect in other services sectors.

In this chapter, the effects of learning by exporting on firm profit growth and employment growth are also considered. The findings show that there is no evidence of this effect on firm profit for both the manufacturing and services sectors. Although the effect of exporting activity on firm employment growth is evident in some cases for manufacturing firms, this effect is insignificant if the research undertakes the PSM technique within the groups of industries. For services firms, the effect on firm

employment growth is found in the hotels and restaurants sector and the business services and other services sector even if the study controls for the self-selection effect within services sub-sector groups.

Finally, the findings in this chapter suggest that there is evidence of the positive effects of exporting on firm productivity growth in some sectors in Vietnam. This confirms the importance of export-oriented growth in Vietnam. In addition, the results show that the learning effects from exporting are different across sectors. This can lead to policy implications for Vietnam. On the one hand, the results suggest the importance of industry heterogeneity in the link between exporting and productivity in Vietnam. On the other hand, the results show that learning effects from exporting in terms of productivity gain are larger for medium and high technology manufacturing sectors than for low technology sectors. For services sectors, this effect is evident in the hotels and restaurants sector only. These results are in contrast to the findings in Chapter 6 that suggest that the self-selection effects are observed in low technology manufacturing sectors and in all services sectors except for hotels and restaurants. This indicates that in some sectors highly productive firms self-select into export markets but there is no evidence for productivity gains stemming from exporting activity after these firms export. This can suggest that Vietnam needs to encourage both firms that have the intention to export and firms that are continuous exporters.

Chapter 8 Conclusion

Does trade liberalization increase productivity and hence improve the economic growth of countries? What is the relationship between productivity and exporting? Answers to these questions can provide an understanding of the mechanisms of economic growth. The answers can differ across countries. Rodriguez and Rodrik (2000) suggest that the impact of international trade might depend on a number of factors such as country heterogeneity.

This thesis answers these questions by examining the association between trade liberalization and productivity and the two-way relationship between exporting and productivity in Vietnam, a country that underwent a transformation from a centrally planned to a market-oriented economy.

The first finding in the thesis is given in Chapter 5. The empirical results support the evidence that trade liberalization can increase firm-level productivity in Vietnam. In particular, the results from the fixed-effect model and alternative model specifications show that a decrease in output tariffs increases firms' TFP levels and growth in Vietnam. To separate the impacts of input tariffs and output tariffs, input tariffs are included in the estimation equation. Once tariffs on inputs are included in the models, the sign of the coefficient of output tariffs does not change and the coefficients for both tariff rates are negative and highly significant. It should be noted that after tariffs on inputs are included, the magnitude of the effect of output tariffs is lower than that of input tariffs. In Chapter 5 the IV method is used to control for the possible endogeneity between productivity and trade liberalization. After controlling

for this endogeneity, the results still suggest that a 10 percent decrease in tariffs leads to a 0.4 percent increase in firms' productivity.

In addition, once the type of firms' ownership is taken into account, the effect of output tariffs and input tariffs differs according to firms' ownership status. Output tariff reductions have a larger impact on foreign-invested and non-state firms than domestic and state-owned firms, respectively. In contrast, the results show that the effect of input tariff reductions is larger for domestic and state-owned firms. The estimation results also suggest that the effect of a decrease in output tariffs is larger for medium and high technology firms than for low technology firms. In contrast, input tariff reductions have smaller effects on medium and high technology firms than low technology firms. The empirical results thus confirm the importance of firms' ownership structure and industry structure in the relationship between trade liberalization and firm productivity in Vietnam.

In addition to the effect of trade liberalization, this thesis examines the effect of firm productivity and sunk entry costs on firms' export decisions and whether productivity gains can arise from exporting. The results given in Chapter 6 support the evidence for the positive effects of key factors on firms' decision to export. As shown in Chapter 6, the sunk entry costs are the most important determinant of the export decision of both manufacturing and services firms. The study also finds evidence supporting the self-selection of highly productive firms into export markets for most manufacturing firms, except for the firms in medium and high technology sectors in the presence of the sunk entry costs. As for services firms, the self-selection effect is also found for most firms except for the firms in the hotel and restaurant sectors.

