Innovation and Export of Vietnam's SME Sector

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Abstract

Innovation has long been considered an important factor for creating and maintaining the competitiveness of nations and firms. The relationship between innovation and exporting has been investigated for many countries. However, there is a paucity of research in Vietnam with respect to this issue. In this paper we examine whether innovation performed by Vietnam's small and medium enterprises (SMEs) enhances their exporting likelihood. Using the recently released Vietnam Small and Medium Enterprise Survey 2005, we find that innovation as measured directly by 'new products', 'new production process' and 'improvement of existing products' are important determinants of exports by Vietnamese SMEs.

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1. Introduction

Vietnam's development strategy aims to achieve an effective economic growth. Its success depends to a large degree on the development of the private sector, which consists mainly of SMEs. In the face of Vietnam's integration into the world market and particularly the country's scheduled entry into the WTO by the end of 2006, the SMEs are having a great opportunity to expand by exporting to other markets. But at the same time they are also facing tough competition at their door step.

During the last twenty year of economic reform, export has been a driving force of Vietnam economic growth. The major problem is that the Vietnamese private sector and small and medium enterprises in particular, is not yet sufficiently competitive. As a result, most companies cannot yet withstand the competitive pressure resulting from liberalization and the opening to the world market not to mention exporting to the world market. In order to maintain the economic growth, somehow Vietnamese SMEs must be able to compete in the export market.

The key question facing policy makers is how to improve the competitiveness of Vietnam's SMEs. Among the many initiatives being proposed to improve the competitiveness of Vietnam's SMEs, innovation policy has attracted attention not only from policy makers, but also from researchers and the business community. Innovation in SMEs has also been given special emphasis in a recent declaration in Hanoi by APEC ministers.[1] Examples of concrete activities to improve the competitiveness through innovation of Vietnam SMEs can be found in the websites of Vietnam Ministry of Science and Technology (http://www.most.gov.vn), Ministry of Planning and Investment (http://www.mpi.gov.vn) and Vietnam Competitiveness Initiative (http://www.vnci.org). These initiatives are based on the assumption that innovation can affect a firm's competitiveness and hence export status by increasing productivity (and reducing costs) and by developing new goods for international market.[2]

The relationship between innovation and export performance is often regarded to be of paramount importance to an economy and has long been investigated by many researchers around the world (e.g. Narula and Wakelin, 1998, Greenhalgh, 1990;

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[1] See *The Hanoi Declaration on Strengthening SME Competitiveness for Trade and Investment*, *http://www.apec.org/apec/ministerial_statements/sectoral_ministerial/small___medium_enterprises/2006_small_and_medium.html*

[2] This can be analyzed in the context of firms that compete in markets with differentiated products. Firms sell low-quality goods in domestic markets, but if they want to sell abroad then they must upgrade technologies to produce high-quality goods.

Verspagen and Wakelin, 1997; Montobbio and Rampa, 2005 and DiPietro and Anoruo, 2006). However, in Vietnam, virtually, there is no research on the relation between innovation and export in general and for SMEs in particular. Given the paucity of research and the active innovation initiatives being implemented, an immediate research into this issue is called for.

In this paper, we investigate the causation of innovation on export using the newly released data set, the Vietnam Small and Medium Enterprise Survey 2005. There are several important features of this dataset. First, this dataset allows us to distinguish between (i) product innovation; (ii) process innovation and (iii) modification/ improvement of existing product. As indicated in the review section below, most of the previous studies did not distinguish between types of innovation, particularly the incremental innovation of modifying existing product. Second, with detailed information about the firms, we are able to find various instruments to deal with the potential endogeneity problem of innovation. Using both the instrumental approach and the bivariate probit model, we find that innovation is an important determinant of export.

This paper is structured as follow. We briefly describe the situation of SMEs in Vietnam in the next Section. Section 3 reviews the literature while section 4 describes the data used. The empirical approaches are in Section 5. The estimation results are reported in Section 6. Section 5 concludes.

2. The development of SMEs in Vietnam

Doi moi (Renovation) was officially carried out since 1986, marks the transition from a centrally planned economy to a market economy of Vietnam. Since then, Vietnam has been under pressure to reduce the size of the state-owned sector. In this process, the private sector has emerged. As a result, small and medium-sized enterprises (SMEs) have emerged as a dynamic force in the development of the Vietnamese economy since the launching of the *doi moi* (Hansen, 2005).

