Higher productivity in exporters: self-selection, learning by exporting or both? Evidence from Vietnamese manufacturing SMEs

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Higher productivity in Exporters: Self-selection, learning by exporting or both? Evidence from Vietnamese manufacturing SMEs

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Abstract

This study examines whether high productivity is either the cause or a consequence of a business's decision to export. Using a balanced panel dataset from 2005-2009 for Vietnamese manufacturing private SMEs, our empirical results find strongly statistical evidence for the self-selection of more productive firms into the export market. The alternative hypothesis, learning by exporting, was shown to be invalid through employing fixed effect panel data estimation, and fixed effect Instrumental Variable regression**.** By going beyond the previous literature, this study also reveals that export participation has a statistically insignificant impact on technical efficiency, technical progress, and scale change. Last but not least, improvement in innovative capacity and network with foreign customers is also important determinants in boosting the export participation of private enterprises.

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1. Introduction

Since the ground-breaking study of Bernard and Jensen (1995) , which described "exceptional export performance", many following empirical studies have focused on investigating the relationship between export status and productivity growth. Two hypotheses are often used to explain the superiority of exporters compared to non-exporters in international trade. The first hypothesis is self-selection, where only the more productive firms will self-select into the export market. An alternative but not mutually exclusive explanation is learning by exporting, which argues that export participation can be a source of productivity growth and that exporting makes firms to become more productive to non-exporters.

One of stylized characteristics from econometric evidence of the linkage between export and productivity is mixed findings. For example, while many studies affirm the existence of the self-selection hypothesis, other research indicates that participation in the export market makes firms more productive (see Wagner, 2007 for a review). In contrast to such findings, recent studies, for example, Bigsten and Gebreeyesus (2009) found support for both hypotheses in Ethiopia, while Sharma and Mishra (2011) and Gopinath and Kim (2009) rejected the validity of each hypothesis in the majority of sectors within India and South Korea respectively.

In an effort to explain why there have been mixed results on the export and productivity growth nexus, Blalock and Gertler (2004) show that the level of economic development may be the main reason for differing results. For example, in their cases, both Indonesia and Sub-Saharan African countries are much less developed than countries described in other studies. Obviously, firms in countries with poor technology and low productivity can gain a greater marginal benefit from exposure to exporting.

Such differences may stem from the variance in characteristics of geographical and economic conditions of countries (Wagner, 2007). More importantly, different conclusions might come from using a wide variety of econometric methodologies for testing these two hypotheses (Sharma & Mishra, 2011).

Interestingly, when considering the relationship between export participation and productivity, there is not a consistent measurement of productivity. Some previous studies often use labor productivity to stand for productivity. This is unsuitable in the Vietnamese context because this index just represents a part of the picture of productivity and should be considered as one of the characteristics of exporting manufacturing firms (Hiep & Ohta, 2009). Other studies often use a methodology developed by Levinsohn and Petrin to measure total factor productivity (TFP) within investigated relationship. Although the method has the advantage of controlling endogeneity of input factors by using the intermediate input demand function under certain assumptions, it does not allow the decomposition of TFP growth. Productivity theory shows that the change in TFP includes various components such as technical progress change, technical change and scale efficiency change (Kumbhakar & Lovell, 2003). As a consequence, when productivity is considered as an aggregated index, this will limit further investigation into the relationship between export participation and its decompositions.

In order to check the relationship between exportation and productivity, several studies employ a conventional approach such as the Solow residual method. This approach is based on a classical assumption that all firms are operating effectively and have a constant return to scale, which means that TFP growth occurs, it is equal to technical efficiency growth (Kumbhakar & Lovell, 2003). The present study revisits hypotheses of self-selection and learning by exporting in order to examine their validity within the context of Vietnamese private domestic manufacturing firms for the period 2005-2009. During this time, Vietnam became a member of the World Trade Organization, and affirmed private sector's increasing ability to freely participate in export activities [2]. For Vietnamese private manufacturing firms, the full efficiency assumption of firms cannot be seen to be working. As described by Kokko & Sjoholm (2000) and Tue Anh et al., (2006) Vietnam is a transition economy where institutional

[2] Vietnam has demolished export license regime since 1998, and introduce enterprise law in 2000 that admitted private sector as a source of economic growth.

discrimination still exists between state enterprises and local private firms due to the consequence of previous planning mechanism. Such discrimination can make local private firms unable to work at desired efficiency levels.

The above issues raise a question about whether the measurement of productivity can offer an alternative explanation for the mixed results in the relationship between productivity and export. Our research uses Stochastic Frontier Approach (SFA) to release the assumption of full efficiency of firms and decompose productivity growth into different components including technical change, scale change and technological progress change. While other approaches (e.g. Data Envelopment Analysis (DEA)) may divide productivity growth, the stochastic frontier model has been employed because of the advantages gained with regard to controlling with the random shocks, outliers and measurement errors in the data (Coelli, 2005; Sharma, Sylwester, & Margono, 2007).

By using the selected approach, this research aims to contribute to the literature of heterogeneous-firm trade theories in several aspects**.** In relation to decomposing productivity, to the best of my knowledge, it is the first investigation to consider the impact of export participation on each component of TFP. It is worth decomposing TFP because this can provide another way to explain the mixed findings in empirical studies as well as providing a detail picture of this relationship. Our argument is that export participation can impact negatively on productivity change but it may create positive effects on each component of productivity. Therefore, considering TFP as an aggregated index will hide such interesting points.

In terms of policy implications, a clear understanding about the causal direction between export participation and productivity is very important, especially for Vietnam where pursuing export-led growth policies and SMEs are dominant in the economy. Given that productivity growth has a close relationship with export status, export promotional policies in the past such as tax exemption of land or imported material for exporters or giving awards for successful exporters will be supported. Alternatively, such policies should be under investigation whether it is suitable and necessary for the economic development of Vietnam.

The structure of paper includes four sections. Section 2 reviews briefly the mixed empirical results of testing the two hypotheses found in previous studies. Section 3 discusses the data source, and methodology in measurement of TFP and econometric models to consider the relationship between export and productivity. The empirical results and summary of findings are displayed in the last section**.**

2. Literature Review

A popular fact in the previous empirical research is that exporters are more productive than non-exporters. The starting point for explaining the above fact is the self-selection hypothesis. This means enterprises will participate in the export market only if they have a sufficient productivity level to overcome the sunk costs such as market research, product modification and transportation costs.

There have been numerous empirical studies using datasets from different countries to test the hypothesis so far. A pioneering effort to examine the relationship between productivity and export status at the firm level was a series of studies that utilized US data (Bernard & Jensen, 1995, 1999, 2004a, 2004b). Bernard and Jensen's empirical results failed to find the evidence supporting an increase in productivity after exporting. For example, Bernard and Jensen (1999) revealed that higher productivity of firms occurs before entry into export market. They find that productivity gains were the result of self-selection rather than learning by exporting. Another important early contribution, Clerides, Lach and Tybout (1998) used dataset from Mexico, Columbia, and Morocco, and also indicated that firms with more productivity are more likely to self-select to become exporters. Their findings were replicated across many countries, including highly industrialized countries (Canada (Baldwin & Gu, 2003), Germany (Bernard & Wagner, 1997, 2001), UK (Girma, Greenaway, & Kneller, 2004) Countries of Latin America (e.g. Chile (Alvarez & López, 2005), Columbia (Roberts & Tybout, 1997) and (Isgut, 2001); Asian countries (Taiwan (Roberts, Chen, & Roberts, 1997) and (Liu, Tsou, & Hammitt, 1999), India (Poddar, 2004), China (Kraay, 1999); transition economies (Estonia (Sinani & Hobdari, 2010) and African countries

By contrast, others have argued that the higher productivity of exporters compared with non-exporters can be attributed to benefits from export activities.

A positive effect of export on productivity growth is witnessed in both developed and developing countries. For example, Baldwin and Gu (2003) investigated firm level data from Canada, which provided evidence of a positive effect of export on productivity growth. Specifically, Canadian exporters in manufacturing industries experienced greater productivity growth than their non-exporting counterparts after exporting.