By disaggregating the countries of origin of FDI, the study shows the positive effects of foreign investment from Japan, Korea, Taiwan and Singapore on firms' export decisions in Vietnam in the absence of sunk entry costs. Interestingly, when the sunk costs are included in the estimation model for manufacturing firms, the impacts of FDI from Japan, Taiwan and Singapore are still statistically significant and positive while the effects of investment from Korea and other countries are insignificant. The result suggests that the effects of foreign investment on the export decisions of manufacturing firms differ according to countries of origin of foreign investment. As for services firms, there is no significant difference across countries of origin of foreign investment. All origins of services firms' foreign investment are statistically significant and positive.

In Chapter 7, the empirical results indicate that the entry into exporting increases the productivity of both manufacturing and services firms, and this slightly increases as the firm continues to export. It is noteworthy that the matching technique is used, allowing for the self-selection mechanism of the most productive firms into export markets. In addition, once the matching technique is used separately within sub-sectors, the learning effect from exporting is less evident. This implies that the learning-by-exporting effect is affected significantly by industry heterogeneity in Vietnam.

The finding given in the thesis can have policy implications for Vietnam. On the one hand, the findings confirm the importance of the Doi Moi reforms in Vietnam. Firm-level productivity increases through the effects of trade liberalization and learning by exporting in Vietnam. On the other hand, the findings can have policy implications for further trade policy reforms in Vietnam. First, more tariff reductions

can further improve productivity by enhancing the positive effects of import competition and the variety of foreign intermediate inputs. Secondly, it is essential to focus on the encouragement of both firms that have the intention to export and firms that continue exporting. The effects of both the self-selection mechanism and learning by exporting can increase productivity and hence improve economic growth. Last but not least, Vietnam's comparative advantage in labour-intensive sectors can increase Vietnamese economic growth. To maintain sustained high growth rates, however, a focus on high technology and capital-intensive industries is essential. This focus can improve productivity and economic growth through the positive effects of trade liberalization, self-selection mechanism and learning by exporting.

The main contribution of this thesis is to provide a case study on the relationship between international trade and firm productivity in a country in transition from a centrally planned to a market-oriented economy. In particular, the thesis examines all the channels through which tariff liberalization can affect firm productivity using Vietnam's firm-level data. The findings given in the thesis suggest that firms need to improve their productivity before they export, and exporting also increases firm productivity in return. This can provide an understanding of the mechanisms of the export-led growth in Vietnam. In addition, the thesis advances the literature by employing the Wooldridge (2005) approach, the matching technique and the DID estimator to examine the two-way relationship between the exporting activity and the productivity of manufacturing and services firms.

Although the thesis provides an understanding of the relationship between international trade and firm productivity for Vietnam, it highlights some limitations for future research to examine. In the thesis, the results find that a decrease in tariffs can

increase firms' productivity in Vietnam. To estimate the effect of tariff reductions, tariffs are constructed at the industry level. Tariffs, however, can be constructed at the firm level. If this type of information is available in Vietnam in the future, the use of firm-level tariffs will shed new light on the channels through which trade liberalization can increase firm productivity. In addition, to examine the relationship between exporting and the productivity of services firms, the productivity of services firms is measured in terms of labour productivity as information about the firms' costs is not available for services firms. If TFP is used as a measure of productivity of services firms, it will provide a further understanding of the link between exporting activity and the productivity of services firms. All of the limitations of the thesis can provide a background for further research in the future.

Appendix A: Appendix to Chapter 2

Table A1: Labour productivity and GDP, 1991-2007 (percentage)

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Source: Asian Productivity Organization (2010)

Table A2: Services exports and imports of Vietnam by sub-sectors, 2005-08 (US$ million)

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Source: GSO (2010)

Appendix B: Appendix to Chapter 5

Table B1: Tariff rates on inputs by two-digit sector

	Sectors	2000	2001	2002	2003
15	Food manufacturing and beverages	10.1	10.0	9.6	9.1
16	Tobacco	16.3	16.3	16.4	16.7
17	Textiles	10.3	10.1	9.8	9.5
18	Wearing apparel	21.2	20.8	20.4	19.8
19	Leather products and footwear	10.6	10.3	10.1	9.7
20	Wood and wood products	3.5	3.4	3.3	3.1
21	Paper and paper products	8.1	8.0	7.7	7.5
22	Printing and publishing	10.3	10.2	9.9	9.5
24	Chemicals and chemical products	3.1	3.1	2.9	2.8
25	Rubber and plastics products	2.9	3.0	2.8	2.7
26	Non-metallic mineral products	8.3	8.0	7.7	7.1
27	Basic metals	4.9	4.9	4.8	4.6
28	Fabricated metal products	8.6	8.9	8.7	8.5
29	Machinery and equipment	6.8	6.7	6.4	6.0
31	Electrical machinery	5.4	5.5	5.6	5.5
32	Television and communication	6.4	6.7	6.9	7.2
33	Medical and optical equipment	3.4	3.3	3.0	2.8
34	Motor vehicles	20.3	18.5	18.0	17.7
35	Other transport equipment	12.7	13.0	12.2	11.6
36	Furniture and other manufactures	11.0	10.8	10.3	9.7
	Weighted average of manufacturing sectors[89]	9.3	9.2	8.9	8.5

