

Vu, Huong Van; Holmes, Mark; Tran, Tuyen Quang; Lim, Steven

Article

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Baltic Journal of Economics

Provided in Cooperation with:

Baltic International Centre for Economic Policy Studies (BICEPS), Riga

Suggested Citation: Vu, Huong Van; Holmes, Mark; Tran, Tuyen Quang; Lim, Steven (2016) : Firm exporting and productivity: what if productivity is no longer a black box, Baltic Journal of Economics, ISSN 2334-4385, Taylor & Francis, London, Vol. 16, Iss. 2, pp. 95-113, <https://doi.org/10.1080/1406099X.2016.1187382>

This Version is available at:

<https://hdl.handle.net/10419/180091>

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To cite this article: Huong Van Vu, Mark Holmes, Tuyen Quang Tran & Steven Lim (2016) Firm exporting and productivity: what if productivity is no longer a black box, *Baltic Journal of Economics*, 16:2, 95-113, DOI: [10.1080/1406099X.2016.1187382](https://doi.org/10.1080/1406099X.2016.1187382)

To link to this article: <https://doi.org/10.1080/1406099X.2016.1187382>



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Firm exporting and productivity: what if productivity is no longer a black box

Huong Van Vu^a, Mark Holmes^a, Tuyen Quang Tran^b and Steven Lim^a

^aDepartment of Economics, University of Waikato, Hamilton, New Zealand; ^bFaculty of Political Economy, VNU University of Economics and Business, Hanoi, Vietnam

ABSTRACT

This paper uses Vietnamese firm-level data to examine the relationship between firm productivity and exporting. In particular, this paper shows that more productive firms are more likely than less productive firms to export, consistent with the extensive prior literature. However, this paper finds no evidence that exporting affects productivity, which can be decomposed into technical efficiency change, technological progress, and scale change. Thus, the findings support a large role of self-selection in accounting for export decision, but little gain from learning-by-exporting in the case of Vietnamese Small medium sized enterprises (SMEs). These findings imply that export promotion policies may not be effective unless accompanied by strategies to help SMEs become more productive.

ARTICLE HISTORY

Received 1 September 2015
Accepted 26 April 2016

KEYWORDS

Exports; productivity; SMEs; Vietnam

JEL CLASSIFICATION

F14; O12

1. Introduction

Since the ground-breaking study of Bernard and Jensen (1995), which described ‘exceptional export performance of firms in the United States’, many empirical studies have focused on investigating the relationship between export status and productivity growth. Two hypotheses are often used to explain the superiority of the productivity 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 (e.g. Bernard & Jensen, 1999). An alternative but not mutually exclusive explanation is learning by exporting, which argues that export participation can be a source of productivity growth enabling exporting firms to become more productive relative to non-exporters (e.g. Van Biesebroeck, 2005).

One of the stylized characteristics from the econometric evidence of the linkage between export and productivity is that of 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 Kim, Gopinath,

CONTACT Huong Van Vu  huongvu@waikato.ac.nz

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and Kim (2009) rejected the validity of each hypothesis for the majority of sectors in South Korea.

Mixed results concerning the export and productivity growth nexus may stem from the variance in characteristics of geographical, economic conditions and level of economic development of countries (Blalock & Gertler, 2004; Wagner, 2007). The marginal benefits from exposure to exporting can be greater for countries with poor technology and low productivity in comparison with those in developed countries. 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 labour productivity. This is unsuitable in the Vietnamese context because this index just represents only part of the productivity picture 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) in investigating the relationship. Although the method can control for the endogeneity of input factors by using the intermediate input demand function under certain assumptions, it does not allow for the decomposition of TFP growth. Productivity theory shows that the change in TFP includes various components such as technological progress (TP), changes in technical change, and scale efficiency (SE) 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 examine the relationship between exporting 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 efficiently and have constant returns to scale. This means that when TFP growth occurs, it is equal to TP (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 the private sector's increasing ability to freely participate in export activities.¹ For Vietnamese private manufacturing firms, the full efficiency assumption of firms cannot be seen to be working. As described by Kokko and Sjöholm (2000), Vietnam is a transition economy where institutional discrimination still exists between state enterprises and local private firms due to the consequence of previous planning mechanisms. Such discrimination can make local private firms unable to work at the 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 a Stochastic Frontier Production Function (SFPF) approach to relax the assumption of full efficiency of firms and decomposes productivity growth into different components including technical change, scale change, and TP change. While other approaches (e.g. Data Envelopment Analysis) may divide productivity growth, the SFPF is employed because of the advantages gained with regard to controlling for any random shocks, outliers, and measurement errors present in the data (Coelli, 2005; Sharma, Sylwester, & Margono, 2007).

Although there is a large literature on the linkage between exports and firm productivity, this paper is significantly different from its predecessors in several aspects. First, this study contributes to literature by providing the first evidence not only on the factors impeding export participation of SMEs but also on the role of export in productivity growth in Vietnam (According to decree No. 90/2001/ND-CP issued on 23 November 2001, SMEs are enterprises with annual labour not greater than 300 people.). Second, by using the SFPF approach, to the best of our 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 a more detailed picture of the impact of firm exporting on productivity. Finally, when considering the role of exports on firms' productivity, one challenge is that the results can be biased because of unobserved characteristics and the potential endogeneity of exports. These issues are overcome by using fixed effect instrumental variable estimations.