Similarly, using a panel dataset of English manufacturing plants with detail information of learning sources from export clients, Crespi, Criscuolo, and Haskel (2008) tested directly the relationship between export and productivity growth and found strong evidence that productivity improvements are a result of learning from exporting rather than self-selection. Evidence for positive effects of export participation on productivity growth also is observed in the United Kingdom (Girma, Greenaway, & Kneller, 2003; Greenaway & Kneller, 2007) and France (Bellone, Musso, Nesta, & Quere, 2008)

In comparison to developed countries, which have limited evidence available, learning by exporting effects are more popular among the developing countries. Blalock & Gertler (2004) used panel data on Indonesian manufacturing firms to examine the impact of export status on productivity. Their empirical results indicate strongly that exporting activities in the foreign market make a significant and direct contribution, adding between 2% to 5% to the productivity of Indonesian firms. They found that such gains in productivity came after firms began involving in exporting activities. Similar findings were also reported by Johannes (2005), who looked at manufacturing plants in nine African countries. The author suggests that exporters gain higher productivity after participating into export market. In addition, the robust check of results is maintained when endogenous export participation is controlled. Other studies also claim that exporters benefit from an increase in productivity after entering into exporting market (Kraay, 1999; Park, Yang, Shi, & Jiang, 2010; Sun & Hong, 2011) for China and (Bigsten et al., 2004) for Sub-Saharan African countries)

Contrary to the above results, some studies reached conclusions in favour of both hypotheses. For example, in a study of Chile by Alvarez and López (2005), a firm level panel dataset was used to consider the relationship between export participation and productivity growth, and indicated that improvements in productivity not only result from learning by exporting but also come from self-selection of better firms into export markets. In other studies using firm-level panel data sets by Kimura and Kiyota (2006) for Japan, Greenaway and Yu (2004) for England, and Bigsten and Gebreeyesus (2009) for Ethiopia confirmed the existence of both self-selection and learning by exporting.

Other important research came to the opposite conclusion. Greenaway, Gullstrand and Kneller (2005) for Swedish manufacturing firms have failed to find any evidence for either hypothesis**.** More recently, Sharma and Mishra (2011) in a study about the relationship between export status and productivity growth did not find supporting evidence toward the hypotheses. Their results indicate that there is little learning effects and self-selection of Indian firms associated with export activities.

It should be noted that when considering the relationship between exporting and productivity, the majority of the aforementioned research use labor productivity or relied on Solow residual method or Levinsohn-Petrin methodology. These approaches do not allow the decomposition of TFP growth into its components**.** In a study in China, when considering the relationship between export status and productivity growth of different industries from 1990-1997, Fu (2005) contributed to the literature by using DEA to compute and decompose productivity growth into technical efficiency and technical progress. After the decomposition, she used a random effects panel data model to test the impact of export status on productivity growth and its components. The results from this study reveal that export activity generates a statistically insignificant effect on TFP growth and its components. However, a limitation of this paper is that it does not consider the contribution of export intensity on scale efficiency. Furthermore, Kim et al. (2009) releases the assumption of full-efficiency of the firm by using DEA methodology to calculate TFP for a panel data of South Korean manufacturing firms. Their studies argue that learning by exporting and self-selection effects might not occur in all types of industry. They found that firms with high productivity level self-selecting in export participation just exist three out of eight industries while only one out of eight industries gain post-exporting productivity improvement.

For the case of Vietnam, there are a few prominent studies on firm exports. Firstly, Nguyen et al., (2008), focused on the relationship between export participation and innovation for non-state domestic manufacturing firms. This research uses probit and IV probit for surveying of manufacturing private domestic SMEs in 2005. However, their study did not examine the causality link between export and productivity growth. The second research was conducted by Hiep and Ohta (2009), who use data from a sample survey, including 1150 private enterprises and surveyed from some provinces. The study results show that it compared well with analysis of superiority of exporters to their non-exporitng counterparts. However, their study results based on the data that are surveyed on retrospective basis, and this raises questions about the measurement error of the data. Lastly, a study was conducted by Trung et al., (2009), however, their study was based on cross-sectional data and a static model that only focused on examining observable characteristics. They failed to identify the underlying factors that might affect the export-productivity growth linkage.

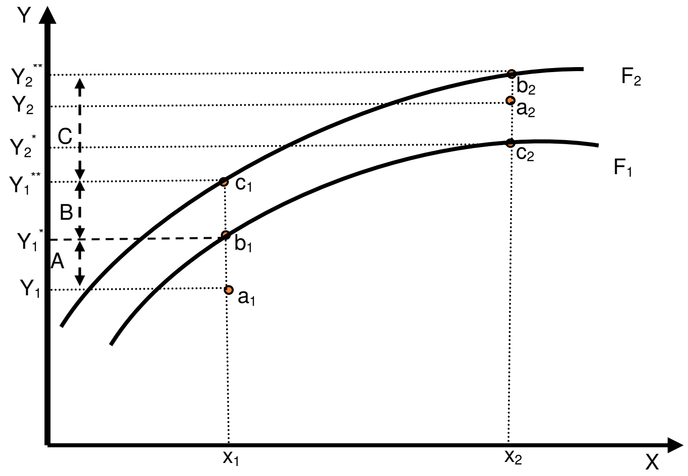
To sum up, so far there have been many empirical results about the export-productivity linkage, but evidence of nexus is mixed and inconclusive. Therefore, the issue, it would seem, is very much informative stage and were no dominant explanation exists, despite there being many studies (Sharma *et al.*, 2011). Furthermore, when considering the relationship between export and productivity growth, most studies often consider productivity under a single umbrella of investigation that does not pay sufficient attention to the various components of productivity and the importance of their influence.

3. Methodology and Data

3.1 Empirical framework

3.1.1 Stochastic frontier and decomposition of productivity change

According to Kumbhakar & Lovell (2003) and Sharma et al. (2007) the productivity change is contributed by (1) the change in technical progress (TP), (2) the change in efficiency of using factors of inputs (TE), (3) the change in scale efficiency (SC). A graphical presentation for differences among components may be seen from the figure as below:



Source: Minh (2005)

The above graph displays an enterprise that faces with two production frontiers F_1 and F_2 at different time t_1 and t_2 respectively. In this case, technical progress refers to the shifts in production frontiers from F_1 to F_2 and the distance is equal to $B=Y_1^{**}- Y_1^{*}$.

Technical efficiency relates to the utilization of existing technology and it reflects how to combine or use input factors with existing technology to create optimal output. Catching up or reaching production function frontiers of firms are closely linked with the change of technical efficiency. A firm is considered to have technical efficiency overtime if the magnitude of $[(Y_2^{**}-Y_2) – (Y_1^{*}-Y_1)]$ is greater zero.

Scale efficiency indicates the scale in which firms operate most efficient. When firms have increasing or decreasing return to scales, scale efficiency increases until firms reach the constant return to scale. In other words, scale efficiency change is disappeared when firms have constant returns to scale. As displayed along the frontier F2, an expansion in input resulting to a growth in the output is measured as $C = (Y_2^{**} - Y_1^{**})$.

In order to calculate TFP growth and its components, our research applied a methodology proposed by Kumbhakar & Love (2003), with a translog production function specification. The panel model is expressed as follows:

$$\begin{aligned} Lny_{it} &= \widehat{\beta_0} + \widehat{\beta_1}\ln K_{it} + \widehat{\beta_2}\ln L_{it} + \widehat{\beta_3}t + 0.5[\widehat{\beta_4}(\ln K_{it})^2 + \widehat{\beta_5}(\ln L_{it})^2 + \widehat{\beta_6}t^2] \\ &+ \widehat{\beta_7}\ln K_{it}\ln L_{it} + \widehat{\beta_8}t\ln K_{it} + \widehat{\beta_9}t\ln L_{it} + v_{it} \end{aligned}$$

Where y_{it} is value added, 2 input factors L_{it} (labour) and K_{it} (capital), t implies time trend, v_{it} is a random variable. As indicated by Kumbhakar & Lovell (2003) Tim Collie (2005) and Sharma et al. (2007), one can draw the productivity change components as below:

Technological progress change: $\Delta TP_{it} = \frac{\partial \ln(y_{it})}{\partial t} = \widehat{\beta_3} + \widehat{\beta_6}t + \widehat{\beta_8}\ln K_{it} + \widehat{\beta_9}\ln L_{it}$ (2)

Technical efficiency change: $\Delta TE_{it} = \frac{TE_{it}}{TE_{is}}$, t and s are two adjacent periods (3)

Scale efficiency change: $\Delta SE_{it} = (\varepsilon - 1)\left[\left(\frac{\varepsilon_k}{\varepsilon}\right)\dot{K} + \left(\frac{\varepsilon_l}{\varepsilon}\right)\dot{L}\right]$

where: $\varepsilon_l = \frac{\partial \ln(y_{it})}{\partial \ln(L_{it})} = \widehat{\beta_1} + \widehat{\beta_4}\ln K_{it} + \widehat{\beta_7}\ln L_{it} + \widehat{\beta_8}t$

$\varepsilon_k = \frac{\partial \ln(y_{it})}{\partial \ln(K_{it})} = \widehat{\beta_2} + \widehat{\beta_5}\ln L_{it} + \widehat{\beta_7}\ln L_{it} + \widehat{\beta_9}t$

$\varepsilon = \varepsilon_l + \varepsilon_k$; $\dot{K}$ and $\dot{L}$ are the rate of change in capital and labour respectively

Total factor productivity change: $\Delta TFP_{it} = \Delta TP_{it} + \Delta TE_{it} + \Delta SE_{it}$ (5)

In order to estimate the translog production function in equation (1), the FRONTIER 4.1 software written by Coelli (2005) was employed. Then, using the estimated coefficients, components of TFP growth were calculated by using equations (2), (3) and (4). The estimation regression results and statistical tests are displayed in the appendix.