Source: Author's calculation. Input tariff is a weighted average of output tariffs of all inputs in the production of a good.

[89] Weighted average tariffs are computed based on value added by I-O sectors.

Table B2: Output tariffs and Input tariffs 1996 by two-digit sector

	Sectors	Output tariffs 1996	Input tariffs 1996
15	Food manufacturing and beverages	27.8	11.2
16	Tobacco	85.6	34.6
17	Textiles	31.9	11.3
18	Wearing apparel	42.7	21.3
19	Leather products and footwear	20.6	11.2
20	Wood and wood products	11.8	4.5
21	Paper and paper products	19.8	9.3
22	Printing and publishing	12.1	10.8
24	Chemicals and chemical products	9.6	4.8
25	Rubber and plastics products	22.6	3.5
26	Non-metallic mineral products	31.5	11.7
27	Basic metals	7.7	6.4
28	Fabricated metal products	7.9	13.3
29	Machinery and equipment	6.2	7.1
31	Electrical machinery	10.1	6.2
32	Television and communication	7.1	6.9
33	Medical and optical equipment	6.9	5.1
34	Motor vehicles	27.8	12.3
35	Other transport equipment	34.5	18.5
36	Furniture and other manufactures	17.1	9.9
	Weighted average of manufacturing sectors[90]	26.4	10.1

Source: Author's calculation. Input tariff is a weighted average of output tariffs of all inputs in the production of a good.

Table B3: Value added per worker and tariff liberalization

	(1)	(2)
VARIABLES	Value added per worker	Value added per worker
Output tariff	-0.0184***	-0.0141***
	(0.0021)	(0.0023)
Input tariff		-0.0206***
		(0.0059)
Firm FEs	Yes	Yes
Year FEs	Yes	Yes
Observations	7,360	7,360
R-squared	0.121	0.124
Number of firms	1,840	1,840

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

[90] Average tariffs of all manufacturing sectors are the averages of output tariffs that are weighted based on value added by sector.

List of two-digit Vietnamese Standard Industrial Classification (VSIC) 1993 manufacturing sectors

D15: Food and beverages

D16: Tobacco

D17: Textile products

D18: Wearing apparel

D19: Leather and leather products

D20: Wood and wood products

D21: Paper and paper products

D22: Printing, publishing

D23: Coke and petroleum products

D24: Chemicals and chemical products

D25: Rubber and plastic products

D26: Non-metallic mineral products

D27: Basic metals

D28: Fabricated metal products

D29: Machinery and equipment

D30: Computer and office equipment

D31: Electrical machinery

D32: Radios, television and telecommunication

D33: Medical equipment, optical instruments

D34: Motor vehicles

D35: Other transport equipment

D36: Furniture and other products

D37: Recycled products

List of manufacturing industry category

Group 1: Low technology industries

D15: Food and beverages

D16: Tobacco

D17: Textiles

D18: Wearing apparel

D19: Leather and products of leather; footwear.

D20: Wood and wood products

D21: Paper and paper products

D22: Printing, publishing

D23: Coke and refined petroleum products and nuclear fuel

D36: Furniture and other products

D37: Recycled products

Group 2: Medium and high technology industries

D24: Chemicals and chemical products

D25: Rubber and plastic products

D26: Other non-metallic mineral products

D27: Basic metals

D28: Fabricated metal products

D29: Machinery and equipment

D30: Computer and office equipment

D31: Electrical machinery

D32: Radios, television and telecommunication

D33: Medical equipment, optical instruments

D34: Motor vehicles

D35: Other transport equipment

Levinsohn and Petrin (2003) methodology

Suppose that the technology of firm i is well described by a Cobb-Douglas production function as follows:

$$y_{it}^{j} = \alpha + \beta_l l_{it}^{j} + \beta_k k_{it}^{j} + \omega_{it}^{j} + e_{it}^{j}$$

where ω_{it}^{j} is productivity of firm i, while e_{it}^{j} is a true error that may contain measurement errors. y_{it}^{j} , l_{it}^{j} , k_{it}^{j} are the logs of value added, labour and capital stock.

