Does exporting spur firm productivity and promote inclusive growth? Evidence from Vietnam

Pham, Thi Thu Tra*

Hoang, Thi Anh Ngoc[+], Pham, Hong Hoa [++] and Ngo, My Tran[#]

* RMIT International University Vietnam

+, ++: International University (Vietnam National University of Ho Chi Minh City);

#: Can Tho University

*Corresponding author: Email: tra.pham@rmit.edu.vn; ptttra@gmail.com

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Abstract

This study uses data of Vietnamese manufacturing firms from the World Bank Enterprise Surveys for the period 2002 – 2008 to examine the causality between export participation and firm productivity. The analysis focuses on the three hypotheses related to the relationship between exporting and firm productivity that have received attention in the literature, namely the self-selection, learning by exporting and core competence hypotheses. In this case study, evidence is found in support each of these hypotheses, which often are portrayed as competing with each other but are in fact complementary. It is found that comparative advantage, which in the case of Vietnam, a labor-abundant, low-wage country, is in labor-intensive products, is central to understanding each of the three hypotheses. The firms' whose productivity was relatively high ex ante and accordingly self-select to export are firms that produce in line with Vietnam's comparative advantage (i.e. firms that are relatively labor intensive). Firms that experienced a relatively large increase in export intensity are found to have experienced higher total factor productivity, supporting the learning by exporting hypothesis, and a relatively large increase in labor intensity, supporting the core competence hypothesis and the central role of comparative advantage. Entry of Vietnamese firms into the world market can therefore spur economic growth, especially inclusive economic growth of the country. On the basis of our findings at both sectoral and firm level data, policy options for promoting inclusive growth through a greater focus on labour-intensive manufacturing are warranted.

JEL Classification Codes: F14, F43, D24, L60

Keywords: exporting; productivity; self-selection; learning-by-exporting; core competence; Vietnam

1. Introduction

It is a well-established fact for many countries that exporting firms perform better (are more profitable and have higher levels of productivity) than firms that only serve the domestic market. What explains the superior performance of exporting firms is, however, a matter of debate in the literature. Several hypotheses have been offered to explain the superior performance of exporting firms, but no consensus has been reached in the literature as to the relative explanatory powerof each hypothesis, which is a matter of some importance since each hypothesis has different policy implications. This study aims to contribute to this unresolved issue with a case study of whether, and if so how, exporting spurs productivity in Vietnam, one of the more dynamic emerging market countries in the world.

In early 1990s Vietnam launched an export-oriented industrialization (EOI *hereafter*) strategy. The export-GDP ratio of Vietnam thereafter reached as high as 76% of GDP in 2011. Exports have long been considered as one of the main drivers of Vietnam's relatively high rates of economic growth and employment generation, especially in the period 1995 – 2008. From a macroeconomic perspective, EOI promotes rapid economic growth by allowing specialization in the production of goods in which a country has a comparative advantage and in so doing generates a higher level of income than would otherwise obtain. With a higher income, countries can save and invest more and grow faster. In addition, EOI increases the capacity of a country to raise productivity by importing capital goods that embody new and better technology and induces efficiency by forcing domestic producers to compete at the international level.

The pursuit of EOI strategy with a focus on labour-intensive manufactured exports is especially relevant from the perspective of inclusive growth. As highlighted in the IRDC research agenda, growth must be inclusive if it is to be sustainable in the long run. One of the principal advantages of EOI is that it is inclusive—it is capable, as no other strategy is, of absorbing un- and under-employed labour into more productive, higher income employment and thereby achieves not only higher growth than would otherwise be possible but also achieves a more equitable income distribution and poverty reduction. In the case of Vietnam, statistics in 2011 (*annex 1*) show that half the labour force (25 million) is employed in agriculture, where the productivity (measured as GDP per worker) is about $1,000, one-fourth the productivity in industry ($4,000). The solution to low productivity in agriculture, under current circumstances, is to attract workers out of agriculture and into labour-intensive manufacturing branches in which Vietnam has a strong comparative advantage in world markets. As the data show (*annex 2*), Vietnam's major manufactured exports, which account for about 40 percent of total manufactured exports in 2010 and 27 percent of total Vietnam's exports, are dominated by the three leading labor-intensive goods (footwear, apparel and furniture). These three branches represent the highest revealed comparative advantage for Vietnam--the share of these goods in Vietnam's exports is 8 times higher than their shares in world trade. The ability to generate productive employment by these leading manufactured export industries is illustrated in *annex 3*, which show that given one unit of capital invested, labor-intensive export branches such as clothing and footwear, furniture and wood processing provide more than twice as much as value-added and about 5 times more employment than the import competing sectors. The illustration above gives rise to an argument that the successfully implemented EOI strategy would allow Vietnam to generate not only faster growth but also a greater pace of poverty reduction.

From a microeconomic perspective, a strong economic logic of the EOI can also be justified at the firm level as the leading microeconomic explanations for the superior performance of open economies point to the superior performance of exporting firms vis-à-vis firms producing exclusively for the domestic market. But, why do exporting firms perform better--exhibit higher productivity and hence are presumably more profitable—than firms that serve only the domestic market? Two hypotheses that have been the focus of most of the empirical work and are often incorrectly portrayed as competing rather than complementary hypotheses, the self-selection hypothesis and the learning by exporting hypothesis. The self-selection hypothesis argues that because of entry costs to exporting, only the most profitable (i.e. efficient or productive) firms in an industry are able to enter and succeed in export markets. Essentially this hypothesis argues that causation runs from firm productivity to the decision to enter the export market. The learning by exporting hypothesis, on the other hand, argues that the activity of exporting itself makes firms more productive, which suggest that the causation run from exporting to firm productivity. Of course, there is no reason to presume that causation cannot run in both directions, and indeed in testing these hypotheses one must adopt an empirical strategy that does not preclude two-way causation.

In addition to the self-selection and learning by exporting hypotheses, which theretofore have been the focus of empirical work on the relation between firm productivity and exporting, a third hypothesis has only recently been introduced. The basic idea is that the relatively high intensity of competition in export markets forces exporting forms to shed products and activities that are not in line with their core competence. In the context of a labor-abundant, low-wage economy like China, for example, the "core competence hypothesis" suggests that competitive pressures will force firms to produce and export ever more labor-intensive products, which in fact is just what exporting firms in China have done according to a recent study (Ma, Tang and Zhang, 2011). The core competence hypothesis, which is grounded in the theory of comparative advantage, should also be seen as a complementary rather than competitive hypothesis to the two more established hypotheses.

This study considers all three of these potentially complementary hypotheses, none of which has established a pre-eminence in explaining the relationship between exporting and firm performance. Here the relative explanatory power of these hypotheses is examined in the case of Vietnam, which like other countries, as we show, exhibits the by now well-established fact of export-firm superiority.

While the main focus of this paper is on the empirical validity of the three hypotheses, it is worthwhile to note the similarities and differences in the policy implications of these hypotheses. The self-selection hypothesis rests on the premise that there are significant entry costs to exporting, which is why only the more productive firms self-select. An obvious policy implication stemming from this hypothesis would be for policy makers to find ways to lower the entry cost of exporting so as encourage a larger number and a greater variety of firms in exporting. The learning by exporting hypothesis rests on the premise that exporting per se improves firm efficiency, which could possibly justify measures to encourage (if not subsidize) firm entry into exporting. The policy relevance of the core competency hypothesis derives from its close relationship to the principle of comparative advantage and the gains that derive from international competition, which recommend no so much introducing policies that promoting exporting as eliminating policies that discourage it.

The remainder of this paper proceeds as follows: Section 2 provides a brief review of the related literature, both theoretical and empirical. Section 3 presents a sector-level analysis of exporting and its respective role toward employment generating impact. The aim of this section is to provide an empirical background to the study. Section 4 discusses the sample data, followed by a descriptive analysis of the export participation vis-à-vis firm characteristics from the sample. Section 5 compares exporters vs. non-exporters as a first step in examining the relationship between exporting and firm productivity. Section 6 presents an empirical analysis of testing whether more productive firms choose to export. Section 7 examines the reverse causality whereby export participation may contribute to improving firms' productivity and to induce firms to focus on the core competence of their production. Finally, section 8 offers a summary of the key findings and discusses some policy implications on inclusive growth of the study.

2. Exporting and firm productivity: a brief review of the literature

The linkage between exporting and firm productivity is nested under the extensive literature on trade and growth. This framework provides three explanations for the superiority of exporting firms. First, the *self-selection* hypothesis, based on the heterogeneous firm theory, argues that only more productive firms self-select into exporting (Clerides, Lach, and Tybout, 1998; Bernard et. al 2003, Melitz, 2003). Reasons for self-selection include the presence of sunk entry costs which prevent less productive firms from entering foreign markets. If firms with higher productivity go into exporting and firms with lower productivity do not, then it follows it is the reallocation of activity across firms raises the average level of productivity of an industry.

The *learning-by-exporting* hypothesis suggests that exporting firms become more efficient and profitable via the knowledge and expertise they gain from participating in world market (Van Biesebroeck, 2005; De Loecker, 2007). Competitive pressures in the world market mayalso induce firms to become more efficient than those serving a protected domestic market. The learning by exporting hypothesis is rooted in endogenous growth theory (Grossman and Helpman 1991, Rivera-Batiz and Romer 1991), which points to the role of technology diffusion through exposure to exporting in driving firm productivity. In addition, it is likely that exporting firms can achieve economies of scale and thereby raise productivity, as suggested by the conventional export-led growth perspective (Dixon and Thirlwall 1975).

The *core competence* hypothesis, grounded in the logic of comparative advantage principle, emphasizes that exporting firms optimize by specializing in their core competence (Feenstra and Ma, 2008; Nocke and Yeaple, 2008; Carsten and Neary, 2010, Ma, Tang and Zhang, 2011). In other words, competition in in the world market induces firms to concentrate on what they do best, while in a protected market with government support firms are more likely to diversify out of core business. According to this theory, the reallocation of activity within-firm, and not across-firm, as reflected by concentration and specialization after exporting, raises productivity.