3.1.2 Model specification and estimation method of self-selection effect

Since export participation is a binary variable with two possible outcomes (0-1), the framework of binary choice models (i.e., logit or probit model) will be employed to quantify the impact of productivity on export participation. The probit model is more appropriate than the logit model because the cumulative probability distribution function of probit is more asymptotic between zero and one than logit (Wooldridge, 2002). Some previous studies employed a cross-sectional or pooled cross-sectional probit model to consider the impact of covariates on export participation (e.g., Trung et al., 2009). However, the limitation of such model is that it cannot evaluate the impact of unobserved factors such as product attributes, managerial skills, or strategic management, marketing strategy, and business strategy. If these characteristics are not properly controlled, the results will be biased and inconsistent in estimation. Therefore, the dynamic probit model framework used in the paper is similar to the method of Roberts and Tybout (1997). In their model, firm i exports in period t if the expected gross revenue of the firm exceeds the current cost. In other words, a firm will export if the expected return from exporting is positive. Hence, the condition of export decisions is:

$$Y_{it} = \begin{cases} 1 \ \ if \ \ p_{it}q^{*}_{it-1} \geq c_{it}(X_t, Z_{it}, q^{*}_{it-1} / q^{*}_{it}) + S(1 - Y_{it-1}) \\ 0 \ \ otherwise \end{cases} \quad (1)$$

where S indicates the sunk entry costs and varies across firms; P_{it}: the price of goods sold abroad. C_{it}: the cost of producing optimal export quantity. X_t refers to vectors of exogenous factors affecting the firms' profitability; Z_t indicates vectors of firm-specific factors affecting the firms' profitability; Y_{it-1}: export status of firm i at time t-1.

Based on the probabilistic decision in equation (1), following Robert and Tybout (1997) and Bernard and Jensen (2004a) for testing self-selection hypothesis, a reduced binary-choice model is indicated as follows:

$$Y_{it} = \begin{cases} 1 \ \ if \lambda_z X_{it} + \ \lambda_z Z_{it} - S(1 - Y_{it-1}) + u_{it} \geq 0 \\ 0 \ \ otherwise \end{cases} \quad (2)$$

In order to estimate model (2), a "redprob" program written in Stata by Stewart (2006) was used. According to past studies, export decisions of firms are determined by a combination of multiple factors. Firstly, standard firm characteristic variables such as firm age, firm size, average wage were included in the majority of past studies (e.g., Aw, Roberts, & Winston, 2007; Roper, Love, & Hagon, 2006; Wagner, 2001). Second, innovation is included in the model basing on findings that the effects of innovative activities on export participation are positive and statistically significant (e.g., Alvarez & López, 2005; Huang, Zhang, Zhao, & Varum, 2008). Third, a dummy variable of having long term trade relationships with foreign partners was incorporated in the model since firms in social networks are found to be more likely to export than firms were not in the networking (Tomiura, 2007). Attention is also given to the relationship between the capital intensity and export participation of firms based on evidence that the higher capital labour intensity a firm has the more likely it participates in exportation (Ranjan & Raychaudhuri, 2011). Furthermore, the governmental supporting activities can have a linkage with export probability, and therefore the role of government support for exporting decision of firms is captured in the model by a dummy variable.

In addition to these variables, the location of firms in geographical areas can have a different impact on the export participation. Therefore, following Hansen, Rand and Tarp (2009) ten provinces in the dataset were divided into two regions (urban and rural areas). Going beyond these considerations, various characteristics of industries may affect differently on the link between export participation and productivity growth (Greenaway & Kneller, 2007). Therefore, different sectors in which enterprises operate were captured by low technology, sector dummy variable in comparison with medium and high tech sectors. With a model of pooled data or panel data, as suggested by Wooldridge (2009), we might capture the change of macro-conditions by a time dummy.

Finally, as indicated by previous studies (Bernard & Jensen, 2004b; Roberts & Tybout, 1997), past export status was employed in order to control for the presence of sunk costs. Productivity with various measurement methods was used in the model to test the validity of self-selection hypothesis. In addition, many previous studies about determinants of export participation often lagged firm characteristics by one or more periods to reduce the simultaneity. Therefore, a series of one-period lagged explanatory covariates were used in our regression estimation.

3.1.3 Model specification of the learning by exporting effect

Following Bernard and Jensen (1995 and 1999), standard specifications of empirical models considering the impact of export participation on productivity growth and its decompositions can be written basically as below:

$$\Delta TFP_{it} = a_0 + a_1 Export_{it} + a_2 X_{1it} + u_{1it} \quad (1)$$

$$\Delta TP_{it} = b_0 + b_1 Export_{it} + b_2 X_{1it} + u_{1it} \quad (2)$$

$$\Delta TE_{it} = c_0 + c_1 Export_{it} + c_2 X_{1it} + u_{1it} \quad (3)$$

$$\Delta SE_{it} = d_0 + d_1 Export_{it} + d_2 X_{1it} + u_{1it} \quad (4)$$

Where dependent variables are represented by total factor productivity change, change in technological progress, and change in technical efficiency and scale efficiency change. The main interest variable is export decision being captured by a dummy variable because of two reasons. First, as indicated by Stampini and Davis (2009), usage of dummy variable allows to consider the effect of average treatment and minimizes the biases due to measurement errors. Second, export intensity in 2007 is unavailable, and this hinders us from considering panel data estimation between export intensity and dependent covariates. Other explained variables include total employment, firm age, share of non-production employees, and average wage. It is expected that firms with higher size and more experience in business are more likely to gain higher productivity. In addition, we add the share of non-production workers as an independent variable, as indicated by Tsou, Liu, Hammitt, and Wang (2008), there is a potential linkage between the share of employees in non-production and productivity growth. Furthermore, average wage as presented for the quality of human resource that has been found to partly explain the change in productivity (Ranjan & Raychaudhuri, 2011; Tsou et al., 2008). Therefore, this index is also included in the model. Finally, as discussed earlier, various characteristics of industrial sectors, locations of firms and change of macro-conditions might impact differently on the relationship between export participation and productivity growth. Consequently, these variables were also controlled in the model.

3.1.4 Estimation methods

When using OLS to estimate the relationship between export participation and productivity growth and its components, a recognized problem is that results can be biased because of unobservable firm characteristics. In order to solve this problem, some previous studies (e.g., Fryges & Wagner, 2010; Wagner, 2011) have used fixed-effect (FE) regression with panel data to consider the impact of export participation on firm performance. This method can overcome the bias in estimated results, where the unobservable characteristics are treated as time invariant factors of the error (Cameron & Trivedi, 2009).

Using a fixed effect panel data model may capture time in-variant unobserved characteristics. However, it cannot solve time variant unobserved firm or industry characteristics that might cause an endogeneity problem (Sun & Hong, 2011). An alternative approach called matching has been used as a means solve this problem in the previous studies(e.g., Greenaway & Yu, 2004; Wagner, 2002). Nevertheless, as indicated by Park et al., (2010), matching can eliminate the selection-bias of observed characteristics but it is unable capture unobservable factors. Others have addressed the endogeneity problem by using dynamic generalized method of moments system (GMM) with panel data (Bigsten & Gebreeyesus, 2009; Van Biesebroeck, 2005). This approach is impossible to implement with the panel dataset in this paper, simply because the time span of the available data was too short (two years for 2007 and 2009). Another common method of dealing with endogeneity involves the use of instrumental variables (Wooldridge, 2002), which has been recently used to consider the impact of export status on productivity growth (Kraay, 1999; Lileeva & Trefler, 2010; Park et al., 2010; Sun & Hong, 2011).