Table 1 presents a breakdown of Vietnamese SMEs by ownership category for the period of 2000-2004. The first row shows the total number of SMEs. . The data indicates that, after a period of 5 years up to 2004, the numbers of SMEs are more than double with the average growth rate is about 25% per year. In the last three rows, number of SMEs is computed as a share of each ownership type on total. The ownership structure of SMEs indicates that most of SMEs are non-state owned. The number of SMEs in state sector decreased due to the progress of privatization. In 2000, there was 11% of state owned SMEs versus only 3% in foreign owned one. In 2004, the shares of SMEs in these two sectors are equal (3%).

Table 1. Number and ownership structure of Vietnamese SMEs 2000-2004

Year	2000	2001	2002	2003	2004
Total	39,897	49,062	59,831	68,687	88,222
Ownership structure					
State owned enterprise	11%	8%	6%	5%	3%
Non-state enterprise	86%	89%	91%	92%	94%
Foreign investment enterprise	3%	3%	3%	3%	3%

Source: Authors' calculation based on Enterprise Census 2000-2004 of GSO of Vietnam.

Table 2 presents the share of SMEs on total number of firms in Vietnam. The first row shows the share of total SMEs on total firms. The data shows that almost 95% of the total of existing firms in Vietnam is SMEs. Breakdown in to type of ownership, the last three rows indicate the share of SMEs in each ownership sector. The fact is that SMEs constitute an overwhelming share of private sector in Viet Nam (99%). Share of SMEs in foreign owned firms (joint venture or 100% foreign owned one) are slightly decrease but still more than three quarters of the firms in that sector. Share of state-owned SMEs are decrease due to privatization.

Table 2. Share of Vietnamese SMEs in total firms by type of ownership

Year	2000	2001	2002	2003	2004
Total	94%	95%	95%	95%	96%
Ownership structure					
State owned enterprise	73%	70%	68%	65%	64%
Non-state enterprise	99%	99%	98%	98%	99%
Foreign investment enterprise	80%	82%	78%	76%	77%

Source: Author's elaboration based on Enterprise Census 2000-2004 of GSO of Vietnam.

Table 3 present the sectoral structural change of Vietnamese SMEs during the last five years. The data shows that most of structural changes occurred in 2000-2004 within the agriculture/fishing and services sectors. The number of SMEs working in agriculture and fishing remarkably decreased during the last five years. Less than 1% SMEs is remaining in agriculture, almost halved (compared to about 2% in 2000). Share of SMEs in fishing is just above 1.5% (more than 6% in 2000). In contrast to agriculture and fishing, more SMEs engage in services sector (about 20% in 2004 vs. 15.4% in 2000).

Table 3. Sectoral structure of Vietnamese SMEs

Sector Year	2000	2001	2002	2003	2004
Total (100%)	39,897	49,062	59,831	68,687	88,222
Agriculture and forestry	1.96%	1.48%	1.32%	1.15%	0.99%
Fishing	6.14%	5.21%	2.44%	2.13%	1.53%
Mining and quarrying	0.86%	1.16%	1.60%	1.39%	1.27%
Manufacturing	22.93%	22.38%	25.08%	21.84%	20.90%
Electricity, gas and water supply	0.25%	0.27%	0.39%	0.34%	1.65%
Construction	8.89%	10.54%	15.18%	13.22%	13.23%
Trade	43.48%	41.81%	47.10%	41.03%	40.66%
Services	15.48%	17.15%	6.90%	18.91%	19.79%

Source: Author's elaboration based on Enterprise Census 2000-2004 of GSO of Vietnam.