A large number of empirical studies have attempted to test empirically the self-selection and learning by exporting hypotheses, though they differ substantially with respect to empirical methodology and measurement of firm productivity. The self-selection argument has received a mixed empirical support. Some have found evidence of self-selection (Arnold and Hussinger, 2004 for Germany; Clerides et al., 1998 for Columbia and Morocco; Alvarez and Lopez, 2005 for Chile; and Delgado et al., 2002 for Spain), while other studies have found no significant effect regarding the causality from firm productivity to the decision to export(Bernard and Jensen, 2004 for the U.S.; Aw et al., 2000 for Korea; and Bigsten et al., 2004 for sub-Saharan Africa).

Similarly, a mixed picture also emerges regarding empirical findings of the learning by exporting hypothesis. Studies that offer evidence of a significant post-productivity gain associated with exporting include, Girma et al. (2004) and Greenaway and Kneller (2008) for the UK; Baldwin and Gu (2003, 2004) for Canada; Castellani (2002) for Italy; De Loecker (2007) for Slovenia; Van Biesebroek (2005) and Bigsten et al (2004) for sub-Saharan Africa, Aw et al. (2000) for Taiwan, Kraay (2002) and Park et al. (2010) for China. On the other hand, a number of studies find no evidence of the learning by exporting effect, even for major exporting countries (Bernard and Jensen (1999) and Hung et al. (2004) for the US, Wagner (2002), and Arnold and Hussinger (2004) for Germany.

The mixed evidence observed across countries and time may simply reflect diverse patterns of firm export behavior conditional not only on firm-specific characteristics but also on many other underlying forces that are associated with the macroeconomic environment and the degree of competition and entry costs in the export markets that firms are likely to face.

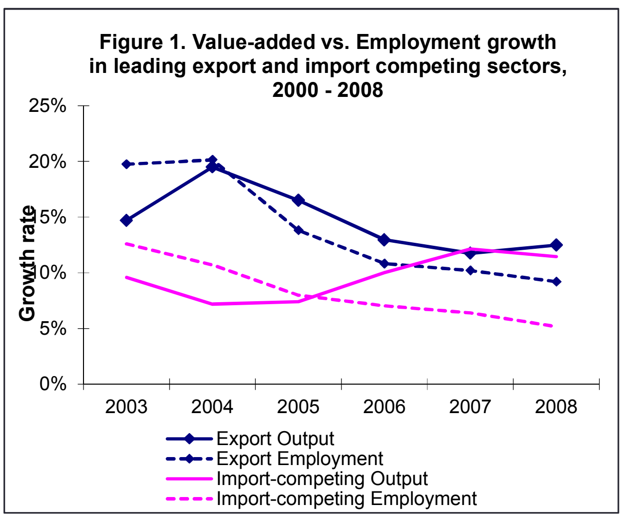
For the case of Vietnam, evidence on the superiority of exporting firms remains modest even though it is a common belief that the EOI strategy has been an engine for rapid economic growth in this country. Nguyen et al. (2007) evaluate the role of innovation on the likelihood of exporting, using a sample of Vietnamese SME in 2005 and find that innovation stimulates exporting within the sample firms. Nguyen (2008) studies spillover effects of foreign direct investment on export behaviours of domestic firms and concludes that export oriented foreign firms are the unique source of export spillovers in Vietnam. Whereas these findings are certainly interesting, they do not take into account the complex nature of the relationship between exporting and firm productivity. As a first effort, Hiep and Ohta (2009) examine the causal relationship between export activities and firm productivity using firm data from the World Bank Enterprise Survey 2005. They find no evidence which suggests that exporters are more productive from the outset, as predicted by the self-selection hypothesis. On the contrary, their empirical findings attribute the exceptional exporter performance to the learning by exporting effect, as reflected by higher growth of TFP and revenue of exporting firms. In their study, the causal effect of exporting is identified within the framework of propensity score matching in combination with difference-in-differences analysis and therefore considers only the within-sector effect rather than within-firm effect of exporting. A recent study by Huong et al. (2012) also examines the causality of exporting and firm productivity using a different sample retrieved from a survey of Vietnamese SME firms.In contrast to Hiep and Ohta (2009), their measure of TFP growth distinguishes between technical progress change, technical efficiency change and scale efficiency but finds no evidence in support of better firms self-selecting into export markets. As with the reverse causality, they derive an estimate of within-firm effects of exporting on firm productivity, using the fixed-effects estimator with instrument variables. They use the ethnicity of the firm owner and trade relationship as instruments for the firm's export decision, and find no evidence of within-firm effects of exporting on firm productivity, which provides little support to the learning by exporting hypothesis.

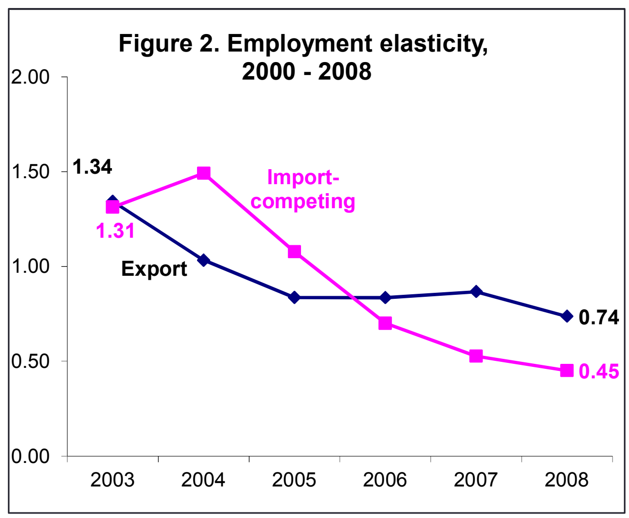
In the present study, we extend the analysis of the superior productivity of exporting firms using survey data of Vietnamese manufacturing firms in the period 2004 – 2008. Our study differs from the existing studies for Vietnam in several ways. First, we rely on the same source of data as used in Hiep and Ohta (2009), but expanded to include the most recent year available from the Enterprise Survey conducted in 2009. Second, regarding the question of causality between from exporting to productivity, we study both the within-sector and within-firm effects of exporting on firm productivity, employing the matching techniques for the former and fixed-effects with instrument variable method for the latter. We also select different instruments for export decisions of firms in the latter approach. Finally, we go beyond existing literature on Vietnam to examine the core competence hypothesis, which allows us to identify the possible channels through which within-firm effect of exporting on firm productivity can occur.

3. Export participation and employment creation effect: A sectoral analysis

In this section, we assess the employment creation effect of exporting at the macro level in an attempt to provide a background for the firm-level analysis of the relationship between exporting - firm productivity, which will be addressed in the subsequent sections. It is well acknowledged that exports offer great opportunities for employment creation in labour-abundant developing countries and that the employment effect is especially strong in labour-intensive manufacturing sectors. According to a recent study by Riedel and Pham (2011) using the GSO industrial census data, the country's three leading export sectors accounted for less than 20 percent of manufacturing value-added and capital stock, but almost 45 percent of manufacturing employment in 2008. In addition, the average annual share of long-term fixed in investment in manufacturing declined from 35 percent for the period 2000-2005 to 24 percent for the period 2006 to 2008. Likewise, the average annual growth rate of employment in manufacturing has declined from 8.2 percent for the period 2000-2005 to 6.3 percent for 2006-2008, a twenty-five percentage point reduction.

It is therefore important to explore how the employment creation effect of exportinghas evolved over time for the case of Vietnam and what are the resulting implications. For this purpose, we also use the GSO industrial census data to calculate the growth rate of employment and value added to estimate the employment elasticity for 20 manufacturing sectors over the period 2000 - 2008. From trade data we are aware of the fact that the leading export-oriented sectors include apparel, footwear and furniture and the import competing sector to cover textiles, chemicals, machines, minerals and motor vehicles.





Figures 1 and 2 illustrate the relation between changes in the structure of output (value-added) and employment in export and import-competing sectors as defined. According to figure 1, the growth rate of value-added and employment has been falling in export-oriented sectors while rising (and in the case of employment falling less rapidly) in import-competing sectors. Figure 2 suggests that the employment generating impact of growth (employment elasticity as it is known) in both export-oriented and import-competing sectors has been diminishing, though much more rapidly in import-competing than in export-oriented sectors. This simply means that labour productivity has been growing in both sectors, but much more rapidly in import-competing sectors.These signs warn that the export-oriented industrialization strategy seems to have gotten off track in recent years (Riedel and Pham, 2011). One hypothesis suggests that the possible decline in the employment creation effect of the export-oriented sectors simply reflects that the labour-intensive EOI strategy has run its course, as widely cited in policy debates in Vietnam. An alternative interpretation is that the country's resources have been diverted away from the EOI strategy and accordingly the role of labour-intensive exports as a driver of inclusive growth was weakened.

In sum, the above analysis provides some indications of the employment creation effect of exporting at the sectoral level. From the next sections, we examine the role of exporting in its relationship with productivity outcomes at the firm level, using sample data of Vietnamese manufacturing firms. We hope, with this firm-level analysis, to gain a better understanding of the microeconomic explanations of the role of exports in Vietnam's economy.

4. Data

4.1 Sample data

This study uses two rounds of firm-level data from the World Bank Enterprise Surveys (ES *hereafter*) for Vietnam. The surveys were conducted following the stratified random sampling approach with three levels of stratification, namely industry, establishment size, and region. The first survey covers information in the year 2004 for 1150 manufacturing firms (ES2004); while the second survey reports data in the year 2008 for 775 manufacturing firms (ES2008). The ESs provide firm-level information on a wide range of indicators of firm characteristics and performance, including age, labour, capital, assets, revenues, wage, main lines of business, export activities and access to finance. Information on exports includes export participation, export turnover (both direct and indirect), years engaged in exporting and the reliance on imported intermediate inputs for exports. Firms are classified in 16 industries in accordance with the ISIC at 2 digit level of aggregation. For the ES 2008, unfortunately the number of industries surveyed is only limited to 8 industries. In the ES2004, several questions were asked on the retrospective basis, which allows us to construct a panel of data of some main variables such as revenues, capital, employment, export participation for the years 2002, 2003, and 2004. Unfortunately, this feature is not available for the ES2008. Importantly, it is possible to link the ESs 2004 and 2008 as a panel of 333 manufacturing firms, using the firm identification code provided by the dataset. Within this panel, however, some firms that have the same identification code appear to differ according to other time-invariant characteristics such as age, first year of exporting, industry etc. This raises some concerns about the reliability of the mentioned panel and hence we should use this panel with caution. In short, we have a three-year panel 2002, 2003, 2004 of 1150 firms with extensive information on firm characteristics and a less reliable four-year panel 2002, 2003, 2004 and 2008 of 333 firms with limited information on firm characteristics.