Fixed effect Instrumental variable estimation with panel data for the two years of 2007 and 2009 was conducted in this research. A set of potential instrumental variables that have an impact on export participation but do not have a relationship with error term of the output of equation were employed (the error terms in productivity growth, technical progress, technical efficiency, scale efficiency equations). Ethnicity of owners was used as an instrumental variable candidate. As discussed by Van Biesebroeck (2005), ethnicity of owners has a close relationship with export likelihood of firms. It is expected that owners within a minority community are able to speak more one language, and hence, an advantageous skill that undoubtedly helps firms when exporting. Moreover, the long term relationship of firms with foreign partners is included in this study as another additional instrument. We expect that SMEs with constrained resource, weak market power, and limited knowledge may take advantage of networks and their relationships with overseas partners to overcome entry costs and participate in exporting markets.

Although potential endogenous variable (export participation) is a binary variable, we did not apply any special considerations when estimating the impact of export on productivity growth by instrumental variables (IV) regression (Wooldridge, 2002). In addition, as discussed by Angrist and Pischke (2008), IV regression produces consistent results regardless of whether or not the first stage model is correctly specified. IV regression with the option of GMM were employed because of the benefits of being able to cope with measurement errors when the endogeineity variable is binary (Bascle, 2008). GMM estimation is also useful because it creates the most efficient estimation when model suffers from heterogeneity problems (Baum, Schaffer, & Stillman, 2003).

3.2. Data Sources

The source of information for this study was drawn from a newly micro dataset of non-state domestic small and medium enterprises 2005, 2007, and 2009. This data was produced by the Institute of Labor Science and Social Affairs (ILSSA) in collaboration with Central Institute for Economic Management (CIEM) and Copenhagen University, Denmark.

The inherent advantages of the dataset are as follows. Firstly, this is a uniquely rich dataset surveyed from ten provinces within three regions of Vietnam: the North, Centre and South. It covers all the major manufacturing sectors namely food processing, wood products, fabricated metal products and other sectors. The original dataset with 2821 enterprises were interviewed in 2005 and 2635 firms in 2007, while a slightly larger number of 2655 were interviewed in 2009**.** After excluding missing value, outliers and checking the consistency of time-invariant variables among the three survey rounds. Database was created comprising of 1640 repeatedly interviewed firms every two year since 2005. Secondly, the dataset contains the main information on export status of the enterprise, the number of labourers, productive capital, location, economic indicators, and innovative activities. This enables a test of export status on productivity growth and vice versa.

A potential problem with time variant data is that it is often expressed in current prices. Therefore, our data on current variables are deflated to 1994 prices using the GDP deflators to avoid biases that might arise because of inflation. More specifically about the dataset, measurements and statistical description of variables in the regression analysis are presented in the appendix 3 and 4.

4. Empirical results and discussion

This section displays the empirical findings of testing the self-selection hypothesis of firms, followed by the estimated regression results of various methods (fixed effects panel data model, instrumental variable estimation) when considering the impact of export participation on productivity growth and its components.

4.1 Pooled Probit and Dynamic Probit results

Table1 : Testing Self-selection hypothesis using Probit and Dynamic Probit

VARIABLES	Export Participation$_{(t)}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Export$_{(t-1)}$	1.08**	-0.23	1.11**	-0.40	1.12**	-0.31	-0.25	-0.32
	(0.17)	(0.36)	(0.17)	(0.49)	(0.17)	(0.39)	(0.42)	(0.41)
Levin & Petrin	0.39**	0.55**						
TFP$_{(t)}$	(0.07)	(0.12)						
Stochastic frontier			1.51**	2.13**				
TFP$_{c\ (t)}$			(0.39)	(0.64)				
Lb$_{(t)}$					0.00*	0.00*		
					(0.00)	(0.00)		
TFP$_{(t-1)}$							0.15	
							(0.10)	
Lb$_{(t-1)}$								-0.00
								(0.00)
Firm age $_{(t-1)}$	-0.00	-0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Firm size$_{(t-1)}$	0.00**	0.00*	0.01**	0.01**	0.00**	0.01**	0.01**	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Capital intensity$_{(t-1)}$	0.00	0.00	0.00	0.00+	0.00	0.00	0.00	0.00+
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Trade	0.82**	0.77**	0.84**	0.77**	0.81**	0.72*	0.70*	0.70*
relationship $_{(t-1)}$	(0.22)	(0.28)	(0.22)	(0.29)	(0.22)	(0.29)	(0.29)	(0.29)
Average wage$_{(t-1)}$	-0.00	-0.01	-0.00	-0.00	0.00	0.00	-0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Government	-0.02	-0.01	-0.06	-0.07	-0.03	-0.01	-0.01	-0.02
assistance$_{(t-1)}$	(0.11)	(0.15)	(0.11)	(0.16)	(0.10)	(0.15)	(0.15)	(0.15)
Innovation$_{(t-1)}$	0.23+	0.30+	0.23+	0.29	0.23+	0.31+	0.29+	0.30+
	(0.12)	(0.18)	(0.12)	(0.18)	(0.12)	(0.18)	(0.17)	(0.18)
Joint-stock	0.46+	0.86+	0.46+	1.08	0.61*	1.22*	1.13+	1.28*
enterprises	(0.27)	(0.45)	(0.27)	(0.66)	(0.26)	(0.56)	(0.57)	(0.59)
Private enterprises	0.43**	0.66**	0.47**	0.86*	0.59**	0.98**	0.91*	1.04**
	(0.12)	(0.24)	(0.12)	(0.42)	(0.12)	(0.34)	(0.36)	(0.38)
Partnership	0.58*	0.71+	0.66**	0.99*	0.72**	0.99*	0.92*	1.01*
enterprises	(0.23)	(0.37)	(0.22)	(0.49)	(0.22)	(0.41)	(0.40)	(0.42)
Low technology	0.27**	0.41*	0.20*	0.33+	0.20*	0.33+	0.31+	0.30+
sectors	(0.10)	(0.18)	(0.09)	(0.19)	(0.09)	(0.18)	(0.18)	(0.18)
Year dummy	0.22+	0.26+	0.30**	0.38*	0.23*	0.26+	0.23	0.26+
	(0.12)	(0.15)	(0.11)	(0.17)	(0.11)	(0.16)	(0.15)	(0.16)
Urban dummy	0.07	0.20	0.12	0.27	0.14	0.30	0.28	0.30
	(0.14)	(0.23)	(0.14)	(0.25)	(0.14)	(0.24)	(0.23)	(0.24)
Constant	-3.55**	-5.18**	-4.23**	-6.45**	-2.59**	-4.04**	-4.16**	-4.01**
	(0.25)	(0.85)	(0.46)	(1.48)	(0.15)	(0.78)	(0.86)	(0.81)
Observations	3,270	4,920	3,270	4,920	3,270	4,920	4,920	4,920
Log likelihood	-398.25	-723.60	-406.4	-730.81	-412.3	-736.09	-737.38	-738.40
Chi2	533.99	93.52	517.73	79.64	505.94	81.16	84.58	77.16

Notes: Standard errors in parentheses; (**),(*), and($^{+}$) indicate levels of significance at 1%, 5% and

10% respectively. (1), (3) and (5): Pooled data probit models; (2), (4), (6), (7) and (8): Heckman's random-effects dynamic probit.

As can be seen from column (1), (3) and (5) of table 1, regression results of the determinants of export participation obtained from the pooled probit model reveal that sunk cost proxied by lagged export status is an important factor in determining export participation of firms. However, the result completely changes when unobservable effects are controlled by using the dynamic probit model. Unsurprisingly, we find a statistically insignificant influence of previous export status on contemporaneous export probability. The reason may be that a two year lagged distance seems to be a long period for observing the presence of past export on decision of firms' current export participation. Similar findings are also found in some previous studies. For example, in a study of Columbian firms, Roberts and Tybout (1997) indicate that an exporter after a two year absence from exporting market would have similar re-entry costs as a new exporter. A more recent publication by Sharma and Mishra (2011) on Indian firms also confirms these findings.

With regard to the impact of innovative activities on export participation, the manufacturing firms with the innovative activities proved to have a higher probability of exportation than their counterparts without innovation. The results are consistent with the majority of previous studies (Huang et al., 2008; Nguyen et al., 2008) and indicate that innovation is one of decisive factors in participating in exportation.

As expected, household firms that accounted for the majority of surveyed enterprises (around 70%) had a lower likelihood of exporting than private counterparts (joint-stock, cooperatives and limited companies). This result is in accordance with Rand and Tarp (2009) who found that there is a higher entry barrier into the exporting market for household enterprises compared with their counterparts Vietnamese manufacturing private SMEs. Household enterprises are often characterized by informality and small scale operations (Rand & Tarp, 2009). Consequently such characteristics may become impediments for businesses wanting to participate into export markets.