The performance of SMEs can be observed though the state, non-state and foreign owned sectors. Regarding the GDP contribution, according to CIEM (2005), in 2005 share of state sectors in GDP at current prices has almost the same as it was in 2000 (38.42% vs. 38.52% respectively). Non-sate sector contribution to GDP reduced from 48.2 in 2000 to 46.03% in 2005. As a result, foreign invested sector contribution increased (15.89% in 2005 vs. 13.27% in 2000). CIEM (2005) also reported the investment behaviour by ownership. Interestingly, share of non-state sector investment remarkably increased which is 32.2% in total 2005 investment vs. 22.6% in 2000. It implies that the private sector, or SMEs, now is paying more attention in investment into their production. Hansen (2006) studied the determinants of growth and survival of SMEs. A study, which was based on a panel data of Vietnamese SMEs from 1990-2000, shows that innovation has positive and significant effect on survival of SMEs.

The potential and significance of the SME-sector stand in contrast to the lack of detailed understanding of the determinants of firm's export and innovation performance in

Vietnam. Given the lack of research on innovation being implemented in Vietnam, an immediate research into this issue is called for.

3. Innovation and export performance: A review[3]

At the macrolevel, international trade models developed by Vernon (1966), Krugman (1979), among others suggest that innovation is the driving force behind exports. In a pioneering work, Krugman (1979) argues that the causation ran from innovation to export. As developing countries imitate the innovative products exported from developed countries, they will later be able to export these matured products. For developed countries, they have to innovate to keep up their export and income. More recently Grossman and Helpman (1991, 1995) in their monopolistic model show that demand-shift factors (technological innovation) could shift a country export demand curve outwards.

At the firm level, it has been argued that innovating firms have incentives to expand into other markets so as to earn higher returns from their investment (Teece, 1986). Through innovation the innovating firms will obtain and sustain its competitive advantage not only in the domestic market but also to enter the global market. Therefore we can expect a positive linkage from innovation to export.

At the marco level, there are ample evidence of the linkage between a country's export performance and its innovation activities (Greenhalgh, 1990; Verspagen and Wakelin, 1997; Narula and Wakelin, 1998; Leon-Ledesma, 2005). For example, Montobbio and Rampa (2005) study the issue of the relationship between technological performance and export growth during 1985–98 for nine large developing countries and 25 primary and secondary sectors. Using structure decomposition analysis, they find that technological advancements partly explain export performance in a way that the characteristics of the specific technological and learning processes affect the relationship between technological investments, innovation, and export market gains according to the technological intensity of sectors. At sectoral level, technological activity generates export gains (i) in high-tech sectors if a country expands its innovative activities in industries with increasing levels of technological opportunities; (ii) in medium-tech sectors if the countries moving out of low opportunity sectors; and (iii) in low-tech

[3] There is a large body of research concerning the relationship between export and productivity. Although productivity and innovation are closely related, we do not attempt to review the literature between export ad productivity here. We only review studies that explicitly examines innovation (measured directly as in our paper or through some other proxies such as R&D activities/expenditure or patent counts). For a review of this literature, see Wagner (2005).

sectors if it is specialized, in the initial year, in sectors with a greater growth of their world share.

DiPietro and Anoruo (2006) try to examine the influence country's creative activity on the value of its exports using data of 59 countries for the year 2000 taken from the World Economic Forum. By using cross-country regressions of exports on creativity and its four constituent parts namely creativity, innovation, technology, technology transfer, and business startups, they find that the results support to the hypothesis that creativity matters for the value of a country's exports. Every one of the creativity indexes has the expected positive sign and statistically significant at 10% level or better. Regarding the influence on total value of export, the impact range falls from: 6% of the cross-country variation explained by technology transfer to 32% by innovation. On the effects of creativity indexes on high-tech exports, the individual creativity indexes explain significant amount of 30% the cross-country variation.

In contrast, at the firm/plant level, the empirical evidence is not conclusive. A number of authors have reported a positive and significant impact of innovation on export performance. Hirsch and Bijaoui (1985) in their study of Israeli firm found that innovative firms are more likely to have export activities and that the number of R&D employees has a positive and significant effect on their export growth. Smith et al (2002) also found R&D is important for being an exporting firm. In their study for the UK, Harris and Li (2006) report that R&D plays an important role for firms to overcome barriers to internationalisation, but conditional on having entered export markets R&D does not increase export intensity. Similar results are reported by Özçelik and Taymar, (2004); Barber and Alegre (2007). Özçelik and Taymar (2004) study the export performance of Turkish firms working on manufacturing industries. Using the innovation database of about 4000 firms, they estimates export intensity depends on various firm characteristic variables. Innovation activity and R&D intensity are found to influence export performance. Pla-Barber and Alegre (2007) also show a significant link between innovation and export intensity when examining data of 121 firms in the French biotechnology industry. The link is seems to be amplified when they focus their study only on science-based industry such as biotechnology. Zhao and Li (1997) test the influence of R&D on export propensity by using data of 1,743 Chinese firms in 39 manufacturing sectors. The results show that innovating firms have higher probability to select themselves entering to the international market than the non-innovator. R&D intensity is positively associated with export performance and it relation is reciprocal. Firms spend 1% in R&D have an induced level of 11% increase in export growth. Their results suggest high R&D investment may be necessary for firms to overcome barriers to entry into foreign markets. Wakelin (1998) also shares the same conclusion with Zhao