The structure of paper includes is based on four sections. Section 2 presents the background of export performance and the development of SMEs in Vietnam. Section 3 discusses the data source, the methodology of measurement of TFP and its decompositions, and econometric models for considering the relationship between export and productivity. The empirical results are displayed in Section 4. A summary of findings and policy implications is presented in the last section.

2. Background of export performance and the development of SMEs

2.1. Vietnam's export performance

Vietnam's total exports (valued in current US dollars), as presented in Figure 1, demonstrates significant growth from nearly US\$14.5 billion in 2000 to US\$72.2 billion in 2010. In addition, as shown in Figure 1, there are three important cornerstones affecting

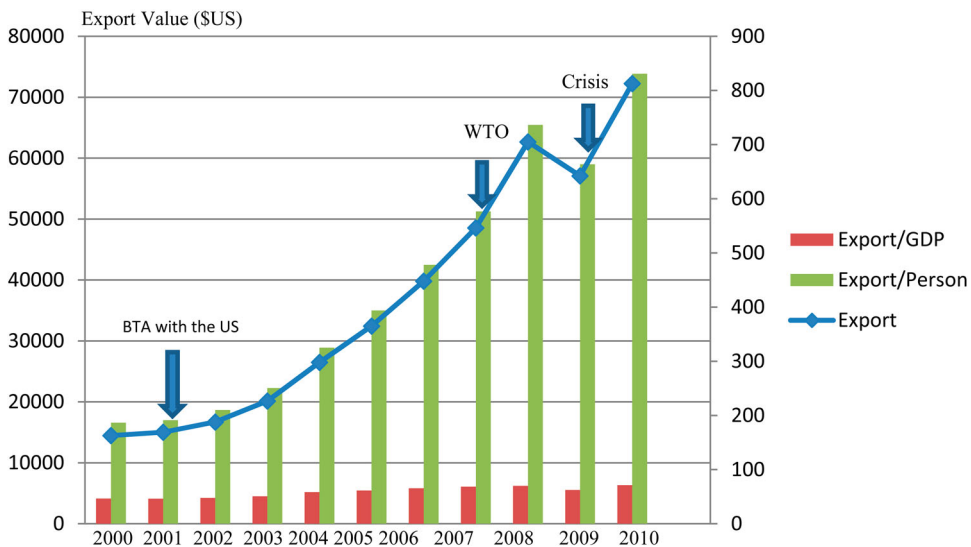


Figure 1. Export, export per person ratio and export-GDP ratio.

Source: Statistical yearbook (various issues) from Vietnam general statistical offices.

Vietnamese export growth throughout this period. The first is the trade agreement signed with the USA in 2001. Since this date, the agreement has spurred a significant increase in the export of Vietnamese goods to the US market. In addition, Vietnamese exports continued to boom in the period following admittance to the WTO in 2007. Although export growth witnessed a drop in 2009 due to the global financial crisis and great recession, there are clear signs of quick recovery in the following years.

The exports over GDP and exports per person ratios are popular indices measuring the integration of the Vietnamese economy. First, the export-GDP ratio increased significantly from 46.46% in 2000 to 71.09% in 2010. Similarly, the export per person ratio also evidenced the same trend from US\$186.56 per person in 2000 rising to US\$830.95 per person in 2010. These indices suggest, on the one hand, that the degree of integration of the Vietnamese economy is increasing and on the other, that the economy may be relatively more vulnerable to external shocks.

2.2. The development and the role of SMEs in Vietnam

Table 1 presents a classification of firms based on the number of employees. As revealed in row 1, the trend was for an increase in the number of SMEs through the study period. A detailed look at each kind of firm according to size indicates that micro and small firms dominate the SME population. The percentage varied from 95% to 98% in the 2000–2008 period.

Regarding the role of SMEs, they play an important role in employment generation. In 2005, for example, 2.5 million jobs were created by SMEs (Trung, Tung, Dong, & Duong, 2009). SMEs are also regarded as the main engine for alleviating poverty, especially in rural areas (Kokko & Sjöholm, 2005). Furthermore, the Vietnamese economy is numerically dominated by SMEs, with 96% of the total number of enterprises contributing nearly 40% of GDP and 32% of total investment in 2006 (Hung, 2007).

However, despite the picture of a high export performance of the Vietnamese economy, the contribution of SMEs to export growth is still modest in comparison with neighbouring countries. Only a small percentage of Vietnamese SMEs, nearly 20%, was engaged in exports, while China, India, Taiwan, and South Korea witnessed significant contributions of SMEs to exports, with approximately 60%, 38%, 56%, and 40% respectively in the 1990s (Tambunan 2007). Furthermore, considering only domestic non-state manufacturing SMEs, recent surveys reveal that export participation ranged from 3% to nearly 6% in the period 2002–2009 (Cuong, Rand, Silva, Tam, & Tarp, 2008; Cuong et al., 2010; Kokko

Table 1. The distribution of SMEs (by employees).