Regarding the role of governmental support and size of firms, an insignificant impact of government assistance on export participation implies that the role of supportive government is not effective in boosting exporting activities. However, firm size in terms of the number of labourers appears to be important in export activities. Larger sized firms are much more likely to enter into exporting. This finding is consistent with the majority of other research, and seems to reflect a fact that SMEs export labor-intensive products.

In terms of the role of trade relationship, and sectors on export decision, SMEs maintaining a long term relationship with foreign customers gain a higher probability of exporting than firms without such relationship. Obviously, SMEs with constraint resource may take advantage of their networking relationship to overcome entry costs when taking part in foreign markets. As expected, SMEs in low technology sector often have a higher exporting probability than medium and high technology sectors. The results are suitable for Vietnamese context when the majority of exporting products come from low technology industries (Ministry of Industry and Trade of Vietnam & United Nations Industrial Development Organisation, 2011)

The role of institutional change and macroeconomic conditions is captured by a time dummy variable. As shown by empirical results, the year dummy has a positive and statistically significant impact on export probability of firms. This suggests that change in economic integration (e.g., WTO accession of Vietnam in this period) is a catalyst to boost exporting probability of firms. This result gains consistence from the study of Tran (2011) who concludes that institutional change is one of important factors to determine the change in exporting volume in Vietnam.

Going to the variable of main interest, the role of productivity in determining export participation is found to be robust to measuring productivity with different methods. When considering the relationship between exportation and productivity, TFP-Levinsohn Petrin[3] is a popular methodology due to benefits in controlling with endogeneity problem of input factors**.** As shown in column (1) and (2), there is statically significant effect of productivity on export participation when controlling for both observable and unobservable heterogeneity of firms.

[3] See appendix for discussion of calculation

Although labour productivity reflects a part of productivity, it is a conventional measurement in previous studies. Therefore, it is used for comparison purpose. The estimated coefficient of the labour productivity on export participation is positive and statistically significant, confirming that productivity has influence on entry into exporting. These results are similar in both models and are displayed in column (5) and (6). Furthermore, if using productivity change calculated from the stochastic frontiers methodology but not productivity level, we still find evidence of more productive firms self-selecting into the export market**.** The above results indicate that not only productivity but also productivity growth does increase the probability of export participation. These findings obviously support the hypothesis that self-selection occurs for more productive firms with regards to export participation in Vietnam. However, whether using of one-period lagged productivity variable, a statistically insignificant impact of productivity on export participation is observed in the column (7) and (8). The insignificant impact from lagged productivity on exports participation may simply be a reflection of the two-yearly dataset since a two-year lagged distance might be too long to observe the impact of past productivity on the decision of firms to export in the current period. Our results are suggesting that effects of productivity on export status are short run, and diminish after two years.

4.2 **Fixed effect panel data estimate**

Table 2: Fixed effect Panel data results

VARIABLES	Levin-Petrin	Stochastic Frontier[4]			
	TFP_c	TFP_c	TP_c	TE_c	SE_c
	(1)	(2)	(3)	(4)	(5)
Export	0.131	-0.013	-0.004	0.000	-0.009
	(0.080)	(0.018)	(0.003)	(0.000)	(0.015)
Total employment	0.001	0.005**	0.001**	0.000	0.004**
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Firm age	-0.002	0.001	0.000+	0.000	0.000
	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
Average wage	0.053**	0.002	0.001+	0.000**	0.002
	(0.009)	(0.002)	(0.000)	(0.000)	(0.002)
Share of non-	0.077	0.031*	0.003	-0.000+	0.029*
production workers	(0.050)	(0.015)	(0.002)	(0.000)	(0.014)
Year dummy	-0.070**	-0.037**	-0.021**	-0.002**	-0.015**
	(0.016)	(0.005)	(0.001)	(0.000)	(0.004)
Low technology	0.004	-0.018	-0.001	-0.000	-0.017

[4] An statistically insignificant impact of export status on the change of TFP and its each component is also found when dividing the whole sample into low tech, medium tech and high-tech sectors according to classification of General Statistic office of Vietnam (see appendix4)

sector	(0.058)	(0.017)	(0.002)	(0.000)	(0.015)
Medium technology	0.026	-0.032+	-0.006*	-0.000	-0.026
sector	(0.099)	(0.018)	(0.003)	(0.000)	(0.017)
Constant	-0.176*	1.019**	0.125**	0.961**	-0.066**
	(0.069)	(0.018)	(0.003)	(0.000)	(0.016)
Urban dummy	Yes	Yes	Yes	Yes	Yes
Observations	3,266	3,266	3,266	3,266	3,266
R-squared	0.091	0.196	0.441	0.883	0.164

Notes: Robust cluster standard errors in parentheses; ** significance at 1%, * significance at 5%, + significance at 10%.

Table 2 displays the estimated results of the effect of export participation on productivity and its decompositions. In terms of the relationship between firm characteristics and productivity growth, while firms with more years in business had little or no influence on productivity, the role of human capital is reflected clearly in the estimation results. In particular, firm size as measured by total employment affects statistically significantly and positively productivity growth.

With regard to other controlled variables, the quality of labour force as proxy by average wage has a positive influence on level of productivity. Similarly, the share of non-production workers impacts positively the growth in productivity. Combined together, a positive relationship between these variables and productivity growth may reflect an important role of human resource quality in improvement of the productivity of Vietnamese enterprises.

In terms of the impact of macroeconomic conditions, as shown by table 4.2, time dummy variable has a negative impact on productivity growth. This may be explained by the fact that the economic crisis in 2008 on a global scale has a negative effect on Vietnamese economy, and this in turn leads to negative effect on change in productivity and its decompositions.

Turning attention to the impact of export participation on productivity growth, as discussed earlier, productivity is measured by different methods to check the robustness of our results. The results in the equation of TFP in column (1) and (2) reveal that export participation has a statistically insignificant effect on productivity regardless of whether change in productivity calculated from Levishon-Petrin or Stochastic Frontier methodologies. Obviously, this does not support for hypothesis of learning effects by exporting of firms.

Moving to each component of TFP growth, the coefficient relating to the influence of export participation on scale efficiency is positive and statistically insignificant. In other words, there is not a considerable difference between exporters and non-exporters in scale efficiency change. Beyond this, investigation of the link between export decision of firms and technical efficiency, empirical results indicate a statistically insignificant but positive influence of export participation on technical efficiency change. The empirical evidence is also in line with a recent study conducted by Le and Harvie (2010). They concluded that exporting SMEs demonstrate a superior efficiency than non-exporting SMEs but the difference is statistically insignificant. However, these findings are inconsistent with the empirical evidence of Pham, Dao and Reilly (2010), who suggest that export participation has a positive and statistically significant effect on technical efficiency. One reason for the different finding of Pham, Dao and Reilly (2010) could be that their study results based on using a national scale dataset in which informal enterprises had been excluded. However, only SMEs in which many are informal enterprises in our regression sample.

Finally, export participation seems not to be a good predictor for the change in technical progress. The estimated coefficient of export participation exhibits a positive but statistically insignificant effect on technological efficiency. Evidence of greater participation in export market do not encourage firms to upgrade technology that is accordance with the results of Fu (2005). Using Chinese industry-level panel data from 1990-1997, their results show that the coefficient of impact of export activity on technical progress is positive but not statistically significant.

A statistically insignificant impact of export status on productivity and its components may stem from some reasons. First, the majority of Vietnamese exporting products are labour-intensive and low value added (Tran, 2011). For manufacturing exporting SMEs, the proportion of these products is much higher than that in total exports of Vietnam (Kokko & Sjöholm, 2005). Beyond this, Vietnamese SMEs often face with limited capital and resources. Therefore, the exporting SMEs may prefer to meet the requirement of overseas customers with low costs and stable quality instead of focusing on innovative activities and applies new technologies. As a result, export participation may not help firms gain much improvement of new knowledge, expertise and technology, and this in turn hinders the change in productivity, and technological progress. Secondly, export dummy may not adequately capture to learning by exporting process. The reason is that learning effects by exporting may depend on exporting market destination whether they are developed countries or developing countries. In addition, various exporting statuses[5] (e.g., continuing exporting firms, starting exporting firms or stopping firms) can affect differently on learning by exporting of each firm. However, the limitation of the dataset has prevented us from considering such scenarios. Last but not least, as noted by Harvie and Lee (2008), the majority of Vietnamese manufacturing SMEs use outdated machines and technologies that might be lagged 3-4 times behind the world average world level**.** Therefore, participation in exporting market may not help firms improve technical efficiency since the current frontier of SMEs has been reached with existing outdated technology and machines.