To address simultaneity bias, the Levinsohn and Petrin method uses the intermediate input demand function to control for productivity shocks. Thus intermediate input demand is an unknown function of productivity and capital:

$$m_{it}^{j} = f(\omega_{it}^{j}, k_{it}^{j})$$

The Levinsohn and Petrin approach also assumes that m is monotonic in productivity. Thus, the inverted equation is $\omega_{it}^{j} = f^{-1}(m_{it}^{j}, k_{it}^{j})$

To identify a consistent estimate of l_{it}^{j}, the Levinsohn and Petrin method substitutes the equation above in the production function in order to control for productivity shocks:

$$y_{it}^{j} = \alpha + \beta_l l_{it}^{j} + \beta_k k_{it}^{j} + f^{-1}(m_{it}^{j}, k_{it}^{j}) + e_{it}^{j}$$

then $$y_{it}^{j} = \alpha + \beta_l l_{it}^{j} + \lambda_{it}^{j} + e_{it}^{j}$$

where $\lambda_{it}^{j} = \beta_k k_{it}^{j} + f^{-1}(m_{it}^{j}, k_{it}^{j})$ that can be approximated by third-order polynomial in m and k.

Based on the above assumptions, the Levinsohn and Petrin methodology employs two estimation stages to get productivity measures.

In the first stage, the aim is to estimate the following equation to identify estimates of β_l by approximating λ_{it}^j by a third-order polynomial.

$y_{it}^j = \alpha + \beta_l l_{it}^j + \lambda_{it}^j (m_{it}^j, k_{it}^j) + e_{it}^j$

In the second stage, the aim is to identify estimated β_k by again approximating an unknown function of lagged values of λ_{it}^j

$\Rightarrow \quad \hat{\lambda}_{t-1} (m_{it}^j, k_{it}^j) = \widehat{y_{lt}^J} - \hat{\beta}_l l_{it}^j$

For any value β_k^* a prediction of ω_t can be obtained

$\widehat{\omega_t} = \hat{\lambda}_t^j (m_{it}^j, k_{it}^j) - \beta_k^* k_{it}^j$

Assuming that TFP exogenously follows the first-order Markov process, that is $\omega_t = E[\omega_t|\omega_{t-1}]+\xi_t$

So $E[\omega_t|\omega_{t-1}]=g(\omega_{t-1})+v_t$ where g(.) is some non-linear function of past TFP

$E(\widehat{\omega_t|\omega_{t-1}}) = \gamma_0 + \gamma_1\omega_{t-1} + \gamma_2\omega^2_{t-2} + \gamma_1\omega^3_{t-3} + \rho_t$

Given $\hat{\beta}_l$, β_k^*, $E(\widehat{\omega_t|\omega_{t-1}})$, the residues can be obtained:

$\widehat{v_t + \xi_t} = y_{it}^j - \hat{\beta}_l l_{it}^j - \beta_k^* k_{it}^j - E(\widehat{\omega_t|\omega_{t-1}})$

$\widehat{\beta_k}$ is defined as a solution as

$\min_{\beta_k^*} \Sigma_t [y_{it}^j - \hat{\beta}_l l_{it}^j - \beta_k^* k_{it}^j - E(\widehat{\omega_t|\omega_{t-1}})]^2$

The Stata levpet programme minimizes the above function to get $\widehat{\beta_k}$

The author fits estimated $\hat{\beta}_l$ (from stage 1) and $\widehat{\beta_k}$ (from stage 2) into the following equation to get the log of estimated TFP

$\omega_{it}^j = y_{it}^j - \hat{\beta}_l l_{it}^j - \widehat{\beta_k} k_{it}^j \qquad (10)$

where y_{it}^{j} , l_{it}^{j} , k_{it}^{j} are the logs of value added, labour and capital stock. The research uses the Stata levpet command to get measures of TFP for each two-digit sector.