and Li, that innovating firms are less likely to become exporters than non-innovating firms but large innovating firms are most likely exporters.

Basile (2001), when examining the behavior of Italian manufacturing firms, find the same answer with others. Applying the Probit model for the probability of exporting, he find that "firms that introduce product and/or process innovations either through R&D activity or through investments in new capital equipment are more likely to export". Moreover, the results also show the export intensity of innovating firm is higher than that of non-innovating firm.

On the other hand, some contradicting results are also reported in the literature. Wakelin (1998) finds that innovating firms are less likely to become exporters than non-innovating firms but large innovating firms are most likely exporters. Some studies even report that the association between innovation and export is insignificant (Lefebvre et. al. 1998, and Starlacchini 2001). More recently, Alvarez (2007) analyzes the determinants of export performance for Chilean manufacturing plants. By distinguishing between firms as non-exporters, sporadic exporters, and permanent exporters, he found that initial firm characteristics such as productivity, skill intensity, size and participant of foreign capital increase the probability of being [permanent/sporadic] exporter. However, the factors that determine success in the exporting process are neither labor skills nor TFP and technological innovation. Labor skill and TFP are found positively associated with exporting, but this factors' effect on probability of being successfully in export performance is negligible. Technological innovation is measured by expenditure in license. Alvarez's proxy for technological is that more technological innovation plays insignificant role in enabling firm to enter international market, moreover, its impact on the firms' export performance rather negative but not significant. His explanation is also an answer for our question above on comparative advantage "technological innovation is not a source of comparative advantage in a developing country like Chile" (Alvarez, 2007, p. 384).

A problem inherent in establishing the causal direction between innovation and export. As pointed out by Lachenmaie and Wößmann (2006) most of the previous studies failed to deal with the problem of endogeneity between innovation and export. Several recent studies have attempted to deal with the problem of endogeneity explicitly (Lachenmaie and Wößmann 2006, Smith et al 2002, Kleinknecht and Oostendorp 2006). This endogeneity is due to the fact that (i) competition on the international markets would force exporting firms to innovate to remain competitive and (ii) the exporting firms may 'learn by exporting' as they are exposed to a richer source of knowledge, expertise and technology that is often not available in the home market. Several approaches could be used to handle the endogeneity of innovation. Smith et al (2002), and Kleinknecht and Oostendorp (2006) adopt the simultaneous equation approach while Lachenmaie and

Wößmann (2006) use the instrumental variable approach. Most recently, Becker and Egger (2007) use the propensity score matching approach. The conclusion from these studies is that after taking into account the endogeneity issue, innovation measured by R&D (Kleinknecht and Oostendorp 2006) or directly observed (Lachenmaie and Wößmann 2006, and Becker and Egger 2007) is found to be important determinant of export.

Before we move on to the next section, it is worth noting that, most of the studies only deal with product innovation with the exception of Lachenmaie and Wößmann (2006) and Becker and Egger (2007). These authors distinguish product innovation from process innovation.