4.3 Fixed Effect Instrumental Variable Estimates

Table 4: Learning by exporting using fixed effect IV Estimates (GMM estimation)

VARIABLES	Levinson-Petrin TFP_c	Stochastic Frontier			
		TFP_c	TP_c	TE_c	SE_c
		(1)	(2)	(3)	(4)
Export	0.038	0.015	0.001	-0.000	0.013
	(0.163)	(0.032)	(0.005)	(0.000)	(0.028)
Total employment	0.001	0.005**	0.001**	0.000	0.004**
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Firm age	-0.002	0.001	0.000+	0.000	0.000
	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
Average wage	0.053**	0.002	0.001+	0.000**	0.002
	(0.008)	(0.002)	(0.000)	(0.000)	(0.002)
Share of non-production employees	0.079	0.032*	0.003	-0.000+	0.029*
	(0.049)	(0.015)	(0.002)	(0.000)	(0.014)
Year dummy	-0.069**	-0.037**	-0.021**	-0.002**	-0.014**
	(0.016)	(0.005)	(0.001)	(0.000)	(0.004)
Low technology sector	0.004	-0.019	-0.001	-0.000	-0.017
	(0.058)	(0.017)	(0.002)	(0.000)	(0.015)
Medium technology sector	0.012	-0.030	-0.005*	-0.000	-0.024
	(0.098)	(0.019)	(0.003)	(0.000)	(0.017)
Urban dummy	Yes	Yes	Yes	Yes	Yes
Observations	3,252	3,252	3,252	3,252	3,252
Excluded instruments	Trade relationship and Ethnicity of owner	Trade relationship and Ethnicity of owner	Trade relationship and Ethnicity of owner	Trade relationship and Ethnicity of owner	Trade relationship and Ethnicity of owner
Weak identification test(Cragg-Donald Wald F	393.88	393.88	393.88	393.88	393.88
	[19.93]	[19.93]	[19.93]	[19.93]	[19.93]

[5] Although these dummies also created in this study, a short panel dataset (two years 2007 and 2009) does not allow us to use fixed effect estimations.

statistic) [Stock-Yogo weak id test critical value at 10 percent]					
Hansen J statistic (overid test) [p value in bracket]	2.971 [0.084]	2.833 [0.093]	0.094 [0.759]	0.129 [0.719]	3.388 [0.066]
Endogeneity test of export participation (p value)	0.437	0.2632	0.2159	0.2932	0.2955

Notes: standard errors in parentheses; ** significance at 1%, * significance at 5%, + significance at 10%.

In order to check the robustness of fixed effect estimations, the above model is re-estimated using fixed effect instrumental variable regressions. Using invalid and weak instrumental variables need to be avoided, and therefore, econometric background for our instrumental variables is formed basing on several statistical tests. Firstly, the values of Cragg-Donald Wald F statistic in all models are 393.88, which is greater than the reported Stock-Yogo's weak identification critical value of 19.93. As a result, we can say that relevance requirement of our instruments is satisfied. In addition, the Hansen J statistic was not statistically significant in all models and thus confirmed the validity of instrumental variables. The above specification test results of instrumental variables candidates suggested that ethnicity of owners and long term relationship with foreign partners were in fact good instruments. These results also support for validity of instrumental variables for cases of technical progress, technical efficiency and scale efficiency. However, the *p*-value for the test statistic in the last row of table 4 indicated that the hypothesis of exogeneity of export participation with productivity growth and its components accepted at the conventional level (5%) for equations.

As displayed by the above table, a similar picture is witnessed when considering the effect of firm characteristics on the productivity. For instance, while firm age does not impact on change of productivity and each its component, firms with larger size gain higher productivity. Furthermore, in terms of the evidence of post-exporting productivity improvement, the results from IV model also indicate a series of statistically insignificant impact of export decision on productivity and its components.

5. Summary of findings

In order to find the sources of higher productivity in exporters compared with non-exporters, this chapter has revisited to test two hypothesizes (self-selection and learning by exporting) in Vietnamese manufacturing SMEs. Our empirical results are consistent with many econometric evidences from other countries (e.g., Bernard & Jensen, 1999, 2004a). It indicates that higher productivity of exporters in the Vietnamese SMEs context come from a self-selection of firms with high productivity rather than learning by exporting process. More specifically, several interesting results are found in testing the first hypothesis.

Firstly, while firm age has a statistically insignificant and negligible impact on export probability, the more labour enterprises have the higher chances of enterprises participate in exporting market. This partly reflects a fact that private SMEs export labor-intensive products. Another important determinant of the likelihood of exporting of private firms is innovation capability. Moreover, a long term relationship with foreign partners plays an important role in boosting the export activities of firms. Finally, a statistically significant impact of productivity on exporting decision of firms is confirmed after controlling unobservable firm characteristics heterogeneity, and using of measurement productivity in different methods.

Regarding the role of export participation on productivity growth, using stochastic frontier approach, we extend the literature by decomposing TFP growth into technical progress change, technical efficiency change and scale efficiency. Our empirical results reveal that export status of firms is statistically insignificantly positively associated with TFP growth, scale change, technical efficiency and technical progress. This result is inconsistent with Hiep and Ohta (2009) but is much similar to the opinion presented by Ohno (2011).

When using fixed effect instrumental variables regression, no evidence of post-exporting productivity growth is also found. As explained above, this may stem from low investments in innovation and R&D activities of SMEs. Therefore, polices orienting firms toward boosting innovation activities are necessary. On the one hand, such policies can impact directly and positively on entry in exporting markets of firms. On the other hand, these policies also have created necessary conditions for a positive impact of export participation on productivity improvement.

It is noticed that although results of the study is informative, it might not remain for other period. In addition, the survey data is an every two year panel dataset; therefore, it prevents us from consider the impact of one year lagged variables on the current exporting status. In addition, when considering the effect of export status on productivity, a short panel dataset has hindered us to consider various scenarios, and therefore, future research may evaluate with a longer panel dataset. Finally, although SFA is more preferable, it is criticized of imposing a specific function form. Consequently, other studies can use DEA to calculate productivity and give comparison results.

Apendixes

Appendix 1: Stochastic production frontier estimation for SMEs

Translog model			
Variables	Coefficient	Standard error	T-ratio
Constant	2.2698289	0.12469876	18.202499
LnK	0.1058	0.024938538	4.2453541
LnL	1.0087327	0.047266537	21.341372
T	0.05766716	0.072498009	0.79543095
$(\ln K)^2$	0.009724	0.00360138	2.7000762
$(\ln L)^2$	-0.042545248	0.011020312	-3.8606211
(lnL)(lnK)	0.004339056	0.010634458	0.40801853
(lnL)t	0.022132343	0.014089915	1.5707933
(lnK)t	0.018620988	0.008200202	2.2707962
T^2	-0.019937029	0.017775959	-1.1215727
σ^2	0.49284044	0.026583366	18.539429
γ	0.34104566	0.02992423	11.396974
μ	0.81994824	0.14370176	5.7059025
η	-0.055855616	0.029717591	-1.8795472
Log-likelihood Value	-4878.8633		
Obs. Number	4920		

Appendix2: Estimation TFP using Levinsohn-Petrin methodology

In previous studies, Levinsohn-Petrin approach is popular method in productivity measurement because of advantages in controlling endogeneity of input factors. In this research, total value added is used as the output while the capital variable proxied by value of machinery and equipments and buildings for production, labour variable measured by total employees are input factors. The freely input are raw material costs and electricity cost that stand for unobservable shocks. All the variables with current price are deflated by deflator GDP index in 1994. In addition, all variables in regression model are employed in natural logarithmic forms. “Levpet” program in Stata written by Levinsohn-Petrin (2003) with 250 time bootstrap replication is used to estimate productivity.

Appendix 3: Collinearity diagnostics for variables in the model of the impact of export participation on changes in productivity and its components

Variable	VIF	1/VIF
Low tech	2.6	0.384814
Medium tech	2.54	0.393164
Total employment	1.28	0.784147

Average wage	1.24	0.804368
Export	1.19	0.838178
Firm age	1.06	0.943719
Urban dummy	1.03	0.971573
Year dummy	1.02	0.980666
Non-production workers share	1	0.997784
Mean VIF	1.44	

Notes: As indicated in appendix4, all the VIF values are much less than 10, which indicates that this regression results does not encounter the problem of multicollinearity.