4.2. Firm characteristics and export participation: a descriptive analysis

Table 1 presents a descriptive analysis of export participation by the sample firms, classified into 13 different manufacturing branches in three selected years, namely 2003, 2004 and 2008. Given our research objectives, we use the available information for the export share in total firm revenues to construct a number of measures of export participation. The first measure is a dichotomous dummy variable, indentified as *exporter* (or *export status,* interchangeably), which is defined on the basis of the export share of the firm's revenue. Two cut-off values of export share of the firm's revenue of the firm's revenue, 10 and 50 percent, are used. In other words, a firm is classified as *exporter* if it exports a share of greater than 10 (or alternatively 50) percent of its revenues. Although this measure and its associated cut-off values are arbitrary, they have been widely used in empirical studies on exporting (see for example Hiep and Ohta, 2009). To complement this imperfect measure of export participation, we rely on the use of the second continuous measure identified as *export intensity*, which denotes the firm's export share as percentage of revenue in each year. Since information for export share is not available for the year 2002, we define the export status of firms in this particular year as firms reported to have engaged in exporting business prior to 2002.

Amongst the sample firms, there are exporting firms in all surveyed industries. On average one-third of the sample firms is engaged in export activities over years, although the proportion of exporters varies substantially across industries. In the leading export-oriented labour-intensive industries, notably textiles, apparel, leather products and furniture, about 50 to *75* per cent of firms are exporters. The proportion of exporters is substantially lower in other less export-oriented industries, such as chemical and chemical products, plastic products and metal products, generally less than 20 percent of firms. In addition, exporting firms in the leading export-oriented industries appear to export more intensively; with 50 up to 90 of their revenues earned from exporting. In less export-oriented industries, export intensity is of course lower. Over the time span 2003 – 2004, the numbers of exporters in the leading export industries did not change, nor did the average share of export. Firms operating in the less export-oriented industries, on the other hand, have become somewhat more export-intensive, the average share of export revenue rising slightly from 30 to 42 per cent for machinery and electronics between 2003 and 2008.

Table 1. Distribution of exporters and share of export as percentage of revenue

	2003			2004			2008		
Sector	No. of firms	Percent of exporters (%)	Export share of revenue (%)	No. of firms	Percent of exporters (%)	Export share of revenue (%)	No. of firms	Percent of exporters (%)	Export share of revenue (%)
Food & Beverage	178	43	68	191	44	64	119	34	61
Textiles	75	56	72	77	66	73	100	35	59
Apparel	74	74	87	77	75	89	122	54	88
Leather products	24	79	86	25	80	86			
Wood & wood prod, incl. furniture	130	45	72	145	43	73			
Paper	60	12	54	62	15	60			
Chemical & Chemical products	64	16	25	67	16	23	18	6	6
Rubber & plastic products, non-metallic mineral products	68	22	41	71	28	40	145	22	43
Basic metals & metal products	104	12	37	119	13	46	121	18	44
Machinery & equipment, electrical machines & Electronics	78	24	30	90	23	34	48	35	42
Construction materials	86	20	47	95	17	43			
Vehicles and other transport equipment	27	15	40	29	24	34			
Other manufacturing	87	22	66	94	19	67	101	27	60
Total	**1,055**	**34**	**64**	**1,142**	**34**	**63**	**774**	**31**	**60**

Notes: (1) Across the years exporters defined as firms with the export share greater than 10%

(2) Across the years export share refers to the export share of exporting firms only.

In addition to export participation and export intensity, our analysis concerns with the change in these variables over time. Table 2 below provides a broad overview of the dynamics of exporting by manufacturing firms in Vietnam.

Over the period of study, the export status of firms appears to be rather stable, with about one-third of the sample firms engaged in export business across the years. Once firms begin to export, very few firms cease exporting. Among 351 firms that exported in 2003, only 9 ceased exporting in 2004, or approximately 2.5 percent, which implies that there were 342 firms exporting in 2003 and 2004. For the 2004-2008 period, the proportion of firms that ceased exporting increased to 25 percent. Of the 129 firms exporting in 2004, 32 had ceased exporting in 2008,Likewise,the proportion of new exporters is also modest. As the number of exporters in 2004 is 370, which is comprised of 342 firms exporting in both years 2003 and 2004, and 28 firms newly exporting in 2004, the percentage of new exporters for 2004 is 7.5percent. Similarly, as the number of exporters in 2008 is 124, of which 97 firms exported in both years 2004 and 2008, and 27 newly exported in 2008, the percentage of new exporters for 2008 is 22 percent. Not surprisingly, the proportion of switching in the export status intensifies over the later period 2004 – 2008 due to a longer time span. This period also witnessed a number of remarkable changes in Vietnam's macroeconomy with its accession to WTO and a significant increase in FDI flows, which would result in more exporters. Overall, the export profile of the period 2003 – 2004 includes 379 firms that engaged in exporting in either year, of which 342 firms (approximately 90 percent) participated in both years. The export profile of the period 2004 – 2008 includes 156 firms that engaged in exporting in either year, though only 97 firms (approximately 62 percent) participated in both years.

The lack of change in export status as observed could be attributed to a number of possible reasons. First, it is perhaps due a short time span of the studied period. Second, it may well be that entry barriers, so-called entry costs, to export are especially high especially for firms in emerging markets. Once established, having invested in entry, exporting firms are likely to be reticent to exit from the world market as is implied by the heterogeneous firm models (Melitz, 2003). On the other hand, the change in export intensity is slightly more evident than that of export participation. Amongst the exporter group some 20 per cent and 32 per cent of the firms have increased their export intensity between 2004 and 2003; and between 2008 and 2004 respectively. The weakness of the dynamics in export participation makes it difficult to estimate the causal impact of exporting, as will be explained and analyzed in section 7.

Table 2 - Changes in export status and export intensity

	2003 - 2004	**2004 - 2008**
Exporter in both years (Export share greater than 10%)	342	97
of which, number of exporters increase their export intensity	72	31
Switching from exporter to non-exporter between two years	9	32
Switching from non-exporter to exporter between two years	28	27
Non-exporters in both years	669	177
Total	**1048***	**333**

*Note: *the number of firms linked as panel between 2004 and 2003 is 1142, of which 94 firms have unknown export status in 2003 due to data unavailability. Therefore, the number of firms included in the analysis of changes in the export status is reduced to 1048 firms.*

5. Export premium: Do exporters outperform non-exporters in Vietnam?

The first step in discerning the causality between exporting and firm performance is to compare exporters to non-exporters along different firm characteristics: Total factor productivity (TFP *hereafter*), labour productivity, capital productivity, capital intensity, revenues, value added, size, employment, average wage rate using the cross-section sample of the two surveys. This analysis, as commonly done in the literature (Ma, Tang and Zhang, 2011;Mukim, 2011;Hiep and Ohta, 2009), aims to derive export premium along the basic patterns of firm characteristics and firm productivity. Export premium is defined as the percentage difference in the mean level of firm characteristics, controlling for differences associated with other firm characteristics, time, sector, ownership and the location of firms. Export premium measures are used to distinguish whether exporting firms are more labour intensive and have higher capital productivity than their non-exporting counterparts. We derive export premium by first regressing each of the relevantfirm characteristics and firm productivity indicators on export status (E_i), controlling for time, industry, ownership and location.

$$\ln Z_i = \beta E_i + \alpha_0 + F_{\sec tor} + F_{year} + F_{location} + F_{ownership} + \varepsilon_i \qquad (1)$$

where Z_i is firm *i*'s characteristics or productivity indicators (such as total factor productivity, labor productivity and capital productivity) and E_i is a dichotomous variable indicating whether the firm has an export share of either 10 or 50 percent of the total revenues. F_{sector}, $F_{location}$, F_{year} and $F_{ownership}$ indicate industry, region, time and ownership fixed effects, respectively. The coefficient β will capture the premium of export conditional on other fixed effects. Accordingly, the percentage of export premium is derived as $(e^{\beta}- 1) \times 100$ for each firm characteristic.

An estimation of total factor productivity (TFP) is done using the Levisohn and Petrin (2003) approach, whereby intermediate inputs are used as a proxy for unobservable productivity shocks, using the procedure ***levpet*** developed by Petrin et al. (2004) for Stata®. As the Levisohn and Petrin (2003) procedure requires panel data, we can estimate the Levisohn and Petrin TFP only for the years 2002 -2004 and have to resort to the standard approach OLS to derive the TFP for the remaining year 2008[1].

[1]The standard approach OLS of estimating TFP refers to estimating the residuals of a Cobb-Douglas production function. In order to estimate TFP one must assume or estimate the weights used to measure total factor input (a weighted average of labor and capital inputs), but the conventional methods are likely to be inappropriate in an surplus labor economy where the social marginal product of labor is close to zero or at least far below the market wage.

Table 3 below reports the export premium of the sample firms measured in percentages, differentiated into across- and within-sector premium panels for the period 2002 – 2004 and the year 2008 alone. The across sector export premium is estimated on the basis of comparing firms between sectors, whereas the estimate of within-sector premium controls for the sectoral fixed effects and thus exclusively compares exporter vs. non-exporter within the same sector. Columns (1) and (5) present the export premium associated with the export status of 10 percent or higher of total revenues; whereas columns (2)and (6) refer to the export premium associated with the export status of 50 percent of total revenues.

For the period 2002-2004,the results of both across- and within-sector export premium indicate that exporters considerably outperform non-exporters in many ways, regardless of which dichotomous measure of export status is used. In this period, exporting firms are larger in terms of size (defined as logarithm of total assets) and capital than their non-exporters. Exporters also have higher revenues, generate higher value added and employ more people. Regarding performance, exporters on average are more productive in terms of TFP than their counterparts. Interestingly, when considered across sectors, exporting firms have lower capital intensity, higher capital productivity and lower labour productivity. This means that exporters use more labour-intensive techniques of production and therefore generate higher value added per unit of capital invested, but lower value added per worker. This finding is consistent with our previous analysis, based on sectoral level data, that export-oriented sectors exhibit higher value added and higher rates of employment per unit capital than more capital-intensive, import-competing sectors. We may conclude, therefore, that the export premium as revealed in the across-sector effect derives from the different factor intensities of production in export-oriented and import-competing sectors.