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Distribution										
Total number of firms (including SMEs)	42,288	51,680	62,908	72,012	91,756	112,950	131,318	155,771	205,689	
SMEs (percentage in total)	92%	93%	93%	94%	95%	96%	96%	96%	97%	
Average growth rate of SMEs		23%	22%	15%	29%	24%	17%	19%	33%	
Micro enterprises	54%	54%	53%	51%	53%	56%	61%	61%	62%	
Small enterprises	34%	35%	37%	39%	38%	37%	32%	33%	33%	
Medium enterprises	4%	4%	4%	3%	3%	3%	3%	3%	2%	

Sources: Anh, Mai, Nhat, and Chuc (2011), (calculations based on Enterprise Census 2001–2009).

& Sjöholm, 2005; Rand & Tarp, 2006). What challenges and barriers hinder them from participating in export activities? And how does the role of export participation affects productivity growth and its decompositions. Part 4 will offer empirical evidence on these research questions.

3. Methodology and data

3.1. Empirical framework

3.1.1. Stochastic frontier and decomposition of productivity change

According to Kumbhakar and Lovell (2003), productivity change is based on the components (1) TP, (2) the change in efficiency of using factors of inputs (TE), (3) the change in SE. The change in TP is defined as the partial derivative of production function over time, and technical efficiency change is measured as the derivative of technical efficiency with respect to time (Kumbhakar & Lovell, 2003). They also define that the elasticity contribution to the TFP growth is used to measure the change in SE.

To calculate TFP growth and its components, our research applies a methodology proposed by Kumbhakar and Lovell (2003), with a translog production function specification.² The panel model is expressed as follows:

$$\ln y_{it} = \widehat{\beta}_0 + \widehat{\beta}_1 \ln K_{it} + \widehat{\beta}_2 \ln L_{it} + \widehat{\beta}_3 t + 0.5 [\widehat{\beta}_4 (\ln K_{it})^2 + \widehat{\beta}_5 (\ln L_{it})^2 + \widehat{\beta}_6 t^2] + \widehat{\beta}_7 \ln K_{it} \ln L_{it} + \widehat{\beta}_8 t \ln K_{it} + \widehat{\beta}_9 t \ln L_{it} + v_{it} - u_{it}, \quad (1)$$

where y_{it} is value added that is assumed endogenous to the choice of two exogenous input factors namely, L_{it} (labour) and K_{it} (capital), t denotes a time trend. Two terms v_{it} and u_{it} are unobservable error terms and are assumed independent of each other. While u_{it} represents technical inefficiency effects and are supposed non-negative, v_{it} reflects statistical noise (e.g. measurement error). According to Kumbhakar and Lovell (2003), an enterprise maximizes output with the inputs used if u_{it} is equal to zero. A firm is inefficient if u_{it} is greater than zero.³

As indicated by Kumbhakar and Lovell (2003) and Sharma et al. (2007), one can draw out the productivity change and its components as below:

$$\text{Technological progress change : } \Delta TP_{it} = \frac{\partial \ln(y_{it})}{\partial t} = \widehat{\beta}_3 + \widehat{\beta}_6 t + \widehat{\beta}_8 \ln K_{it} + \widehat{\beta}_9 \ln L_{it}, \quad (2)$$

$$\text{Technical efficiency change : } \Delta TE_{it} = -\frac{\partial u_{it}}{\partial t}, \quad (3)$$

$$\text{Scale efficiency change : } \Delta SE_{it} = (\varepsilon - 1) \left[\left(\frac{\varepsilon_k}{\varepsilon} \right) \dot{K} + \left(\frac{\varepsilon_l}{\varepsilon} \right) \dot{L} \right], \quad (4)$$

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 rates of change in capital and labour respectively

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

In order to estimate the translog production function in Equation (1), the FRONTIER 4.1 software written by Coelli (2005) is employed. Then, using the estimated technical efficiency and coefficients, components of TFP growth are calculated by using Equations (2), (3), and (4).

3.1.2. Model specification of self-selection effect

Since export participation is modelled as a binary variable with two possible outcomes (0 and 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. Some previous studies have employed a 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 marketing strategy, and business strategy. If these characteristics are not properly controlled for, the results will be biased and inconsistent in estimation. Therefore, the dynamic Probit model framework used in this paper is similar to the method advocated by 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 for export decisions is as follows:

$$Y_{it} = \begin{cases} 1 & \text{if } p_{it}q_{it-1}^* \geq c_{it}(X_{it}, Z_{it}, q_{it-1}^*/q_{it}^*) + S(1 - Y_{it-1}) \\ 0 & \text{otherwise,} \end{cases} \quad (6)$$