4. Data and descriptive statistics

We use the Vietnam Small and Medium Enterprise Survey conducted in 2005 (SME 2005). The Small and Medium Scale Enterprise (SME) Survey in Vietnam has been conducted since 1991. The survey has been conducted four times in 1991, 1997, 2002 and 2005 by the Ministry of Labor, Invalid and Social Affairs (MOLISA) and the Stockholm School of Economics. Although attempts have been made to make it possible for researchers to construct a panel data, in our study we use only the 2005 wave as previous waves do not contain the necessary innovation information for our purpose.[4]

A number of previous studies have used R&D expenditure as indirect measures of innovation (Basile 2001, Kleinknecht and Oostendorp 2006, Zhao and Li 1997). This can be considered as a limitation as the R&D expenditures can capture only part of the inputs in the innovation black box. More and preferred measures of innovation would be explicit information of innovation. Several previous studies have used such explicit measures of innovation (Wakeline 1998, Roper and Love 2002, Cassiman and Martinez-Ros 2004, Lachenmaie and Wößmann 2006). In Vietnam, the survey is the only source of data that contains innovation information for enterprises in general and SMEs in particular. One of the useful and interesting feature of the survey is that various measures of innovation are available. The survey distinguishes between whether the firm introduced new products, improved existing products and introduced new production process/new technology. These are the measures of innovation we used in this paper. Compared with previous studies which mainly focused on new product innovation (with the exception of Lachenmaie and Wößmann (2006) and Becker and Egger (2007), we contribute to the literature by exploring the impacts of process innovation and product improvement on export behaviour of SMEs.

[4] In particular, the SME2002 does not distinguish between product versus process innovation.

As discussed below, one of the approach we used in this paper is the IV approach. Several potential instruments can be identified in the data and they are described in Table 3. They are the number of skilled workers in the labour force, investment strategy, perception of firm's owner with respect to the importance of lacking skilled workers in starting up new project, and training.

5. Modelling the impacts of innovations on export

Following Robert and Tybout (1997) and Bernard and Jensen (1999), we assume that the decision to export is made by rational and profit maximising firm. If the expected profit of exporting is greater than not exporting the firm will export its products.

Our basic export model is as follow:

$$Export = \beta_0 + \beta'_1 X + \theta_2 Innovation + \varepsilon \quad (1)$$

where *Export* is an indicator taking value of 1 if firm *i* is exporter and 0 otherwise, Innovation is a vector of innovation measure (new products, new production process/technology, or improvement of existing products), X is an vector which includes firm's characteristics such as firm size, turnover, capital intensity, regional dummies, sector dummies and owner/manager characteristics, and ε is an error term.

As discussed above, the relationship between innovation and export is potentially endogenous. Hence, direct estimation of the equation (1) above using logit/probit model without taking the endogeneity into account will lead to a biased estimate of the causal effect of innovation on export. This is because the innovation measures may be correlated with the error term ε. Two common approaches have been used in the literature to deal with the endogeneity of innovation on export, namely the instrumental variable (IV) approach (Lachenmaie and Wößmann 2006) and simultaneous equation approach (Smith et al 2002).

The basic idea of the IV approach is to find variables that are highly correlated with innovation but not with the error term, ε, in the *Export* equation (1) above. Usually another regression equation is specified for *Innovation* as follow:

$$Innovation = \gamma' Z + \varepsilon \quad (2)$$

where the vector Z will includes the instrumental variables. The fitted value of innovation obtained after estimating equation (2) will serve as the instrument in equation (1).

Following Lachenmaie and Wößmann (2006) we adopt the IV approach to handle the problem of endogeneity between export and innovation, using variation in innovations that is credibly exogenous to exports. In the first stage (equation (2)), they include

'innovation impulses' that they argued to be exogenous to export and then use the fitted value of innovation in the equation (1) above.

The difficult part of the IV approach is to identify appropriate instruments as the problem of weak instrument is well-documented. Fortunately, in our data, there are several potential instruments. They are the number of employees having college education, the awareness of the owners/managers regarding the difficulty of lacking skilled workers, and most importantly, the investment strategy of the enterprises. We believe that the investment strategy of the enterprise, perception toward skilled workers and the number of skilled employees will be important determinants for innovation but not for export.