Regarding the within-sector comparison, the difference in factor intensity between exporters and non-exporters is not significant. In other words, exporters do not necessarily exhibit a lower capital intensity compared to their non-exporter counterparts. On the other hand, within the same sector exporting firms appear to use their resources more efficiently, illustrated by higher productivity in all measures of productivity, including TFP, labour and capital productivity.

As for the year 2008, a similar pattern of the export premium emerges for the same firm characteristics and factor intensity, though to a lesser extent. In addition, results do not reveal that exporters are superior to non-exporters regarding firm productivity, except for the capital productivity, as the export premium associated with both measures of TFP and labour productivity appear to be statically insignificant.

Table 3. Export Premium of the sample firms (in percentage)

Note:Export premium defined as the difference in percentage in the mean level of the characteristic of interest; ***, **, and * denote significance at 1%, 5% and 10%, respectively.

VARIABLES	*1150 manufacturing firms 2002 – 2004*				*775 manufacturing firms 2008*			
	Export status 1 (Share > 10%)	Standard Errors	Export status 2 (Share > 50%)	Standard Errors	Export status 1 (Share > 10%)	Standard Errors	Export status 2 (Share > 50%)	Standard Errors
Across sectors								
Revenues	213.40	0.065***	146.11	0.083***	328.75	0.104***	210.71	0.156***
Value added	249.87	0.064***	194.47	0.081***	297.37	0.149***	244.32	0.160***
Firm size	193.44	0.060**	129.91	0.076***	265.61	0.154***	171.72	0.174***
Employment	294.76	0.049***	298.13	0.064***	317.91	0.076***	337.98	0.124***
Average wage	-1.67	0.033	-9.86	0.045**	5.58	0.092	-8.51	0.091
Capital	209.60	0.069***	145.69	0.086***	297.41	0.165***	166.26	0.189***
Capital intensity	-21.21	0.056***	-38.41	0.070***	-1.24	0.140	-41.78	0.154***
Labour productivity	-10.88	0.042***	-26.07	0.053***	8.42	0.103	-15.76	0.107
Capital productivity	13.60	0.050**	24.21	0.067***	6.49	0.133	39.56	0.153**
TFP (LP, value added)	63.04	0.045***	39.25	0.057***				
TFP (LP, revenue)	40.21	0.028***	28.16	0.037***				
TF (OLS, value added)					-1.23	0.097	-11.17	0.105
Within Sector								
Revenues	312.80	0.068***	258.37	0.091***	396.34	0.102***	318.58	0.154***
Value added	304.35	0.070***	264.44	0.095***	344.06	0.151***	323.72	0.163***
Firm size	261.65	0.063***	208.24	0.083***	343.80	0.160***	274.87	0.190***
Employment	247.19	0.053***	247.02	0.073***	290.83	0.076***	312.06	0.128***
Average wage rate	11.90	0.035***	6.06	0.053	12.24	0.099	-3.20	0.093
Capital	264.84	0.074***	206.88	0.096***	393.03	0.169***	279.28	0.205***
Capital intensity	6.65	0.059	-10.68	0.080	30.03	0.133**	-9.59	0.160
Labour productivity	17.50	0.043***	4.90	0.059	25.67	0.100**	8.55	0.110
Capital productivity	12.11	0.053**	22.26	0.075***	-2.72	0.133	19.55	0.162
TFP (LP, value added)	100.51	0.049***	81.45	0.066***				
TFP (LP, revenue)	53.45	0.029***	43.59	0.041***				
TFP (OLS, value added)					7.04	0.096	1.30	0.109

6. Do more productive firms self-select to export?

We now turn to the question of whether more productive firms tend to self-select into exporting, and to what extent firm characteristics such as firm size, factor intensity, age, ownership, and industry sectors explain the firm's decision to become an exporter.

Our empirical framework for this analysis is grounded on the heterogeneous-firm trade theories (Melitz 2003 and Bernard et.al 2003) which emphasizes that the existence of entry costs associated with exporting in conjunction with firm heterogeneity as an explanation of a firm's export decision. Roberts and Tybout (1997) develop an econometric framework to model the changes in the export decision of firms, which has been widely adopted in most econometric studies of firm's decision to enter into exporting. The essence of the Robert and Tybout (1997) framework is that firm *i* would export in the current period *t* if its expected profitability is non-negative. A firm's export behavior is modeled as a discrete choice equation:

$$Y_{it} = \begin{cases} 1 \; if \; p_{it} q^*_{it-1} \geq c_{it}\left(X_t, Z_{it}, \frac{q^*_{it-1}}{q^*_{it}}\right) + S(1 - Y_{it-1}) \\ \\ 0 \; otherwise \end{cases} \tag{2}$$

where Y_{it} is the current export status, p_{it} denotes the price of goods sold abroad, C_{it} denotes the cost of producing optimal export quantity $q*_{it}$. S indicates the sunk entry costs; X_t indicates vectors of exogenous factors affecting the firms' profitability; Z_{it} indicates vectors of firm-specific factors affecting the firms' profitability; and finally Y_{t-1} denotes the export status of firm *i* at time *t-1.* According to this specification, the firm will not have to incur the entry cost again in time *t* once it has exported in the period time *t-1*. The firm exports in time t when its revenues exceed its cost. The reduced-form of the above binary choice model is therefore written as

$$Y_{it} = \begin{cases} 1\ if\ \lambda_X X_{it} + \lambda_z Z_{it} \quad - S(1 - Y_{it-1}) +\ u_{it} \geq 0 \\ \\ \qquad\qquad 0\ otherwise \end{cases} \tag{3}$$

Following this framework, we specify the following model to estimate the export status of firms conditional on the previous export status and observed characteristics that potentially affect firm profitability at both the firm and sector levels. This framework assumes that firms have to decide every year whether or not to export, conditional on their past export status and other lagged value of firm attributes. Decision of export participation is thus made every year as follow:

$$E_{it} = \beta_Y E_{t-1} + \beta_P \Pr oductivity_{it-1} + \beta_C Chacteristics_{it-1} + F_{year} + F_{\sec tor} + F_{location} + \varepsilon_i + \eta_{it} \tag{4}$$

where E_i is a dichotomous dummy variable indicating the firm's export status, namely *exporter*. E_{t-1} denotes the previous export status, which aims to identify sunk cost effects. The key variable of interest is the lagged productivity, which is believed to have an impact on the current export status of firms as only firms that are more efficient (i.e. more productive) are willing to pay the additional costs to enter the foreign markets. Firm-specific characteristics such as firm size, age, wage, capital intensity, and ownership etc., are also included. Since larger firms are more able to exploit the economies of scale, they are more inclined to enter the export market. A firm's production technology, represented by its capital intensity, also determines the firm's incentive to become an exporter, which in the Vietnam context (a labor-abundant, low-wage country) would suggest that firms producing relatively labor-intensive goods would be more likely to select to export. Lagged values of firm productivity and firm characteristics are used to control for reverse causation running from exporting to firm performance. As government and overall economic conditions in support of export activities are often region and sector specific, which argues for the inclusion of region and sector dummies in the empirical model. Also included is a year dummy to capture the possible influence of the business cycle on a firm's export status.

A different specification of the self-selection model is warranted if firms' decision to export is made not every year but only once when they enter the export market for the first time. To test this formulation of the self-selection hypothesis, we confine our sample to observations of firms that had not previously exported and subsequently either chose to export or to remain as a non-exporter. In other words, we eliminate from the sample those observations of firms that exported in the past. The decision to become an exporter or remain as a non-exporter is specified as follows:

$$D_{it} = \beta_P \Pr oductivity_{it-1} + \beta_C Chacteristics_{it-1} + F_{year} + F_{\sec tor} + F_{location} + \varepsilon_i + \eta_{it} \qquad (5)$$

Where D_{it} is a dichotomous dummy variable indicating whether a firm is a new exporter in the year of consideration or it has decided to remain as non-exporter. The past export status is not present in the equation as it is already incorporated in the decision to export. Lagged values of various firm characteristics are included as potential determinants of the decision to export.

In short, specification (4) estimates the determinants of the firm decision to export each year, conditional on past export participation, while specification (5) estimates the decision to become an exporter in the first instance. Both are estimated for the unbalanced panel 2002, 2003, 2004, and 2008 using a random logit model for specification (4) and a pooled logit model for specification (5). It is worth noting that random logit model estimates (as used for equation (4))do not control for the presence of unobserved firm heterogeneity, which are likely to be serially correlated with the lagged dependent variable, namely the past export status. As a result, the effect of this variable on the firm's current export participation may be overestimated. Nevertheless, these specifications allow the causal relationship between past firm productivity and current export status to be identified, which is the principal objective of this analysis. Under specification (5), the potential problem of serial correlation between is controlled for as the focus is the change in export status, the so-called decision to become an exporter or to stay as a non-exporter.

Estimates of the self-selection model are presented in table 4.The estimation results for equation (4) are presented in columns (1) to (4), and reveal that the past export status is a strong determinant of the current export status, evident from the highly significant coefficient associated with the lagged variable of export status. Controlling for observed firm characteristics such as size, age, sector, location and ownership, once firms begin to export they remain exporters in the subsequent years. Other empirical studies on exporting behaviours in Vietnam also find the persistence of export status of firms (Hiep and Ohta, 2009; Huong et al., 2012). Our finding further confirms this result. Many firm characteristics also appear to be statistically significant determinants of a firm's export status as hypothesized. Not surprisingly, firms that are more mature and have a higher share of foreign ownership exhibit a higher probability to export.

The key question in regard to the self-selection hypothesis is whether more productive firms are more likely to self-select to export, controlling for their past export status. In the context of Vietnam, more productive firms can be interpreted as firms that better align with the country's comparative advantage and those large enough to exploit economies of scale that may exist. Our results highlight a number of interesting observations in support of this argument. The significant negative coefficient on lagged capital-intensity suggests that firms with a relatively low capital-labour ratio are more like to engage in exporting. Consistent with that observation, firms with lower labour productivity, i.e. firms characterized with less value added per unit of labour and hence lower labor per unit capital, tend to have a higher likelihood to export, indicated by the significant negative coefficient associated with the lagged value of labour productivity.

Firms with higher capital productivity are more inclined to export, but this relationship is not statistically significant. Past total factor productivity is not found to significantly influence firm's current exporting status, but this finding does not necessarily invalidate the self-selection hypothesis since the measure of total factor productivity in the Vietnam context is highly problematic, as noted in section 4.