where S indicates the sunk entry costs which vary across firms; p_{it} : the price of goods sold abroad. q_{it}^* : the optimal quantity of goods sold abroad; c_{it} : the cost of producing optimal export quantity. X_{it} refers to vectors of exogenous factors affecting the firms' profitability; Z_{it} 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 Roberts and Tybout (1997) and Bernard and Jensen (2004a) for testing the self-selection hypothesis, a reduced binary-choice model is indicated as follows:⁴

$$Y_{it} = \begin{cases} 1 & \text{if } \lambda_z X_{it} + \lambda_z Z_{it} - S(1 - Y_{it-1}) + u_{it} \geq 0 \\ 0 & \text{otherwise,} \end{cases} \quad (7)$$

where X_{it} and Z_{it} as described in Equation (6); u_{it} is error term. According to past studies, export decisions of firms are determined by a combination of multiple factors. First, productivity is considered as the main interest variable. Productivity with various measurement methods is used in the model to test the robustness of the results.

Second, standard firm characteristic variables (X_{it}) such as firm age, firm size, average wage are included in the majority of past studies (e.g. Aw, Roberts, & Winston, 2007; Roper, Love, & Hagon, 2006). Third, 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. Nguyen, Pham, Nguyen, & Nguyen, 2008). Fourth, a dummy variable picking up long-term trade relationships with foreign partners is incorporated into the

model since firms in social networks have been 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 then 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. Beyond this, recent studies show that higher export probability has a close positive link with low credit constraints levels of firms (e.g. Minetti & Zhu, 2011). Hence, firm credit constraints are controlled for in the model using a dummy variable. In addition to these variables, we also control for the location of firms, sectors, and kinds of ownership based on the fact that the behaviour of SMEs are much different among these factors (Rand & Torm, 2011; Vu, Holmes, Lim, & Tran, 2014).

Finally, as indicated by previous studies (Bernard & Jensen, 2004b; Roberts & Tybout, 1997), past export status is employed to control for the presence of sunk costs. In addition, many previous studies of determinants of export participation often lagged firm characteristics by one or more periods to reduce simultaneity (e.g. Hiep & Ohta, 2009; Roberts & Tybout, 1997). Accordingly, a series of one-period lagged explanatory covariates of firm characteristics was used in our regression estimation.⁵

3.1.3. Model specification of the learning by exporting effect

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

$$\Delta TFP_{it} = a_0 + a_1 \text{Export}_{it} + a_2 X_{1it} + u_{1it}, \quad (8)$$

$$\Delta TP_{it} = b_0 + b_1 \text{Export}_{it} + b_2 X_{1it} + u_{1it}, \quad (9)$$

$$\Delta TE_{it} = c_0 + c_1 \text{Export}_{it} + c_2 X_{1it} + u_{1it}, \quad (10)$$

$$\Delta SE_{it} = d_0 + d_1 \text{Export}_{it} + d_2 X_{1it} + u_{1it}, \quad (11)$$

where the dependent variables are represented by TFP change, change in TP, and changes in technical efficiency, and SE change. The main interest variable is the export decision which is being captured by a dummy variable because of two reasons. First, as indicated by Stampini and Davis (2009), usage of a dummy variable allows one to consider the average treatment effect and minimizes the biases due to measurement errors. Second, export intensity data for 2007 are unavailable, and this hinders us from considering panel data estimation between export intensity and the dependent covariates.⁶

Other firm characteristics variables such as total employment, firm age, innovation, and average wage also are controlled for in the model. Justification of including these variables in the model is as follows. It is expected that firms with higher size and more experience in business are more likely to gain higher productivity. In addition, the innovation is added as an independent variable based on finding that there is a potential linkage between innovation activities and productivity growth (Grazzi, 2012). Furthermore, the average wage as a proxy for the quality of human resource has been found to partly explain the change in productivity (e.g. Tsou, Liu, Hammitt, & Wang, 2008). Therefore, this index is also added in

the model. Finally, as discussed above, various characteristics of industrial sectors, locations of firms might impact differently on the relationship between export participation and productivity growth.

The role of export participation on productivity growth is often estimated by fixed effect estimation (e.g. International Study Group on Exports and Productivity, 2008), where the unobservable characteristics are treated as time-invariant factors of the error (Cameron & Trivedi, 2009). However, this approach cannot address 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). However, as indicated by Park, Yang, Shi, and Jiang (2010), matching can eliminate the selection-bias of observed characteristics, but it is unable capture unobservable factors. Other studies have addressed the endogeneity problem by using dynamic generalized method of moments system (GMM) with panel data (Bigsten & Gebreyesus, 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 is too short (two years for 2007 and 2009). Another common method of dealing with endogeneity involves the use of instrumental variables (IV) (Wooldridge, 2002), which has been recently used to consider the impact of export status on productivity growth (e.g. Park et al., 2010; Sun & Hong, 2011).