In addition to the IV approach, we also follow Smith et al (2002) to specify export and innovation in a system of equations to disentangle the determination of exports in an export equation from the determination of innovation in an innovation equation. In particular, we estimate the following model

$Y'_1 = \beta'_1 X_1 + \varepsilon_1$ $\quad Y_1 = 1$ if firm *i* is an exporter, else $Y_1 = 0$ (3)

and

$Y'_2 = \beta'_2 X_2 + \varepsilon_2$ $\quad Y_2 = 1$ if firm *i* is an innovator, else $Y_2 = 0$ (4)

Y_1 and Y_2 are export and innovation indicators respectively. The covariance of the residuals in the above two equation is given by Cov ($\varepsilon 1$, $\varepsilon 2$) = ρ where the residuals are standard residuals with zero means and a variance equal to one. Due to the fact that both Y_1 and Y_2 are binary variable, a bivariate probit model would be appropriate choice. In our paper, we use the maximum likelihood estimation to estimate the above bivariate probit model. (Green 2000).

Ideally, the vectors X_1 and X_2 should not be exactly the same for the purpose of identification. This may cause some problem for researchers to identify factors that affect export but not innovation. However, as suggested by previous studies, we can rely on the functional non-linearity for identification purposes. At the very least, because this approach has been used by previous studies, we could rely on non-linearity for identification. Smith et al. (2002) make several assumptions for identification exclusion. In their model wage share, average salary, and financial solvency are assumed to affect exports but not innovation (i.e. R&D). Fortunately, as discussed above, there are several potential instruments available namely the number of employees having college

education, the awareness of the owners/managers regarding the difficulty of lacking skilled workers, and the investment strategy of the enterprises.[5]

6. Estimation result

The estimation results for the relation between (i) new product innovation and export; (ii) new process innovation and export; and (iii) modification to existing products and export are reported in Tables 5, 6, and 7 respectively. In each of the table, we report three export models: (i) simple probit model which does not deal with the endogeneity; (ii) IV model and (iii) Bivariate probit model.

We report both the export equation and the innovation equation. In the export equation we include we include several control variables often found in the literature such as regional dummies, sectoral dummies, revenue, average wage, wage share. The key variable of interest is the innovation variable. In the (i) the first-stage innovation equation for the IV model and (ii) the innovation equation for the bivariate probit model, we include we include revenue turnover, the number of skill workers, training of worker, awareness of owner with respect to the importance of skilled workers and investment strategy. Now, for ease of exposition, we discuss each model in turn.

6.1 New product innovation and export

In the simple probit model, revenue (logrev04) and wage share (wageshare04) are positive and statistically significant, indicating that revenue and wage share increasing the probability of being exporter. The variable average wage (wagemean04) is statistically significant but having negative sign, implying the higher the cost of labour the less likely the firm will export. This is quite interesting and consistent with the situation of Vietnamese's firms and SMEs in particular whose exports are labour intensive. As a result, firms producing labour intensive products (higher wage share) will be more likely to export while firms producing relatively capital intensive products (higher average labour cost) will be less likely to export. products. These results are of similar magnitude and consistent across the IV model and the bivariate probit model.

As for the variable of interest, product innovation (newproduct) is found to be a statistically significant determinant of exporting. This implies that the more innovative firms will be more likely to export. Taking into account the potential endogeneity problem in the IV model and the bivariate model, the variable product innovation is found to be statistically significant. The magnitude of the estimate from the IV model is much higher than the simple probit model while the estimate from the bivariate model

[5] Smith et al (2002), that is we assume wage share and average salary are important determinant in innovation equation but not in the export equation.

lies in between the simple probit and the IV models. As the bivariate probit model is the most efficient model estimating the two equations simultaneously, the preferred specification is the bivariate model. The covariance (rho) is also statistically significant, and we reject the hypothesis that the covariance of the two error terms is zero. This indicates that studies that do not take into account the endogeneity of the innovation will lead to biased estimate of the impact of innovation on export.

In the product innovation equation, we find that our instruments are all statistically significant except the number of skilled workers (skillworkers).

6.2 New process innovation and export

For the process innovation we obtain similar results to product innovation. Revenue (logrev04) and wage share (wageshare04) are positive and statistically significant while average wage (wagemean04) is statistically significant but having negative sign. The variable of interest, process innovation is of positive sign and also statistically significant. In terms of the magnitude of the estimate, the same pattern is found similar to product innovation with the highest estimate from IV and lowest from the simple probit model. As the preferred model, the estimate from the bivariate mode indicates that process innovation is also increasing the likelihood of exporting. The covariance of the error terms is also significant statistically and the null hypothesis that there is no correlation between the two equations is rejected, indicating that we need to take into account the endogeneity problem again in the model for process innovation.