Estimates of the self-selection model as specified in equation (5) are present in columns (5) to (8) of table 4. The dependent variable represents the decision to enter (or not to enter) into exporting, not the firms status as an exporter as specified in equation (4) and presented in columns (1) to (4). Interestingly, the results confirm that firms producing labor-intensive products (low capital intensity) and accordingly exhibiting relatively low labor productivity and high capital productivity are more likely to enter into exporting.

The results presented here provide some support for self-selection hypothesis. Low labour productivity and high capital productivity are characteristics of firms operating in export-oriented sectors in a labour-abundant country. Firms operating in sectors in which the country has a comparative advantage either "self-select" or are selected by the market to participate in exporting.

Table 4. Estimates of the determinants of export participation and decision to export 2002 - 2008

The dependent variables take the form of a dichotomous dummy variable. Columns (1) – (4) are estimates from a random logit model, columns (5) - (8) present logit estimates ofdecision to enter the export market.Robust coefficients are reported with t-statistics in brackets; ***, **, and * denote significance at 1%, 5% and 10%, respectively.

Dependent variable	Current Export Participation (1/0) (1 if export share > 10%)				Decision to enter the export market (1/0) (1 if new exporter and 0 if remain as non-exporter)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exporter_{t-1} (share > 10%)	4.613***	4.602***	4.599***	4.601***				
	[24.990]	[25.049]	[24.852]	[25.123]				
Ln(TFP_{t-1}) (LP, value added)	-0.0228				-0.0023			
	[-0.177]				[-0.012]			
Ln(Labour product_{t-1})		-0.301**				-0.533***		
		[-2.443]				[-2.670]		
Ln(Capital product_{t-1})			0.0499				0.204*	
			[0.645]				[1.850]	
Ln(Capital intensity_{t-1})				-0.147**				-0.354***
				[-1.966]				[-3.363]
Firm size_{t-1}	0.153*	0.201***	0.148**	0.179**	0.198*	0.302***	0.243***	0.330***
	[1.696]	[2.731]	[2.162]	[2.477]	[1.650]	[3.044]	[2.613]	[3.367]
Ln(Average wage $_{t-1}$)	-0.0146	0.153	-0.0339	0.0235	0.182	0.613**	0.0685	0.251
	[-0.110]	[1.154]	[-0.278]	[0.206]	[0.703]	[2.141]	[0.303]	[1.204]
Firm age (years)	0.0625**	0.0576**	0.0612**	0.0563**	0.0844**	0.0839**	0.0836**	0.0703*
	[2.452]	[2.270]	[2.403]	[2.230]	[2.211]	[2.214]	[2.181]	[1.872]
Firm age squared	-0.00138**	-0.00132**	-0.00136**	-0.00127**	-0.00213**	-0.00217**	-0.00213**	-0.00188**
	[-2.477]	[-2.361]	[-2.441]	[-2.295]	[-2.369]	[-2.442]	[-2.354]	[-2.141]
State ownership (%)	0.0034	0.00282	0.00341	0.00344	0.0101**	0.00851*	0.00946**	0.00987**
	[1.025]	[0.845]	[1.031]	[1.051]	[2.270]	[1.897]	[2.114]	[2.214]

Foreign ownership (%)	0.00728**	0.00802**	0.00729**	0.0112***	0.00484	0.00742	0.00514	0.0122**
	[1.995]	[2.141]	[1.988]	[3.163]	[0.860]	[1.299]	[0.911]	[2.399]
Year 2003		0.0553		0.00144	-1.174***	-1.277***	-1.147***	-1.277***
		[0.189]		[0.005]	[-3.217]	[-3.494]	[-3.121]	[-3.468]
Year 2004	0.208	0.268	0.206	0.244	-1.641***	-1.737***	-1.614***	-1.677***
	[1.088]	[0.934]	[1.082]	[0.856]	[-4.397]	[-4.642]	[-4.299]	[-4.497]
Year 2008	-0.0707		-0.0783					
	[-0.241]		[-0.267]					
Sector dummies	Included	included	included	included	included	Included	included	Included
Region dummies	Included	included	included	included	included	Included	included	Included
Constant	-4.269***	-4.187***	-4.316***	-4.300***	-4.385***	-4.350***	-4.664***	-4.701***
	[-6.552]	[-5.871]	[-6.568]	[-6.105]	[-4.777]	[-4.686]	[-4.969]	[-5.141]
lnsig2u	-13.34	-13.36	-13.33	-12.85				
	[-0.375]	[-0.382]	[-0.373]	[-0.627]				
N	2085	2107	2080	2168	1340	1357	1340	1395
chi2	750.6	754.7	748.6	769.5	86.62	94.32	90.01	102

7. Does exporting lead to higher firm productivity?

7.1 *Causal effects of export participation on firm productivity: fixed-effects and IV fixed effects analyses*

Contrary to the self-selection hypothesis, the learning by exporting and core competence hypotheses suggest that the direction of causation underlying the positive relation between firm productivity and exporting runs from exporting to high productivity. The *learning by exporting* hypothesis argues that exporting firms benefit from participation in international trade via the knowledge and expertise they gain from participating in world market, which in turn improves their productivity. The *core competence* hypothesis, on the other hand, argues that exporting firms become more productive by specializing in the products closer to their core competence, which are products in which the country's comparative advantage is relatively strong.

In testing these two hypotheses (learning by exporting and core competence) it is important to recognize that a firm's decision whether to export and how much to export (measured as the export share of total revenue) is likely not random. Non-randomness in this case may arises from three possible biases, namely the endogeneity bias, selection bias and attrition bias. Many firm and sectoral attributes are unobservable, but could nonetheless be relevant determinants of the firm productivity and the firm's export behaviour. This unobserved heterogeneity is likely embedded in firms' and sector's history and hence may be assumed to be time-invariant. On the other hand, other unobserved attributes associated with managerial skills, firms' relationship with their business communities and relevant authorities, may differ across firms and vary over time. The second source of bias arises when firms' decision to participate in export activities in a given year is not random, such as would occur if firms self-select to export in anticipation of higher productivity in the future. This argument received some support from the empirical findings reported in the preceding section. Finally, firms may choose to continue or quit exporting after some time, causing a possible attrition bias.

An appropriate empirical strategy should therefore be adopted to address these possible biases in order to derive clean estimates of the causal effect of exporting on the outcome variables. The empirical framework used here is an augmented version of Bernard and Jensen (1995 and 1999), where firm productivity is determined at the firm level to be conditional on firm observed characteristics (size, labour skill and age etc.) and the firm export participation, which is captured by both a dichotomous participation dummy and export intensity. The empirical model is specified as follows.

$$\ln(S_{it}) = \alpha_i + \beta_E E_{it} + \beta_C Chacteristics_{it} + F_{\sec tor} + F_{location} + F_{year} + \eta_{it} \quad (6)$$

where S_{it} is the outcome variable, which indicate either the productivity or the core competence of firm *i* in year *t; α* is an unobserved fixed firm effect and E_{it} is the treatment variables – export dummy and export intensity. In addition to export, firm characteristics may jointly determine firm productivity and firm core competency. Firms of larger size and with more experience in business tend to perform better. Further, average wage can proxy for the quality of human resource, which is highly relevant to explaining the change in productivity and core competence (Ranjan & Raychaudhuri, 2011; Tsou et al., 2008). Type of ownership measured in percentage is also included in the model as a control variable. Finally, F denotes a vector of fixed-sector, location, year effects.

The first outcome variable includes various measures of productivity: labour productivity (measured as the logarithm of value added per labour), capital productivity (measured as the logarithm of value added per unit of capital); and TFP estimated from both Levinsohn and Petrin approach and the conventional OLS approach, also in the logarithm form. The second outcome variable is the firm's technology of production, which reflects the firm's core competency, and is measured by the firm's capital intensity expressed in logarithms[2]. The coefficient β_E captures the effect of a one percentage point higher of export intensity on the outcome variables.

Equation (6) is estimated in a fixed effect framework, with and without instrumental variables (IV). Although the fixed-effects estimator controls for time-invariant unobserved heterogeneity, it cannot entirely solve the endogeneity bias since it is unable to control for time-variant unobserved firm heterogeneity that affect both a firm's decision whether and how much to export and the outcome variables (various measures of productivity and capital intensity). The fixed-effects model therefore may provide a consistent but biased estimate of the causal effect of exporting. It is therefore appropriate to use an IV within fixed-effects to derive an unbiased estimate of the causal effect of exporting on productivity and capital intensity, respectively. It should be noted that in the context of panel data, the IV application can also correct for the problem of possible attrition bias, whereby an individual firm's decision to continue or quit exporting is determined by unobserved heterogeneity (Miller and Hollist, 2007).

A major challenge inherent to the IV strategy is, however, to select good instruments for exporting, and to ensure the appropriateness of the selected instruments. In the current framework, the average share of imported intermediate inputs at the sectoral level is used as an instrument for a firm's export behaviour, expressed as either export participation dummy or export intensity. The sector share of imported intermediate inputs reflects the embedded nature of Vietnamese manufacturing firms' participation in the global production sharing process. As in other low-wage labour-abundant countries, Vietnamese manufacturing firms concentrate at the final stage of the

[2] The authors wish to thank Brian McCaig for his suggestion on the use of a better measure of the firm's core competency such as the share of revenue or value added generated by the firm's top product. Unfortunately, this information is essentially missing across firms in our dataset.

manufacturing production process, which for the most part involves assembling imported intermediate inputs into final products for export, which means the amount of inputs imported is positively correlated with the degree of export. While this variable may not be exogenous at the sectoral level and country level, it is assumed to be exogenous to firms that operate in any particular sectors. To control for the non-linearity of this possible effect on individual firms' export behaviour, we extend our set of instruments to include the interaction between the sectoral share of imported inputs and firms characteristics (size, age, the wage rate etc.). To justify the use of the IV method within a fixed-effects model, several tests of the instruments were conducted. First, a test of the endogeneity of the regressor indicates whether the IV method is required. Second, a weak identification test, with the Angrist-Pischke F statistic, was employed to examine the relevance of our instruments and confirm that they correlate with the treatment variable. A weak identification indicates the weak explanatory power that causes an increased bias in the estimated IV coefficients (Hahn and Hausman, 2002). Third, we use a test of over-identifying restrictions, that is, the Hansen J, to test the validity of the instruments (i.e., if the instruments are orthogonal to the error distribution of productivity outcomes of firms).