Fixed effect Instrumental variable estimation with panel data for the two years of 2007 and 2009 is conducted in this research. A set of potential IV that have an impact on export participation, but do not have a relationship with the error term from the output of equation are employed (the error terms in productivity growth, TP, technical efficiency, and SE equations). Ethnicity of owners is 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 than 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 resources, 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 the potential endogenous variable (export participation) is a binary variable, we do not apply any special considerations when estimating the impact of export on productivity growth by instrumental variable (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 is employed because of the benefits of being able to cope with measurement errors when the endogeneity 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 is drawn from a new micro dataset of non-state domestic small and medium enterprises 2005, 2007, and 2009. These data are produced

by the Institute of Labor Science and Social Affairs (ILSSA) in collaboration with Central Institute for Economic Management (CIEM) and Copenhagen University, Denmark.⁷

The inherent advantages of the dataset are as follows. Firstly, this is a uniquely rich dataset surveyed for 10 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 and checking the consistency of time-invariant variables among the three survey rounds, the database was created comprising 1664 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.⁸

4. Empirical results and discussion

This section presents the empirical findings from testing the self-selection hypothesis of firms, followed by the estimated regression results when considering the impact of export participation on productivity growth and its components.

4.1. Determinants of export participation

As reported in [Table 2](#), the role of productivity in determining export participation is found to be robust when measuring productivity using different methods. When considering the relationship between exporting and productivity, TFP-Levinsohn Petrin is a popular methodology due to benefits in controlling for potential endogeneity problem of input factors. In this research, total value added is used as the measure of output while input factors are made up of capital variable proxied by the value of machinery, equipment, buildings for production, and the labour variable measured by the total number of employees. The proxy variables are raw material and electricity costs that represent unobservable shocks. The *Levpet* programme in Stata written by Petrin, Poi, and Levinsohn (2004) with 250 time bootstrap replication is used to estimate productivity. As shown in column 1, [Table 2](#), productivity has a positive and statistically significant effect on export participation when both controlling for both observable and unobservable heterogeneity of firms.

Although labour productivity reflects one type of productivity, it is a conventional measurement used in previous studies, and is therefore used for comparative purposes. The estimated coefficient for labour productivity on export participation is positive and statistically significant, confirming that productivity has influence on entry into exporting. These results are displayed in column 3, [Table 2](#). Furthermore, if using productivity change calculated from the stochastic frontiers methodology as opposed to 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 increases the probability of export participation. These findings support the hypothesis that self-selection occurs for more productive firms with regards to export participation in Vietnam. However, when using a one-period lagged productivity variable, a statistically

Table 2. Random effects dynamic probit estimates.^a

Variables	(1)	(2)	(3)	(4)	(5)
Export _(t-1)	1.3143** (0.287)	1.3410** (0.284)	1.3160** (0.285)	1.3229** (0.283)	1.3231** (0.283)
Levin & Petrin TFP _(t)	0.0023** (0.001)				
Stochastic frontier TFP _{c (t)}		1.6207** (0.373)			
LP _(t)			0.0029* (0.001)		
TFP _(t-1)				-0.0000 (0.000)	
LP _(t-1)					-0.0001 (0.001)
Firm age _(t-1)	-0.0065 (0.006)	-0.0060 (0.006)	-0.0065 (0.006)	-0.0065 (0.006)	-0.0065 (0.006)
Firm size _(t-1)	0.0029* (0.001)	0.0035** (0.001)	0.0032* (0.001)	0.0033* (0.001)	0.0032* (0.001)
Capital intensity _(t-1)	0.0000 (0.000)	0.0000 (0.000)	-0.0000 (0.000)	0.0000 (0.000)	0.0001 (0.000)
Trade relationship _(t-1)	0.6175** (0.232)	0.6252** (0.232)	0.6156** (0.231)	0.6127** (0.230)	0.6130** (0.231)
Average wage _(t-1)	0.0016 (0.007)	-0.0025 (0.006)	0.0022 (0.006)	0.0032 (0.006)	0.0034 (0.006)
Credit constraint _(t-1)	0.1201 (0.149)	0.1301 (0.150)	0.1251 (0.148)	0.1227 (0.148)	0.1228 (0.148)
Innovation _(t-1)	0.2230 ⁺ (0.116)	0.2132 ⁺ (0.116)	0.2256 ⁺ (0.115)	0.2270* (0.114)	0.2270* (0.114)
Government support _(t-1)	-0.0293 (0.110)	-0.0584 (0.111)	-0.0286 (0.110)	-0.0342 (0.110)	-0.0344 (0.110)
Urban dummy	0.1401 (0.106)	0.1274 (0.106)	0.1480 (0.106)	0.1686 (0.105)	0.1688 (0.105)
Join-stock ownership	0.7885** (0.255)	0.6277* (0.259)	0.8103** (0.255)	0.8206** (0.254)	0.8207** (0.254)
Private ownership	0.5719** (0.126)	0.4981** (0.126)	0.5859** (0.125)	0.6012** (0.124)	0.6014** (0.124)
Partnership ownership	0.7136** (0.224)	0.6098** (0.226)	0.7203** (0.224)	0.7114** (0.223)	0.7111** (0.223)
Low tech	0.2079* (0.100)	0.1840 ⁺ (0.099)	0.2006* (0.100)	0.1831 ⁺ (0.098)	0.1827 ⁺ (0.098)
Year 2009	0.1404 (0.107)	0.2248* (0.109)	0.1433 (0.106)	0.1487 (0.106)	0.1487 (0.106)
Constant	-2.7691** (0.209)	-2.9928** (0.220)	-2.7742** (0.209)	-2.7356** (0.204)	-2.7347** (0.204)
Observations	4992	4992	4992	4992	4992

Notes: Robust standard errors in parentheses; (**), (*), and (†) indicate levels of significance at 1%, 5%, and 10% respectively. The estimated coefficients are reported. The base categories for ownership are household ownership, while reference group for low tech dummy is a combined group of medium and high tech sectors.