Appendix C: Appendix to Chapter 6

Table C1: Firm productivity and exporting participation in hotels and restaurants sectors

Variables	(1) Pooled probit model	(2) Random-effect probit model	(3) Pooled probit model	(4) Wooldridge dynamic non-linear model
Exp_{it-1}			2.070***	0.985***
			(0.0382)	(0.134)
Exp_{i0}				2.576***
				(0.300)
$Lnlp_{it-1}$	-0.158***	-0.0211	-0.0591***	0.0566
	(0.0124)	(0.0339)	(0.0153)	(0.0696)
$Lnkl_{it-1}$	0.132***	0.164***	0.103***	-0.125
	(0.0134)	(0.0412)	(0.0165)	(0.100)
Lnw_{it-1}	0.214***	0.0105	-0.0156	0.0650
	(0.0246)	(0.0577)	(0.0316)	(0.112)
$Lnsize_{it-1}$	0.0942***	0.410***	0.118***	0.966***
	(0.0124)	(0.0451)	(0.0151)	(0.148)
$Lnage_{it-1}$	0.0609***	0.161***	0.0417**	0.202**
	(0.0143)	(0.0530)	(0.0201)	(0.0786)
fies	0.830***	1.755***	0.644***	2.689***
	(0.0999)	(0.378)	(0.126)	(0.774)
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	13,241	13,241	10,018	3,912
log_likelihood	-6819	-5258	-4399	-1421
chi-squared	2455	448.2	4267	486.4
Number of firms		4,869		1,304
rho		0.877		0.728

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 columns 2 and 4 show the marginal effects of the variables of the pooled and random effect model in columns 1 and 4, respectively. exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. tfp_{it-1} is one-year lagged TFP. $Lnlp_{it-1}$ is firm labour productivity. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises. Japan, Korea, Taiwan, Singapore, Hong Kong (China) and others: dummies of country sources of firm foreign ownership in Vietnam.

Table C2: Firm productivity and exporting participation in transport, storage and communication sectors

Variables	(1) Pooled probit model	(2) Random-effect probit model	(3) Pooled probit model	(4) Wooldridge dynamic non-linear model
Exp_{it-1}			2.696***	1.519***
			(0.0664)	(0.250)
Exp_{i0}				6.228***
				(0.530)
$Lnlp_{it-1}$	0.184***	0.366***	0.164***	0.557***
	(0.0141)	(0.0409)	(0.0190)	(0.125)
$Lnkl_{it-1}$	-0.0967***	-0.236***	-0.0297	-0.489***
	(0.0178)	(0.0491)	(0.0235)	(0.187)
Lnw_{it-1}	-0.176***	-0.354***	-0.239***	0.131
	(0.0267)	(0.0697)	(0.0337)	(0.197)
$Lnsize_{it-1}$	0.0628***	0.160***	0.0686***	0.665***
	(0.0135)	(0.0415)	(0.0172)	(0.238)
$Lnage_{it-1}$	-0.0107	-0.0174	-0.0492*	-0.154
	(0.0200)	(0.0606)	(0.0291)	(0.156)
$Fies_{it-1}$	0.692***	2.022***	0.689***	2.051***
	(0.0901)	(0.303)	(0.109)	(0.541)
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	15,642	15,642	11,993	3,921
log_likelihood	-2996	-2109	-1787	-547.7
chi-squared	850.5	187.9	2523	373.5
Number of firms		6,416		1,307
rho		0.880		0.924

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 columns 2 and 4 show the marginal effects of the variables of the pooled and random effect model in columns 1 and 4, respectively. exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. tfp_{it-1} is one-year lagged TFP. $Lnlp_{it-1}$ is firm labour productivity. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises. Japan, Korea, Taiwan, Singapore, Hong Kong (China) and others: dummies of country sources of firm foreign ownership in Vietnam.

Table C3: Firm productivity and exporting participation in business services and other services sector