Table 5 presents the estimation results for two periods, the 2003 – 2004 period presented in columns (1) to (5) and the 2004 – 2008 period in columns (6) to (9). Section (a) refers to the results of the fixed-effects estimates while section (b) includes the estimates from the fixed-effects with IV. Since we only include the continuous treatment variable – export intensity in our fixed-effects analysis[3], we in fact discern the

[3]As a matter of fact, we first attempted to apply the fixed-effects framework using two full panel samples, notably the 2002-2004 panel of 1150 firms, and the 2002 – 2008 panel of 333 firms with respect to both variables of export participation, export status as a treatment dummy and export intensity as a continuous treatment variable. However, the fixed-effects estimator fitted in both panels with respect to the export status appears to suffer from a serious problem of limited change in the export status between the years. We therefore confined our fixed-

time variation of the outcome variable (either firm productivity or firm core competence) given the change in the export intensity of firms over time. Note that in this setting, the fixed-effects estimator drops off all variables such as firm age, type of ownership, sector, region and year dummies for they perfectly collinear with the fixed-effects. For both periods, we only included in our sample those firms that exported in the latter year of the period, indicated by the positive value of the firms' export share.

effects analysis to only export intensity, and in-so-doing limits our first sample to the two-year 2003 – 2004 panel. For compatibility, we also use the two-year 2004-2008 panel as the second sample for the fixed-effects analysis.

Table 5: Estimates of the impact of exporting on firm productivity and capital intensity: Fixed effects (FE) and Instrument Variables within Fixed effects (FE – IV)

The dependent variable takes various forms of productivity and capital intensity, all in logarithm.
The FE estimates appear in section (a), FE - IV in section (b). Robust coefficients reported with t-statistics in bracket; ***, **, and * denote significance at 1%, 5% and 10%, respectively. Results presented in columns (1) to (5) for the panel 2003-2004; and columns (6) to (9) for the panel 2004-2008.

	(a) Fixed effects estimates of the impact of exporting								
	2003 – 2004					2004 – 2008			
	TFP (LP, value added)	TFP (OLS, value added)	Labor product.	Capital product.	Capital intensity	TFP (OLS, value added)	Labor product.	Capital product.	Capital intensity
	(1)	(2)	(3)	(3)	(5)	(6)	(7)	(8)	(9)
Export intensity (%)	0.0018	0.0022	0.0006	0.0020	-0.00200	0.00791*	0.00675	0.00522	-0.00204
	[0.884]	[1.117]	[0.284]	[1.039]	[-1.628]	[1.844]	[1.632]	[1.017]	[-0.359]
Firm size	0.263***	0.179***	0.224***	0.0911	0.0667	-0.418***	-0.107	-0.574***	0.455***
	[3.602]	[2.926]	[3.564]	[0.764]	[0.596]	[-4.871]	[-1.264]	[-7.581]	[5.974]
Average wage	0.152***	0.172***	0.162***	0.180	-0.0434	0.535***	0.532***	0.291	0.274**
	[3.160]	[3.211]	[2.996]	[1.499]	[-0.380]	[3.189]	[3.435]	[1.374]	[2.539]
Constant	2.429***	-0.330	0.856	-0.920	2.514*	4.497***	2.969***	5.094***	-1.973**
	[3.097]	[-0.467]	[1.190]	[-0.667]	[1.956]	[5.214]	[3.458]	[6.048]	[-2.432]
N	1389	1389	1409	1389	1449	1195	1216	1195	1239
No of id	1013	1013	1027	1013	1048	1090	1102	1090	1122
R^2	0.0976	0.0805	0.0808	0.0548	0.0172	0.340	0.268	0.325	0.284
F	5.384	4.154	4.441	1.206	1.278	12.74	6.954	19.91	13.42

	(b) Instrumental variable within fixed effects estimates of the impact of exporting								
	2003 – 2004					2004 – 2008			
	TFP (LP, value added)	TFP (OLS, value added)	Labor product.	Capital product.	Capital intensity	TFP (OLS, value added)	Labor product.	Capital product.	Capital intensity
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Export intensity (%)	0.0083*	0.0200***	0.0012	0.0088	-0.0116**	0.00621	-0.00632	-0.00194	-0.00574
	[1.742]	[3.093]	[0.246]	[1.377]	[-1.979]	[0.169]	[-0.192]	[-0.066]	[-0.458]
Firm size	0.234***	0.102	0.220***	0.0597	0.109	-0.417***	-0.0928	-0.571***	0.462***
	[3.648]	[1.482]	[3.736]	[0.468]	[0.907]	[-4.520]	[-0.948]	[-7.550]	[5.757]
Average wage	0.146***	0.156***	0.160***	0.174	-0.0350	0.539***	0.572***	0.311	0.278**
	[3.220]	[3.068]	[2.994]	[1.446]	[-0.305]	[2.928]	[3.059]	[1.517]	[2.514]
N	738	738	748	738	786	210	228	210	234
N of id	369	369	374	369	393	105	114	105	
P-val endogeneity C test[1]	0.0041	0.0003	0.9028	0.4709	0.1465	0.2027	0.3622	0.8350	0.8388
P-val Hansen J test[2]	0.8887	0.1647	0.9490	0.1414	0.1042	0.1634	0.3418	0.6366	0.3950
P-val Angrist-Pischke F test[3]	0.0050	0.0050	0.0050	0.0050	0.0050	0.2642	0.2109	0.2642	0.1649

1) Tests the null hypothesis that the regressor can be treated as exogenous.
2) Tests for the over-identifying restrictions with a null hypothesis stated as follows: The endogenous regressor is orthogonal to the error term
3) Weak identification test of the excluded instruments.

The fixed effects estimates presented in section (a) of table 5 indicate that only one measure of firm TFP changes in a response to a change in the export intensity of firms for the 2004-2008 period. The estimated coefficient on export intensity suggests that one percentage point increase in export intensity, other things equal, leads to an increase in TFP (calculated using the Levinsohn and Petrin approach on a value added basis) of nearly 1 percent (β_E = 0.00791).No effects were found on other productivity outcomes and capital intensity using the fixed effects method without the IV.

Turning to the estimation results using the IV within fixed-effects, as noted earlier, the fixed-effects estimates with IV correct for both time-invariant and –variant unobserved heterogeneity and thereby yield a true estimate of the causal effect of exporting on the firm outcomes. For the 2003-2004 period, results presented in the first five columns of section (b) reveal a number of significant effects of firms' export intensity on the outcome variables. Both measures of TFP productivity appear to respond to a rise firm's export intensity, controlling for other observed and unobserved attributes. Specifically, an increase in export share by one percentage point leads to a rise in TFP. In line with the core competence hypothesis, a rise of one percentage point in export intensity *ceteris paribus* is associated with a decline in the firm's capital intensity by 1.2 percent. As predicted, this result suggests that firms with higher export intensity adjust their product scope to include more labor-intensive products. In other words, the more firms export, the more they become specialized in their core activities that align with the country's comparative advantage.

The last three rows of section (b) of table 6 present the result of various tests of the IV within fixed-effects. Most of the tests indicate satisfactory outcomes with respect to the performance of the instrumental variables. First, the endogeneity tests' result confirms that the endogenous regressor - export intensity is indeed endogenous in most of specifications, as indicated by a P_{value} smaller than 0.1. This result provides empirical justification for the use of the IV approach. Secondly, the test of the validity of the instrument using the Hansen J test of overidentifying restrictions indicates that the endogenous regressor is orthogonal to the error term in the productivity equation (P_{value}> 0.1), or equivalently the selected instrument appear to be valid. Much attention should be paid to the weak instrument test, for which the tests' result of the Angrist-Pischke multivariate F test indicates rejection of the weak identification hypothesis in most of the equations. This result provides further econometric support for the choice of instruments – the sectoral level of imported inputs and its interaction with other firm characteristics as they are strong instruments for export intensity.

For the 2004-2008 period, the IV fixed effects estimates cannot identify any effects of exporting on either firm productivity or firm core competence, as evident from the insignificant coefficients included in the last four columns of section (b). The last three rows of the same columns show that the performance of instruments in the sample 2004 - 2008is not desirable. The endogeneity test in most equations fails to validate the use of the IV method. In addition, although the Hansen J test indicates that the selected instruments are valid, they are weakly related to export intensity, as evident from the Angrist-Pischke F test (P_{value}> 0.1). As such, the use of the IV within fixed-effects is not well justified for this panel. Further observations regarding the results reported for the 2004-2008 period merit our attention. First, the negative effect of firm size on the productivity outcome seems to be at odds with our expectation and the result found in the 2003-2004 period. Second, there remains some uncertainty regarding the reliability of the panel of 333 firms between 2004 and 2008 as we discussed previously in section 3. These concerns do not lend strong credence to our IV fixed-effects estimates of the impact of exporting on firm productivity over the 2004-2008 period.

Overall, controlling for both time-invariant and time-variant unobserved firm and sectoral heterogeneity, we find, for the 2003-2004 period, evidence of a productivity gain of exporting under the estimates with IV within fixed-effects for both measures of TFP. Our results offer some evidence in support of the learning by exporting hypothesis for the case of Vietnam, which has not been revealed by previous studies (Huong et at., 2012 and Hiep and Ohta, 2009). More importantly, for the same period, our result validates the core competence hypothesis as firms with higher export intensity tend to shift to focus on their core activities, i.e. producing more labor-intensive products.

7.2. Causal effects of export participation on firm productivity: A difference in differences analysis with matching

In this subsection we employ a combination of propensity score matching and difference-in-differences approach to evaluate the within-sector effects of exporting on firm's productivity. This method has been intensively done in the literature on trade, including recent studies for Vietnam (Hiep and Ohta, 2009). The idea behind the matching method is to compare outcomes of participants and ones of compatible observable non-participants to estimate the effects of the intervention. Following this framework, we match exporters, so-called the treated, with the untreated group of non-exporters on the basis of observed firm characteristics. We attribute the change across time in various measures of productivity outcomes between the treated and the untreated firms to the effect of changing export participation by the treated firms.