^aAs a robustness check, the above model is re-estimated using fixed effect estimations for the whole sample. In addition, firm exporting is much various among levels of technology (Ministry of Industry and Trade of Vietnam & United Nations Industrial Development Organisation, 2011). Hence, we also consider the role of export participation on productivity growth and its decompositions in sub-samples according technological level classification (See Vu, Lim, Holmes, & Doan, 2013) for Vietnamese Technological level classification). However, the similar results are created in all cases, and they are available on requests.

insignificant impact of productivity on export participation is observed in the columns 4 and 5, Table 2. 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 seems to be a long period for observing the presence of past productivity on decision of firms' current export participation. Our results suggest that the effects of productivity on export status are short run, and diminish after two years.

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 (Nguyen et al., 2008) and indicate that innovation is one of decisive factors in participating in exportation.

Going to the variable of firm characteristics, as can be seen from Table 2, regression results of the determinants of export participation reveal that sunk costs proxied by lagged export status is an important factor in determining export participation of firms. Similar findings are also found in some previous studies. For example, in a study of American manufacturing firms, Bernard and Jensen (2004b) indicate that having exports one or two years ago impacts positively and significantly on exporting today.

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 Cuong et al. (2010) who found that there is a higher entry barrier into the exporting market for household enterprises compared with their counterparts. Household enterprises are often characterized by informality and small scale operations (Cuong et al., 2010). Consequently such characteristics may become impediments for businesses wanting to participate into export markets.

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

Finally, the influence of government assistance on export participation is insignificant. This implies that the supporting role of government is not effective in boosting export activities. As documented by Tran, Grafton, and Kompas (2008), Vietnamese government aid does not seem to be based on firms' performance criteria. In addition, corruption and bribery remain prevalent and staff in public sectors lag behind in skills and qualifications (De Jong, Tu, & Van Ees, 2012; Rand & Tarp, 2012). Consequently, these factors may limit the benefits of government support.

4.2. Fixed effect instrumental variable estimates

Using invalid and weak IV needs to be avoided. 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 one of IV. The above specification test results of IV candidates suggested that ethnicity of owners and long-term relationship with foreign partners were good instruments. These results also support for validity of IV for cases of TP, changes in technical efficiency and SE.⁹

Theoretically, productivity decomposition may provide a new insight in testing learning effect. There are three main mechanisms that exporting may contribute to productivity growth. First, sales in both foreign and domestic markets can help firms gain higher revenue and promote production in larger scale. In other words, exports can help firm expand production scale and may gain economies of scale. In addition, as discussed by Fu (2005), participating into exporting market help firm can improve efficiency through learning by exporting process by gaining new knowledge and information. Exporting also promote resource reallocation from less efficient to more efficient enterprises. Finally, exports can improve technical progress because technology spillovers can be gained by contacting with foreign partners and competition by encouragement of innovation activities as well as research and development.

As displayed in Table 3, the results in the equation of TFP in columns (2) and (3) reveal that export participation has a statistically insignificant effect on productivity regardless of whether change in productivity calculated on the basis of Levishon–Petrin or Stochastic Frontier methodologies and even labour productivity. This does not appear to support for the hypothesis of learning effects by exporting of firms as revealed by De Loecker (2007, 2013) in Slovenia.

Moving to each component of TFP growth, the coefficient relating to the influence of export participation on SE is positive and statistically insignificant. In other words, there is not a considerable difference between exporters and non-exporters in SE 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.

These findings, however, 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 et al. (2010) could be that their results are based on using a national scale dataset in which informal enterprises had been excluded. However, the majority of SMEs in our regression sample are informal enterprises.

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

The statistically insignificant association between export status and productivity as well as its components may arise for a number of reasons. First, an export dummy may not adequately capture the learning by exporting process because a binary indicator for export makes no allowance of capturing for the degree of export participation. However, export intensity data for 2007 are not available and hence, this has prevented us from considering such an exercise for panel dataset.