Appendix 4: Variables in testing the self-selection hypothesis

Dependent variables	***Description***	**Obs**	**Mean**	**Sd**
Exporter	1 if firm has export activities; 0 otherwise	4920	0.052	0.222
Explanatory variables				
Sunk cost	Export status in the previous period	3280	0.050	0.218
TFP	Total factor productivity predicted from Levinsohn-Petrin methodology	4920	16.12	64.5
TFP_c	Total factor productivity calculated from Stochastic frontier methodology	3280	1.084	0.137
LP	Labor Productivity calculated by value added per total employees	4920	12.81	56.23
Firm size	Total employment	4920	0.361	0.48
Capital intensity	The ratio of capital over total employment	4920	15.4	27.76
Trade relationship	1 if firms have a long term relationship with foreign partners, 0 otherwise	4920	0.03	0.17
Firm age	The number of years since established	4920	14.01	10.76
Average Wage	Ratio of total wage to total employees	4920	3.88	5.09
Innovation	1 if introduce new products on the market 0 otherwise	4920	0.16	0.37
Household enterprises	1 if ownership is household ownership, 0 otherwise	4920	0.723	0.44
Private enterprises	1 if ownership is private ownership, 0 otherwise	4920	0.23	0.42
Partnership enterprises	1 if ownership is partnership ownership, 0 otherwise	4920	0.029	0.16
Joint stock enterprises	1 if ownership is joint stock ownership, 0 otherwise	4920	0.015	0.12
Urban Dummy	1if firm located in Hanoi, Haiphong and Ho Chi Minh, 0 otherwise	4920	0.383	0.486
Time dummy	1 if year is 2009, 0 otherwise	4920	0.33	0.47
Low technology sector dummy	1 if firms belong to low technology sector, 0 otherwise	4920	0.54	0.49
Medium technology sector dummy	1 if firms belong to medium technology sector, 0 otherwise	4920	0.32	0.46
High technology sector dummy	1 if firms belong to high technology sector, 0 otherwise	4920	0.14	0.34
Government assistance	1 if firms have government support, 0 otherwise	3280	0.28	0.45

Appendix 5: Variables in testing the learning by exporting hypothesis

Dependent variables	Description	Obs	Mean	Sd
TFPc	Total factor productivity change predicted from stochastic frontier production function	3266	1.084	0.137
TPc	Technical change predicted from stochastic frontier production function	3266	0.126	0.058
Tec	Technical efficiency change predicted from stochastic frontier production function	3266	0.95	0.014
Sec	Scale efficiency change predicted from stochastic frontier production function	3266	-0.002	0.109
TFPc	Total factor productivity predicted from Levinsohn-Petrin methodology	3266	0.062	0.772
Controlled variables				
Firm size	Total employment	3266	15.86	27.96
Firm age	The number of years since established	3266	15.06	11.18
Share of non-production workers	The percentage of non-production employees to total labour force	3266	0.35	0.21
Wage mean	Ratio of total wage to total employees	3266	4.02	3.81
Instrument variables				
Ethnicity of owners	1 if ethnicity of owners belong to minority group, 0 otherwise	3266	0.069	0.25
Trade relationship	1 if firms have a long term relationship with foreign partners, 0 otherwise	3266	0.039	0.19

Appendix6: List of the industries in terms of the level of technology.

Group 1: Low technology
D15: Food and beverages
D16: Cigarettes and tobacco
D17: Textile products
D18: Wearing apparel, dressing and dying of fur
D19: Leather and products of leather; leather substitutes; footwear.
D20: Wood and wood products, excluding furniture
D21: Paper and paper products
D22: Printing, publishing, and reproduction of recorded media
D23: Coke and refined petroleum products and nuclear fuel
D36: Furniture and other products not classified elsewhere
D37: Recycles products
Group 2: Medium technology
D24: Chemicals and chemical products
D25: Rubber and plastic products
D26: Other non-metallic mineral products
D27: Iron, steel and non-ferrous metal basic industries
D28: Fabricated metal products, except machinery and equipment
Group 3: High technology
D29: Machinery and equipment
D30: Computer and office equipment
D31: Electrical machinery apparatus, appliances and supplies

D32: Radios, television and telecommunication devices
D33: Medical equipment, optical instruments
D34: Motor vehicles and trailers
D35: Other transport equipment

References

Alvarez, R., & López, R. A. (2005). Exporting and performance: evidence from Chilean plants. *Canadian Journal of Economics/Revue Canadienne D'économique, 38*(4), 1384-1400.

Angrist, J. D., & Pischke, J. S. (2008). *Mostly harmless econometrics: An empiricist's companion*. Princeton, NJ: Princeton University Press.

Anh, N. T. T., Hong, V. X. N., Thang, T. T., & Hai, N. M. (2006). *The impacts of foreign direct investment on economic growth in Vietnam*. Hanoi, VietNam: Central Institute for Economic Management.

Aw, B. Y., Roberts, M. J., & Winston, T. (2007). Export market participation, investments in R&D and worker training, and the evolution of firm productivity. *The World Economy, 30*(1), 83-104.

Baldwin, J. R., & Gu, W. (2003). Export-market participation and productivity performance in Canadian manufacturing. *Canadian Journal of Economics/Revue Canadienne D'économique, 36*(3), 634-657.

Bascle, G. (2008). Controlling for endogeneity with instrumental variables in strategic management research. *Strategic Organization, 6*(3), 285-327.

Baum, C. F., Schaffer, M. E., & Stillman, S. (2003). Instrumental variables and GMM: Estimation and testing. *Stata Journal, 3*(1), 1-31.

Bellone, F., Musso, P., Nesta, L., & Quere, M. (2008). The u-shaped productivity dynamics of French exporters. *Review of World Economics, 144*(4), 636-659.

Bernard, A., & Wagner, J. (1997). Exports and success in German manufacturing. *Review of World Economics, 133*(1), 134-157.

Bernard, A., & Wagner, J. (2001). Export entry and exit by German firms. *Review of World Economics, 137*(1), 105-123.

Bernard, A. B., & Jensen, J. B. (1995). Exporters, jobs, and wages in US manufacturing: 1976-1987. *Brookings Papers on Economic Activity. Microeconomics, 1995*, 67-119.

Bernard, A. B., & Jensen, J. B. (1999). Exceptional exporter performance: cause, effect, or both? *Journal of International Economics, 47*(1), 1-25.

Bernard, A. B., & Jensen, J. B. (2004a). Exporting and productivity in the USA. *Oxford Review of Economic Policy, 20*(3), 343-357. doi:10.1093/oxrep/grh020

Bernard, A. B., & Jensen, J. B. (2004b). Why some firms export. *Review of Economics and Statistics, 86*(2), 561-569.

Bigsten, A., Collier, P., Dercon, S., Fafchamps, M., Gauthier, B., Gunning, J. W., et al. (2004). Do African manufacturing firms learn from exporting? *Journal of Development Studies, 40*(3), 115-141.

Bigsten, A., & Gebreeyesus, M. (2009). Firm productivity and exports: Evidence from Ethiopian manufacturing. *The Journal of Development Studies, 45*(10), 1594-1614.

Blalock, G., & Gertler, P. J. (2004). Learning from exporting revisited in a less developed setting. *Journal of Development Economics, 75*(2), 397-416.

Cameron, A. C., & Trivedi, P. K. (2009). *Microeconometrics using stata* (Vol. 5). College Station, TX: Stata Press

Clerides, S. K., Lach, S., & Tybout, J. R. (1998). Is learning by exporting important? Micro-dynamic evidence from Colombia, Mexico, and Morocco. *The Quarterly Journal of Economics, 113*(3), 903-947. doi:10.1162/003355398555784