Variables	(1) Pooled probit model	(2) Random-effect probit model	(3) Pooled probit model	(4) Wooldridge dynamic non-linear model
Exp_{it-1}			2.502***	1.389***
			(0.0970)	(0.330)
Exp_{i0}				5.684***
				(0.662)
$Lnlp_{it-1}$	0.213***	0.946***	0.224***	1.121***
	(0.0278)	(0.111)	(0.0341)	(0.249)
$Lnkl_{it-1}$	-0.343***	-1.263***	-0.255***	-1.298***
	(0.0252)	(0.121)	(0.0306)	(0.302)
Lnw_{i-1}	0.142***	-0.175	0.0720	-0.103
	(0.0400)	(0.134)	(0.0486)	(0.285)
$Lnsize_{it-1}$	0.235***	0.993***	0.219***	0.881**
	(0.0211)	(0.125)	(0.0252)	(0.371)
$Lnage_{it-1}$	-0.185***	-0.506**	-0.185***	-1.067***
	(0.0442)	(0.205)	(0.0546)	(0.397)
$Fies_{it-1}$	1.590***	7.820***	1.141***	4.729***
	(0.0686)	(0.388)	(0.0848)	(0.547)
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	23,701	23,701	18,688	6,723
log_likelihood	-1257	-895.1	-826.3	-348.6
chi-squared	1826	558.0	2419	384.7
Number of firms		9,854		2,241
rho		0.954		0.940

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 columns 2 and 4 show the marginal effects of the variables of pooled and random effect model in columns 1 and 4, respectively. exp_{it} is a binary variable indicating whether a firm exports or not in period t. EXP_{it-1} is one-year lagged exporting status. exp_{i0} is initial exporting status. tfp_{it-1} is one-year lagged TFP. $Lnlp_{it-1}$ is firm labour productivity. $lnsize_{it-1}$: one-year lagged firm size. $lnkl_{it-1}$: one-year lagged capital intensity (ratio of capital to employment). $lnwage_{it-1}$: one-year lagged average wage per employee. $fies_{it-1}$: dummy of foreign-invested enterprises. Japan, Korea, Taiwan, Singapore, Hong Kong (China) and others: dummies of country sources of firm foreign ownership in Vietnam.

Appendix D: Appendix to Chapter 7

Table D1: The result of t-tests of balancing properties in manufacturing firms in matched sample of starters and non-exporters (2002-04) (learning by exporting: first year)

Variable	Mean (treated)	Mean (control)	t-test p value
Lag TFP	1.5985	1.6258	0.681
Lag Size	3.7831	3.6353	0.287
Lag Fies	0.1858	0.1561	0.361

Notes: Lag TFP, lag Size and lag Fies are lagged values of TFP, firm size and the dummy of foreign-invested firms, respectively. *** p<0.01, ** p<0.05, * p<0.1

Table D2: The result of t-tests of balancing properties in service firms in matched sample of starters and non-exporters (2004-06) (learning by exporting: first year)

Variable	Mean (treated)	Mean (control)	t-test p value
Lag Labour Productivity	4.3302	4.3884	0.629
Lag Size	2.7338	2.7622	0.771
Lag Fies	0.1470	0.1446	0.921

Notes: Lag TFP, lag Size and lag Fies are lagged values of TFP, firm size and the dummy of foreign-invested firms, respectively. *** p<0.01, ** p<0.05, * p<0.1

Table D3: The result of t-tests of balancing properties in service firms in matched sample of starters and non-exporters (2004-05) (learning by exporting: second year)

Variable	Mean (treated)	Mean (control)	t-test p value
Lag Labour Productivity	4.443	4.51	0.721
Lag Size	3.045	2.8755	0.320
Lag Fies	0.1875	0.1937	0.887

Notes: Lag TFP, lag Size and lag Fies are lagged values of TFP, firm size and the dummy of foreign-invested firms, respectively. *** p<0.01, ** p<0.05, * p<0.1

List of two-digit Vietnamese Standard Industrial Classification (VSIC) 1993 services sectors

G Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods

50 Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel

51 Wholesale trade and commission trade, except of motor vehicles and motorcycles

52 Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods

H Hotels and restaurants

55 Hotels and restaurants

I Transport, storage and communications

60 Land transport; transport via pipelines

61 Water transport

62 Air transport

63 Supporting and auxiliary transport activities; activities of travel agencies

64 Post and telecommunications

J Financial intermediation

65 Financial intermediation, except insurance and pension funding

66 Insurance and pension funding, except compulsory social security

67 Activities auxiliary to financial intermediation

K Research and technology

70 Research and technology

L Real estate, renting and business activities

71 Real estate activities

72 Renting of machinery and equipment without operator and of personal and household goods

73 Computer and related activities

74 Other business activities

N Education

80 Education

O Health and social work

85 Health and social work

P Recreational, cultural and sporting activities

90 Recreational, cultural and sporting activities

T Community, social and personal service activities

92 Sewage and refuse disposal, sanitation and similar activities

93 Other service activities

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