Table 3. Fixed effect IV estimates (GMM estimation).^a

Variables	Stochastic frontier					
	LP (1)	Levinson–Petrin TFP _c (2)	TFP _c (3)	TP _c (4)	TE _c (5)	SE _c (6)
Export	0.1722 (0.173)	−0.0016 (0.216)	0.0141 (0.031)	0.0026 (0.006)	−0.0000 (0.000)	0.0113 (0.027)
Firm size	−0.0081** (0.002)	0.0034 (0.003)	0.0097** (0.001)	0.0013** (0.000)	−0.0000 (0.000)	0.0084** (0.001)
Firm size squared	0.0000* (0.000)	−0.0000 (0.000)	−0.0000** (0.000)	−0.0000** (0.000)	0.0000+ (0.000)	−0.0000** (0.000)
Firm age	−0.0016 (0.002)	−0.0021 (0.002)	0.0004 (0.000)	0.0001 (0.000)	0.0000 (0.000)	0.0004 (0.000)
Average wage	0.0887** (0.010)	0.0617** (0.011)	0.0016 (0.001)	0.0006* (0.000)	0.0000** (0.000)	0.0010 (0.001)
Innovation dummy	0.0233 (0.028)	0.0631* (0.029)	−0.0050 (0.006)	0.0001 (0.001)	−0.0000 (0.000)	−0.0052 (0.005)
Low tech sectors	0.0431 (0.062)	0.0203 (0.061)	−0.0115 (0.011)	−0.0009 (0.002)	−0.0001 (0.000)	−0.0105 (0.009)
Household ownership	0.0146 (0.078)	0.1004 (0.069)	0.0017 (0.014)	−0.0063* (0.003)	−0.0001 (0.000)	0.0081 (0.012)
Year 2009	−0.0201 (0.018)	−0.0896** (0.020)	−0.0414** (0.003)	−0.0294** (0.001)	−0.0014** (0.000)	−0.0104** (0.003)
Observations	3328	3328	3328	3328	3328	3328
Centred R-squared	0.194	0.080	0.322	0.588	0.871	0.280
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	Trade relationship and ethnicity of owner
Weak identification test (Cragg– Donald Wald <i>F</i> statistic) [Stock–Yogo weak id test critical value at 10%]	408.939 [19.93]	408.939 [19.93]	408.939 [19.93]	408.939 [19.93]	408.939 [19.93]	408.939 [19.93]
Hansen <i>J</i> statistic (overid test) [<i>p</i> -value in bracket]	0.701 [0.4023]	1.341 [0.2468]	2.445 [0.117]	0.000 [0.985]	0.167 [0.682]	3.029 [0.082]

Notes: Robust clustered standard errors in parentheses; **significance at 1%, * significance at 5%, + significance at 10%. The models also account for sector differences.

^aOne may worry that minority ethnicity can affect productivity through other network related effects that do not have to do with exports per se. We conduct just-identified specification with using only ‘minority ethnicity as an IV, we find that this is a weak IV.

In addition, learning effects by exporting may depend on the market destination of exports and whether they are developed countries or developing countries (Brambilla, Lederman, & Porto, 2012). However, this unavailability of dataset limits us to investigate further for this channel.

Moreover, learning by exporting may take time but a short period panel dataset (2 years for 2007 and 2009) has prevented us from considering various scenarios such as export patterns (new entrants, exporters for only 2 years, exporters with 4 years' experience and more) in testing the learning by exporting hypothesis.

Finally, the majority of Vietnamese exporting products are labour-intensive with 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 (Rand, 2007). 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 applying new technologies. Another reason is that the advantage of competition of Vietnamese exporting products relies on cheap unskilled labour and low-price competitiveness that requires the low skill and low technology. Hence, this also may have discouraged SMEs for innovation and improvement in technology. 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, efficiency and TP.

5. Summary of findings

In order to find the sources of higher productivity among exporters compared with non-exporters, this paper has undertaken the testing of two hypotheses (self-selection and learning by exporting) in Vietnamese manufacturing SMEs. Our empirical results are consistent with econometric evidence from other countries (e.g. International Study Group on Exports and Productivity, 2008). This evidence indicates that the higher productivity of exporters in the Vietnamese SME context derives from the self-selection of high productivity firms who participate in exporting rather than from the learning by exporting process.

Several other interesting results are also found in testing the self-selection hypothesis. For example, while firm age has a statistically insignificant and negligible impact on export probability, the more labour enterprises have available to them, the higher is the probability of enterprises participating in the export market. Another important determinant of the likelihood that private firms will export is innovation capability. This suggests that supporting activities for improvement in innovation are important for helping firms increase the probability of exporting. Moreover, while firms receive few benefits from government support, a long-term relationship with foreign partners plays an important role in boosting the export activities of firms, suggesting that improving and maintaining links with foreign partners are necessary for increasing the probability of firms' participating in exporting activity.

Regarding the role of export participation on productivity growth, this study adopts the stochastic frontier approach to extend the literature by decomposing TFP growth into technical progress change, technical efficiency change, and SE. The empirical results

reveal that statistically, the export status of firms shows an insignificant association with TFP growth, scale change, technical efficiency, and technical progress.

With policy implications in mind, the above results show that productivity is one of the main entry barriers for export participation by SMEs and export participation does not improve productivity or its decomposition. As discussed previously, only 3–6% of non-state private manufacturing SMEs participate in exporting even though Vietnam has a variety of trade promotion policies. These findings might imply that export promotion policies may not be effective unless accompanied by strategies to help SMEs become more productive.