Coelli, T. (2005). *An introduction to efficiency and productivity analysis*. New York, NY: Springer Verlag.
Crespi, G., Criscuolo, C., & Haskel, J. (2008). Productivity, exporting, and the learning-by-exporting hypothesis: direct evidence from UK firms. *Canadian Journal of Economics, 41*(2), 619-638.
Fryges, H., & Wagner, J. (2010). Exports and profitability: First evidence for German manufacturing firms. *The World Economy, 33*(3), 399-423.
Fu, X. (2005). Exports, technical progress and productivity growth in a transition economy: A non-parametric approach for China. *Applied Economics, 37*(7), 725-739.
Girma, S., Greenaway, A., & Kneller, R. (2004). Does exporting increase productivity? A microeconometric analysis of matched firms. *Review of International Economics, 12*(5), 855-866.
Girma, S., Greenaway, D., & Kneller, R. (2003). Export market exit and performance dynamics: A causality analysis of matched firms. *Economics Letters, 80*(2), 181-187.
Greenaway, D., Gullstrand, J., & Kneller, R. (2005). Exporting may not always boost firm productivity. *Review of World Economics, 141*(4), 561-582.
Greenaway, D., & Kneller, R. (2007). Industry differences in the effect of export market entry: Learning by exporting? *Review of World Economics, 143*(3), 416-432.
Greenaway, D., & Yu, Z. (2004). Firm-level interactions between exporting and productivity: Industry-specific evidence. *Review of World Economics, 140*(3), 376-392.
Hansen, H., Rand, J., & Tarp, F. (2009). Enterprise growth and survival in Vietnam: Does government support matter? *The Journal of Development Studies, 45*(7), 1048-1069.
Harvie, C., & Lee, B. C. (2008). *Small and medium sized enterprises in East Asia: Sectoral and regional dimensions*. Cheltenham, England: Edward Elgar Publishing.
Hiep, N., & Ohta, H. (2009). *Superiority of exporters and the causality between exporting and firm characteristics in Vietnam* (Working paper no. 239). Retrieved from http://www.rieb.kobe-u.ac.jp/academic/ra/dp/English/dp239.pdf
Huang, C., Zhang, M., Zhao, Y., & Varum, C. A. (2008). Determinants of exports in China: A microeconometric analysis. *The European Journal of Development Research, 20*(2), 299-317.
Isgut, A. (2001). What's different about exporters? Evidence from Colombian manufacturing. *Journal of Development Studies, 37*(5), 57-82.
Kim, S. I., Gopinath, M., & Kim, H. (2009). High productivity before or after exports? An empirical analysis of Korean manufacturing firms. *Journal of Asian Economics, 20*(4), 410-418.
Kimura, F., & Kiyota, K. (2006). Exports, FDI, and productivity: Dynamic evidence from Japanese firms. *Review of World Economics, 142*(4), 695-719.
Kokko, A., & Sjoholm, F. (2000). Some alternative scenarios for the role of the state in Vietnam. *The Pacific Review, 13*(2), 257-277.
Kokko, A., & Sjöholm, F. (2005). The Internationalization of Vietnamese Small and Medium-Sized Enterprises. *Asian Economic Papers, 4*(1), 152-177. doi:10.1162/asep.2005.4.1.152

Kraay, A. (1999). Exports and economic performance: evidence from a panel of Chinese enterprises. *Revue d'Economie du Developpement, 1*(2), 183-207.
Kumbhakar, S. C., & Lovell, C. A. K. (2003). *Stochastic frontier analysis*: Cambridge Univ Pr.
Le, V., & Harvie, C. (2010). *Firm performance in Vietnam: Evidence from manufacturing small and medium enterprises* (Working paper 10-04). Wollongong, NSW, Australia: University of Wollongong. Retrieved from http://www.uow.edu.au/content/groups/public/@web/@commerce/@econ/documents/doc/uow090518.pdf
Lileeva, A., & Trefler, D. (2010). Improved access to foreign markets raises plant-level productivity for some plants. *The Quarterly Journal of Economics, 125*(3), 1051-1099. doi:10.1162/qjec.2010.125.3.1051
Liu, J.-T., Tsou, M.-W., & Hammitt, J. (1999). Export activity and productivity: Evidence from the Taiwan electronics industry. *Review of World Economics, 135*(4), 675-691. doi:10.1007/bf02707390
Ministry of Industry and Trade of Vietnam, [MITV], & United Nations Industrial Development Organisation, [UNIDO]. (2011). *Vietnam industrial competitiveness report*. Retrieved from http://institute.unido.org/documents/M8_LearningResources/VICR_2011_executivesummary.pdf
Nguyen, A. N., Pham, N. Q., Nguyen, C. D., & Nguyen, N. D. (2008). Innovation and exports in Vietnam's SME sector. *The European Journal of Development Research, 20*(2), 262-280.
Nguyen, M. K. (2005). Anh huong cua tien bo cong nghe den tang truong cua cac nganh san xuat [The impact of technical progress on growth of manufacturing sectors]. In M. K. Nguyen (Ed.), *Anh huong cua tien bo cong nghe den tang truong kinh te* [The impact of technical progress on economic growth] (pp. 60-96). Hanoi, VietNam: Science and Technology Publishing House.
Ohno, K. (2011). Comment on "Revisiting Exports and Foreign Direct Investment in Vietnam". *Asian Economic Policy Review, 6*(1), 134-135.
Park, A., Yang, D., Shi, X., & Jiang, Y. (2010). Exporting and firm performance: Chinese exporters and the Asian financial crisis. *The Review of Economics and Statistics, 92*(4), 822-842.
Pham, H. T., Dao, T. L., & Reilly, B. (2010). Technical efficiency in the Vietnamese manufacturing sector. *Journal of International Development, 22*(4), 503-520.
Poddar, T. (2004, September 9-11). *Understanding Indias export dynamism of the 1990s*. Paper presented at the European Trade Study Conference, Nottingham, England. Retrieved from http://www.etsg.org/ETSG2004/Papers/Poddar.PDF
Rand, J., & Tarp, F. (2009). *Characteristics of the Vietnamese business environment: Evidence from a SME survey in 2008*. Hanoi, VietNam: CIEM.
Ranjan, P., & Raychaudhuri, J. (2011). Self-selection vs learning: Evidence from Indian exporting firms. *Indian Growth and Development Review, 4*(1), 22-37.
Roberts, B. Y., Chen, X., & Roberts, M. J. (1997). *Firm-level evidence on productivity differentials, turnover, and exports in Taiwanese manufacturing* (Working paper series). Retrieved from

http://ssrn.com/paper=136950http://papers.ssrn.com/sol3/papers.cfm?abstract_id=136950

Roberts, M. J., & Tybout, J. R. (1997). The decision to export in Colombia: An empirical model of entry with sunk costs. *The American Economic Review, 87*(4), 545-564.

Roper, S., Love, J. H., & Hagon, D. A. (2006). The determinants of export performance: Evidence for manufacturing plants in Ireland and Northern Ireland. *Scottish Journal of Political Economy, 53*(5), 586-615.

Sharma, C., & Mishra, R. K. (2011). Does export and productivity growth linkage exist? Evidence from the Indian manufacturing industry. *International Review of Applied Economics, 25*(6), 1-20.

Sharma, S. C., Sylwester, K., & Margono, H. (2007). Decomposition of total factor productivity growth in US states. *The Quarterly Review of Economics and Finance, 47*(2), 215-241.

Sinani, E., & Hobdari, B. (2010). Export market participation with sunk costs and firm heterogeneity. *Applied Economics, 42*(25), 3195-3207.

Stampini, M., & Davis, B. (2009). Does nonagricultural labor relax farmers' credit constraints? Evidence from longitudinal data for Vietnam. *Agricultural economics, 40*(2), 177-188.

Stewart, M. B. (2006). Maximum simulated likelihood estimation of random-effects dynamic probit models with autocorrelated errors. *Stata Journal, 6*(2), 256-272.

Sun, X., & Hong, J. (2011). Exports, ownership and firm productivity: Evidence from China. *The World Economy, 34*(7), 1199-1215.

Tomiura, E. (2007). Effects of R&D and networking on the export decision of Japanese firms. *Research Policy, 36*(5), 758-767.

Tran, V. T. (2011). Comment on "Revisiting Exports and Foreign Direct Investment in Vietnam". *Asian Economic Policy Review, 6*(1), 132-133.

Trung, T. Q., Tung, N. T., Dong, T. D., & Duong, P. H. (2009). Performance of export-oriented small and medium-sized manufacturing enterprises in Viet Nam. *Asia-Pacific Trade and Investment Review 2008, 4*, 83.

Tsou, M.-W., Liu, J.-T., Hammitt, J. K., & Wang, K.-H. (2008). Exporting and producitivity growth: Evidence from the Taiwan electronics plants. *Scottish Journal of Political Economy, 55*(2), 190-209.

Van Biesebroeck, J. (2005). Exporting raises productivity in sub-Saharan African manufacturing firms. *Journal of International Economics, 67*(2), 373-391.

Wagner, J. (2001). A note on the firm size – Export relationship. *Small Business Economics, 17*(4), 229-237. doi:10.1023/a:1012202405889

Wagner, J. (2002). The causal effects of exports on firm size and labor productivity: First evidence from a matching approach. *Economics Letters, 77*(2), 287-292.

Wagner, J. (2011). Exports, imports and profitability: First evidence for manufacturing enterprises. *Open Economies Review*, 1-19.

Wooldridge, J. M. (2002). *Econometric analysis of cross section and panel data*. Cambridge, MA: The MIT press.

Wooldridge, J. M. (2009). *Introductory econometrics: A modern approach*. Mason, OH: South Western, Cengage Learning.