Fitted in cross-section data, this matching method comes down to identifying the average effect of export participation – the Average Treatment effect on the Treated (ATT), defined as follows:

$$\text{ATT} = E(\Delta|D = 1) = E(Y_1|x, D = 1) - E(Y_0|x, D = 1) \tag{7}$$

where $Y_1$is the productivity outcome of a firm given that it changed its export participation, either export status or export intensity; $Y_0$is the outcome of a firm given that it had not change export status or export share; *D* is the treatment if the firm changed the export status/export share (1) or not (0). The second term $E(Y_0|x, D=1)$ is a counterfactual so it is not observable and need to be replaced by $E(Y_0|x, D=0)$using propensity score matching of Rosenbaum and Rubin (1983)

ATT = $E(\Delta|p(x), D=1)$ = $E(Y_1|p(x), D=1)$ - $E(Y_0|p(x), D=0)$ (8)

The propensity score matching method first estimates the probability of export participation decision, *P(x)* conditional on specific firm characteristics in the base year, the so-called pre-treatment characteristics, to derive the estimated propensity scores. Following Hiep and Ohta (2009), we include in the propensity score equations the lagged value of firm characteristics that are relevant to determining the firm's export participation behaviour, on the basis of our estimates of the determinants of export participation in section 6. In this way, we hope to control for the reversed effects that may confound our estimate of the probability of exporting. In the second step, the estimated scores are used to match treated firms and control (untreated) firms. After a careful check for the balancing property required for pre-treatment characteristics, we apply the radius matching technique to derive a matched sample.

There are several procedures for matching, namely nearest-neighbour, kernel, radius, stratification, and weighting matching and none of them is superior. The nearest-neighbour algorithm is the most straightforward and common technique. A firm from the control group is selected as a match for a treated firm once the untreated has the closest propensity score. However, this approach is not appropriate for small samples, especially when the control group contains more observations than the treated group, which turns out to be case for our sample. Consequently, under nearest-neighbour matching for some treated firms the nearest neighbor may have a very different propensity score (Becker and Ichino, 2002). The radius matching provides a solution to this problem by using more observations than the nearest-neighbour matching and therefore lower the variances (Dehejia and Wahba, 1998). In this technique, a treated case is matched only with non-treated cases whose propensity score lies within the calliper – the propensity range close to the propensity score of the treated case. Results are sensitive to the chosen calliper (or radius). The bigger radius, the easier it is to find a match within the range, but resulting in higher variances. On the other hand, the smaller radius, the more difficult it is to find a match within the calliper, causing a greater number of treated cases that are not matched. This drawback of radius matching is noted by Smith and Todd (2005). We therefore use radius matching with the calliper of 0.25 of the logit of the propensity scores as recommended by Cochran and Rubin (1973).

The panel setting of our data allows us to combine a difference-in-differences analysis with propensity score matching, as suggested by Blundell and Costa Dias (2000). According to this combined approach, the difference-in-differences estimator derives the difference in firm productivity outcomes between two time periods as follows.

$$\text{ATT} = E(\Delta_a - \Delta_b | D = 1) = E((Y_{1a} - Y_{0a}) - (Y_{1b} - Y_{0b}) | x, D = 1)$$

$$= E(Y_{1a} - Y_{1b} | D = 1) - E(Y_{0a} - Y_{0b} | D = 1) \quad (9)$$

where the first term $E(Y_{1a} - Y_{1b} | D = 1)$ indicates the difference in productivity outcome observed before (0) and after (1) the treatment taking place for the treated group, i.e. exporters . Since the difference is induced by not only the exporting but also other factors, the second term $E(Y_{0a} - Y_{0b} | D = 1)$ refers to the differences in productivity of the untreated firms in order to control for 'other factors' bias.

The major challenge inherent to this approach is to control for the selection bias problem, which possibly arises as a firm's decision to export and/or how much to export does not follow a random process (Rosenbaum and Rubin 1983). As such, the differences in productivity outcomes (if any) between exporters and non-exporters can be induced by unobserved firm heterogeneity that affect both the export participation and the productivity outcomes of firms. The difference-in-differences analysis with propensity score matching, once competently done, can capture the observed attributes that underlie firm heterogeneity. Nevertheless, it fails to control for the unobserved attributes. In this way, this approach assumes away selection bias on unobserved variables, which is known as the Conditional Independence Assumption. Another challenge of this approach comes from the assumption of Common Support Region, which requires that potential matches must exist between the treated and untreated firms. Under this assumption, there must be substantial overlap between the treated and untreated groups on the propensity scores in order to provide a strong support of casual inference. To enforce these assumptions, a large sample size must be required, not only in terms of the number of pre-treatment characteristic variables but also in the number of observations in treated and untreated group. Small sized samples increase the variance of estimated effects and bias when more distant matches are accepted due to fewer matches available. Zhao (2004) suggests that propensity score matching works better in large sample (N>1000). As a result, any causal effects derived from this approach on a small sized sample should be interpreted with caution.

Given our research objectives, we distinguish two separate specifications in which firms change their status of export participation and accordingly we attempt to estimate the causal effect of the changing export behaviour on the firm productivity outcomes. In specification one, we compare *new exporters* that start to export in the year of consideration to firms that have never exported in both years, so-called *not-ever-*

exporters. Exporters are defined as firms that export at least 10 percent of their total revenue. In specification two, amongst the group of firms that export in both years, we compare firms that increase their export intensify by more than 20 percentage points between the two years, so-called *intensified exporter*, to firms that sustain their export share over time – *persistent exporter*. The effect of export participation derived from the first specification is expected to measure an immediate impact on firm productivity once firms start to export for the first time. On the other hand, the effect derived from the second specification can be attributed to a cumulative learning effect of exporting as firms penetrate in the export markets. Both types of effects are relevant for our purpose of testing the learning-by-exporting effect. We include in our analysis both panel samples, the panel 2003 – 2004 and the panel 2004 – 2008.Table 6 below gives a summary of the group formation and the number of firms in each group.

Table 6. Group identification for the difference in differences analysis with propensity score matching

Change in export participation	Treated group		Untreated (Control) group	
	Description	N	Description	N
2003 - 2004				
Starting to export *New exporters vs. not-ever-exporters*	Firms starting to export in the year of consideration	28	Non-exporters in both years	669
Increase in export intensity. *Intensified vs. persistent exporter*	Firms increasing export share by more than 20 percentage points between years	13	Firms having stable export share between years	294
2004-2008				
Starting to export *New exporters vs. not-ever-exporters*	Firms starting to export in the year of consideration	27	Non-exporters in both years	177
Increase in export intensity. *Intensified vs. persistent exporter*	Firms increasing export share by more than 20 percentage points between years	14	Firms having stable export share between years	51

Table 6 indicates that the number of firms in each specified group is considerably modest, especially for the sample 2004-2008. This confirms the lack of the dynamics of the export status of the sample firms, in line with our discussion in section 4, and thereby challenges our application of the difference-in-differences in combination with the propensity score matching approach.

We use ***pscore*** developed by Becker and Ichino (2002) and ***psmatch2*** developed by Leuven and Sianesi (2003) and for Stata® to derive the propensity scores and estimates of the ATT as specified in equation (7). In this process, we have encountered several problems concerning the later sample 2004-2008 with respect to both specifications, possibly caused by the use of small sized sample. For specification one, the propensity score equation under the logit estimator is not statistically significant, even though the balancing property is satisfied. For specification two, the assumption Common Support Region does not hold for the sample 2004-2008on the second specification due to an extremely narrow overlap between the treated and untreated groups. These problems do not allow us to identify a reliable matched sample for our estimates of the ATT for this period. As a result, table 7 includes our estimates of the ATT only for the sample 2003-2004 with two specifications: new exporters vs. not-ever-exporters and intensified exporters vs. persistent exporters. Since all measures of productivity are in logarithm, the estimated ATT indicates the growth rate in percentage of the productivity variables.

Table 7. Average treatment of the treated effect (ATT) of export participation on firm productivity for 2003-2004.

Note: radius matching with calliper of 0.25 in use. ATT reported with t-statistics in brackets; ***, **, and * denote significance at 1%, 5% and 10%, respectively.

Growth rate in productivity (all in logarithm)	TFP(LP, value added) (1)	TFP (LP, revenue) (2)	TFP (OLS, value added) (3)	TFP (OLS, revenue) (4)	Labour product. (5)	Capital product. (6)
New vs. not-ever-exporters	0.179	0.057	0.198	0.127	0.121	0.334*
(total 497; 24 new exporters)	[1.11]	[0.86]	[1.26]	[1.27]	[0.74]	[1.83]
Intensified vs. persistent exporters	0.174	0.095	0.151	0.254	0.138	0.232
(total 186; 11 intensified exporters)	[0.67]	[0.67]	[0.63]	[1.17]	[0.56]	[0.82]

Our ATT estimates show that new exporters within a given sector enjoy a gain in capital productivity, denoted by a rise of 33 percentage points, compared to firms that never exported between the years 2003 and 2004. This implies that for newly exporting firms, entry to export markets motivates a more efficient use of capital invested, thereby raising the amount of value added per unit of capital. This also confirms our finding in section 5 of a significant positive within-sector differential in capital productivity, reported as export premium, between exporters and non-exporters of the unmatched sample.

Concerning other measures of productivity including TFP and labour productivity, the average productivity differentials are also positive but statistically insignificant. So the decision to export does not significantly improve the firm's overall efficiency, measured by TFP, and its labour productivity, as also reported in Hiep and Ohta (2009) using the same data. A possible explanation is that, newly exporting firms need time to absorb new knowledge and expertise from participation in world trade so as to raise their overall efficiency. Therefore, it would be interesting to examine how the learning by exporting effect evolves over the course of exporting for the group of new entrants in the export market, as often done in previous studies where much longer panel data are available (see for example Ma, Tang and Zhang, 2011; Mukim, 2011). As for the insignificant effect associated with labour productivity, it can be argued that new exporters are likely to specialize in more labour intensive products for export, thereby lowering their capital intensity. Accordingly more value is added per unit of capital but it is not so for unit of labour. Firms with lower labour productivity in the past are more likely to choose to export as indicated by our findings in section 6, but exporting does not necessarily induce any gains in labour productivity.

Next we consider the productivity differential between intensified exporters and persistent exporters. Given a 20 percentage point or higher increase in the export intensity, no statistically significant effect is found on productivity regardless of how productivity is measured. This suggests that the cumulative learning effect of exporting does not occur even for firms that are already established in the export business within our studied sample. Changes in the export intensity of firms do not cause any within-sector effects on productivity, nor any within-firm effects as revealed by our fixed-effects estimates in the previous subsection.