Notes

1. In 1998, Vietnam dismantled the export license regime and in 2000 introduced an Enterprise Law that admitted the private sector as a source of economic growth.
2. The likelihood ratio (LR) is used to test the appropriate functional form specification. This index (LR) is calculated as the difference in the log-likelihood value between restricted and unrestricted functions. This result in Appendix 1 shows that the Translog model is preferable to Cobb–Douglas.
3. This study also conducts a hypothesis test to check if technical inefficiency is absent. The results in Appendix 1 confirm that inefficiency is found in the whole sample.
4. In order to estimate model (7), a ‘redpace’ programme written in Stata by Stewart (2006) was used.
5. This study used only one-period lagged firm characteristics variables because of the short period of time covered by panel data.
6. The direct information of import status is not available. The caveat of data prevents us from considering this variable in the regression.
7. The data have been shared kindly by Professor John Rand.
8. Our data on current variables are deflated using 1994 prices for the GDP deflator to avoid biases that might arise because of inflation. The statistical description of variables in the model is displayed in Appendix 3.
9. As a robustness check, the above specification is re-estimated by Random Probit model. However, qualitatively similar results are yielded in all cases. The results are available on requests.

The survey data represent a 2-year panel dataset. This prevents us from considering the impact of 1-year lagged variables on the current status of exporting.

Acknowledgments

The authors thank two anonymous reviewers and the editor of *Baltic Journal of Economics* for helpful comments which have considerably improved the original manuscript.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributor

Huong Van Vu is a lecturer at Academy of Finance, Vietnam and a Research Associate at University of Waikato, New Zealand. His recent papers have been published in *Journal of Business Ethics*, *Applied Economics Letters* and *Post-communist economies*.

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Appendix 1. Hypothesis testing

Null hypothesis	Log-likelihood	Test statistics (λ)	Critical value ^a		Decision
			1%	5%	
I. Cobb–Douglas $H_0: \beta_{ll} = \beta_{lk} = \beta_{kk} = \beta_{lt} = \beta_{lt} = \beta_{kt} = 0$	–5144.43	83.46	16.81	12.59	Reject H_0
II. No stochastic inefficiency $H_0: \gamma = 0$	–5112.5	432.527	10.51	7.045	Reject H_0

Note: The hypothesis (I) assumes that SMEs follow a Cobb–Douglas production function. Thus, the hypothesis is tested by using the likelihood-ratio test statistic (λ) that is defined as $\lambda = -2 [L(H_0) - L(H_1)]$. The value of the λ statistic in the first row greatly exceeds critical value. This indicates that the Translog function is the appropriate choice for our data. The value of the test hypothesis is reported automatically as ‘LR test of the one-sided error’ in Frontier 4.1 and is used to test the hypothesis (II). The result shows that using OLS or average production function estimation will underestimate the actual frontier because of the existence of technical inefficiency.

^aCritical values for these tests are taken from Table 1 of Kodde and Palm (1986).

Appendix 2. Definition and measurement of variables in the model

Variables	Definitions	Obs	Mean	SD
Exporter	1 if firm has export activities; 0 otherwise	4992	0.052	0.223
Levin & Petrin TFP	TFP predicted from Levinsohn–Petrin methodology	4992	18.71	91.23
Stochastic frontier TFPc	TFP change calculated from stochastic frontier methodology	3328	0.156	0.118
Tec	Technical efficiency change predicted from SEPF	3328	–0.025	0.009
TPc	Technical change predicted from SPPF	3328	0.160	0.053
Sec	SE change predicted from SEPF	3328	0.021	0.09

(Continued)

Continued.

Variables	Definitions	Obs	Mean	SD
LP	Labour productivity calculated by value added per total employees	4992	12.78	55.79
Firm size	Total employment	4992	15.73	27.7
Capital intensity	The ratio of capital over total employment	4992	59.68	131.94
Firm age	The number of years since established	4992	14.0	10.7
Trade link	1 if firms have a long-term relationship with foreign partners, 0 otherwise	3328	0.03	0.171
Average real wage	Ratio of total wage to total employees	4992	3.89	5.07
Innovation	1 if firms introduced new products, had major improvements in existing products, or introduced new production processes or technology, 0 otherwise	4992	0.54	0.498
Credit constraint	1 if firms applied for a loan but failed to obtain the loan, 0 otherwise	4992	0.078	0.26
Government support	1 if a firm receives investment incentives or loans, a human resource training programme, national key trade programme, quality and technology improvement programme, or other type of government assistance, 0 otherwise	3328	0.282	0.45
Private ownership	1 if firms have private or limited liability ownerships, 0 otherwise	4992	0.233	0.423
Partnership ownership	1 if firms have partnership or cooperative ownerships, 0 otherwise	4992	0.03	0.171
Join-stock ownership	1 if firms have joint-stock ownerships, 0 otherwise	4992	0.015	0.124
Urban dummy	1 if firm located in Hanoi, Haiphong or Ho Chi Minh, 0 otherwise	4992	0.384	0.486
Ethnicity of owners	1 if owners belong to minority ethnic group, 0 otherwise	3328	0.071	0.256