8. Concluding remarks and policy implications

The decade 2000 – 2008 has witnessed a rapid economic growth in Vietnam and much of it is attributed to exporting. This study considers the impact on firm productivity of exporting using data from the World Bank Surveys 2004 and 2008 of Vietnamese manufacturing firms. Our descriptive analysis of the sample firms finds, both within and across sectors, that the export productivity premium is positively associated with capital-intensity, size, revenue, employment, value added and TFP. Across sectors, exporters tend to be less capital-intensive and so exhibit lower labour productivity than their non-exporter counterparts. However, exporters appear to have higher labour productivity within sectors perhaps due to their superior efficiency and/or higher capital-intensity. The export productivity premium, as measured, does not indicate whether more productive firms chose to export or whether firms that export become more productive, which is the central question addressed in this study.

The empirical analysis conducted in this study has focused on the three theoretical arguments related to the relationship between exporting and firm productivity, namely self-section, learning-by-exporting and core competence. Are exporting firms superior because only superior firms choose to become exporters or do they become superior by virtue of being exporters and having to face greater competition and to specialize in core activities?

Our estimates of the determinants of export participation for the entire period 2002-2008 reveal that at the firm level a decision to export in the past predicts current export behaviour of exporting firms. Controlling for ownership, age, sector and location, firms with larger size, lower labor productivity, higher capital productivity and lower capital intensity tend to self-select to export. These results provide some support for the self-selection hypothesis.

Our estimates of the learning-by-exporting effect were designed to identify the causal effect running from exporting to productivity and firm activities that can occur both within a sector and within a firm. To identify the within-sector effect of exporting on productivity, we have applied propensity score matching in combination with the difference-in-differences analysis. When matching new exporters with those that have never exported, we find that the decision to export induces a gain in capital productivity for the new exporters, but no significant effect is observed for labour productivity and TFP. This result offers some support of the learning-by-exporting effect that occurs within a sector. Among the group of firms that continued to export between the years 2003 and 2004, *intensified exporters* representing firms that increased their level of export by at least 20 percentage points, were also matched with *persistent exporters* which refer to firms that sustained their export level. We find no significant impacts of the change in export intensity on firm productivity, though.

As far as the within-firm effect of exporting on productivity is concerned, we estimated a firm-fixed effects model, both with and without instrument variables. The average share of imported inputs at the sectoral level and the interaction of this variable with other firm characteristics were used as instrumental variables for the export intensity of firms. The intuition behind this choice of instrument is that sectors that have a higher share of imported inputs sector tend to be more export-intensive. Our instrumental variable fixed-effects estimates reveal a positive significant effect of export intensity on firm productivity, indicated by TFP, and a negative effect of export intensity on firm core competency, captured by the firm capital intensity. This holds only for the 2003-2004period, but not the latter 2004 – 2008 period. Although the performance of our instruments appears to be less than perfect in a few specifications, our findings provide some evidence of the learning by exporting effect that occurs within a firm. More interestingly perhaps, our findings offer some new evidence that exporting firms become more specialized over the course of exporting, i.e. they focus on their core activities.

Our study offers several important policy implications vis-à-vis inclusive growth at both macro and firm level. Exports, especially labour-intensive manufactured exports offer great opportunities for employment creation in labour-abundant developing countries. As confirmed by our sectoral data, Vietnam's major labour-intensive manufactured exports dominated by footwear, apparel and furniture provide more than twice as much as value-added and about five times more employment than the import competing sectors, given one unit of capital invested. As such, the focus on labor-intensive manufactured exports is capable of absorbing un-and under-employed labour in the agricultural sector into more productive, higher income employment in the labour-intensive manufactured sectors for exports. Therefore, this strategy achieves not only higher growth than would otherwise be possible at the nation level but also achieves a more equitable income distribution and poverty reduction thanks to job creation for the low skilled workers who mostly reside in the rural poor.

Our results from the firm level analysis also justify the role of exporting in promoting inclusive growth, in particular with respect to the finding in support of the core competence hypothesis. As Vietnamese manufacturing firms intensify their core activities of producing labor-intensive products for export, the ability to generate productive employment of the export-oriented sectors is enhanced and the role of labor-intensive manufactured exports as a driver of inclusive growth is reinforced at the firm level. Entry of Vietnamese firms into the world market can therefore spur economic growth, especially *inclusive* economic growth of the country. On the basis of our findings at both sectoral and firm level data, policy options for promoting inclusive growth through a greater focus on labour-intensive manufacturing are warranted.

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ANNEXES

Annex 1. GDP, Population and Employment by Sector, 2011

	USD billions	Percent
GDP (USD billions)	115	100
Agriculture	25	22
Industry	46	40
Services	43	38
	Pers. Millions	**Percent**
Population	88	100
Rural	62	70
Urban	26	30
	Pers. Millions	**Percent**
Employment	51	100
Agriculture	25	48
Industry	12	22
Service	15	30
	USD	**VND millions**
GDP per capita	1,309	29
Ag GDP/Rural pop	409	9
Non-ag GDP/Urban pop	3,456	76
	USD	**VND millions**
GDP per worker	2,242	49
Agriculture	1,029	23
Industry	4,028	89
Services	2,857	63

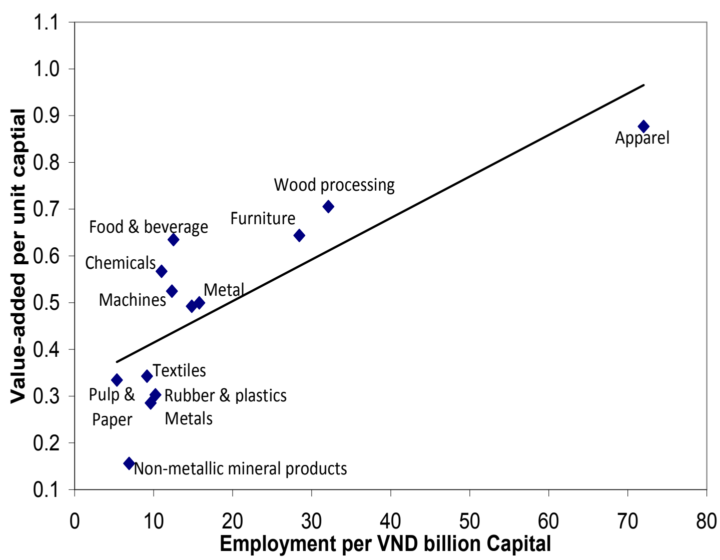
Source: authors' calculation from GSO statistics.

Annex 2. Vietnam's Top Ten Manufactured Exports by Revealed Comparative Advantage and Share in Total manufactured exports (%) in 2010

SITC code	Sector	Revealed Comparative Advantage	Share (%)
85	Footwear	12.76	10.98
84	Clothing	6.50	22.36
82	Furniture	4.72	6.38
83	Travel goods & handbags	4.64	1.70
65	Textile yarn & fabrics	2.65	6.57
61	Leather, leather manufactures	2.43	0.78
89	Miscellaneous manufactures	2.06	9.91
62	Rubber manufactures	1.42	1.69
76	Telecom recording equipment	1.18	6.52
63	Cork & wood products	1.14	0.62
	Average RCA and Total Share	3.95	67.51

Source: authors' calculation from the WITS trade database

Annex 3. Value-added and Employment per unit of capital in Manufacturing



Source: authors' calculation from the Industrial Census 2008, GSO

Annex 4. Variable definition

All variables in monetary terms adjusted for the constant price of year 2004

Variable	Definition
EXPORT PARTICIPATION	
Exporter	A dummy (1/0) receiving 1 if a firm is an exporter. A firm is defined as exporter if its direct export holds at least 10 or 50 percent of total revenue.
Export intensity	The share of direct export share over total revenue
Decision to export	A dummy (1/0) receiving 1if a firm is a new exporter in the year of consideration; 0 if the firm remains as non-exporter
Experience of exporting	Number of years since the firm started to export
Age	The number of years since establishment
Revenue	Total sales
Capital	Net book value of machinery and equipment
Employment	The sum of permanent employees and the temporary employees adjusted for the average length of employment of these temporary workers.
Firm size	Logarithm of total assets
Value-added	Total revenue subtracted by total purchases of raw materials, intermediate inputs and energy costs.
Imported inputs	The share of imported intermediate inputs
Capital intensity	Ratio of capital over total employment
Average wage	Total labour cost divided by total employment
FIRM PRODUCTIVITY	
Capital productivity (Value-added per unit of capital)	Ratio of value-added over capital
Labour productivity	Ratio of value-added over total employment

(Value-added per employee)	
Total factor productivity (TFP) *which includes*	We use information of output, capital and employment to estimate the production function to measure the TFP of firms. Output takes the form of both revenue and value-added. Estimation methods include the Levisohn and Petrin (2003) and the conventional OLS regression approach.
TFP(LP, value added)	TFP estimated based on the Levisohn and Petrin approach, using value added as output.
TFP(LP, revenue)	TFP estimated based on the Levisohn and Petrin approach, using revenue as output.
TFP(OLS, value added)	TFP estimated based on the conventional OLS approach, using value added as output.
TFP(OLS, revenue)	TFP estimated based on the conventional OLS approach, using revenue as output.
State ownership	Share of state ownership (in percentage)
Foreign ownership	Share of foreign ownership (in percentage)
FIXED-EFFECT DUMMIES	
Sector dummies	The ES2005 classifies the manufacturing sector into 16 branches. We combine Rubber & Plastic Products and Non-metallic Mineral Products into Rubber, Plastic Products & Non-metallic Mineral Products; Basic metals and Metal Products into Basic metals and Metal Products; and finally Machinery and Equipment, Electrical Machineryand Electronics all together. The ES2009 does not cover a number of branches including Leather products, Wood & Wood Productsand Furniture, Paper, Construction Materials; Vehicles and other transport equipment.
Region dummies	There are four region dummies including Southern Central Coast, South East, Mekong River Delta and Northern Central with Red River Delta as the reference group.
Export-oriented sector dummy	The export-oriented sector refers to the following: Food and Beverage, Textiles, Apparel, Leather products, Wood & Wood Productsand Furniture, and Paper.