6.3 Modification to existing products and export

Similar to the product innovation and process innovation, we find similar pattern of results for the model of modification of existing products. The innovation variable is found to be statistically significant in all three model. In the bivariate probit model, however, the covariance parameter is not statistically significant.

The estimation results discussed above indicate that innovation is important determinants of the probability of exporting for Vietnamese SMEs.

7. Conclusion

In this paper, we examine whether innovation causes export for a sample of Vietnam's small and medium enterprises. We use three measures of innovation, namely product innovation, process innovation and modification of existing product. Previous studies have only examined product and process innovation. Thus we add to the literature by examining the impact of modification of existing products on exporting. We employ both the instrumental variable approach and the bivariate probit model to deal with the endogeneity of innovation. Our results indicate that all three measures of innovation are

important determinants of exporting. We also find evidence of the endogeneity of innovation. Previous studies which failed to take this endogeneity into account may lead to biased estimate of innovation.

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Table 4. Description of variables (N=2738)

Variable	Description	Mean	Std. Dev.
Dependent variable			
EXPORT	1 if exporter, 0 otherwise	0.06	0.25
Innovation			
NEWPRODUCT	1 if firm introduces new product(s), 0 otherwise	0.41	0.49
NEWPROCESS	1 if firm introduces new production process, 0 otherwise	0.30	0.46
MODIPRODUCT	1 if firm makes major improvements of existing product(s) or changes specification, 0 otherwise	0.60	0.49
Control variables			
LOGREV04	Log of firm's revenue in 2004	12.95	1.71
WAGEMEAN04	Ratio of total wage to number of employees (Vietnam Dong)	7862.55	12111.32
WAGESHARE04	Ratio of total wage to firm's revenue in 2004	0.13	0.14
Instruments			
SKILLWORKERS	Number of skill workers	3.84	16.61
INV_CAPACITY (investment strategy)	1 if firm invests in their capacity, 0 otherwise	0.38	0.49
INV_REPLACE (investment strategy)	1 if firm invests in replacing old equipment, 0 otherwise	0.11	0.31
INV_PRODUCTIVITY (investment strategy)	1 if firm invests in improving their productivity, 0 otherwise	0.07	0.25
INV_QUALITY (investment strategy)	1 if firm invests in improving their quality of output, 0 otherwise	0.02	0.13
INV_NEW (investment strategy)	1 if firm invests in producing new output, 0 otherwise	0.02	0.15
INV_OTHER (investment strategy)	1 if firm's investment is for other purposes, 0 otherwise	0.02	0.14
LACKSKILLEDWORKER	1 if firm's owner perceived the importance of lacking skilled workers in staring up new projects, 0 otherwise	0.30	0.46
TRAINING2	1 if firm normally trains its existing workers or new workers, 0 otherwise	0.06	0.23
Location			
HCM	1 if firm located in Ho Chi Minh city, 0 otherwise	0.25	0.43
HN	1 if firm located in Hanoi city, 0 otherwise	0.11	0.31
HAIPHONG	1 if firm located in Hai Phong city, 0 otherwise	0.07	0.26
HATAY	1 if firm located in Ha Tay province, 0	0.14	0.35

	otherwise		
LONGAN	1 if firm located in Long An province, 0 otherwise	0.05	0.21
PHUTHO	1 if firm located in Phu Tho province, 0 otherwise	0.10	0.30
QUANGNAM	1 if firm located in Quang Nam province, 0 otherwise	0.06	0.24
NGHEAN	1 if firm located in Nghe An province, 0 otherwise	0.14	0.35
KHANHHOA	1 if firm located in Khanh Hoa province, 0 otherwise	0.04	0.19
Sector			
FOOD	1 if firm engaged in manufacturing food sector (meat, grain, bakery), 0 otherwise	0.25	0.43
BEERTOBACO	1 if firm engaged in manufacturing beer and tobacco sectors, 0 otherwise	0.03	0.16
TEXTILE	1 if firm engaged in textile sector, 0 otherwise	0.09	0.29
WOOD	1 if firm engaged in manufacturing wood sector (wood, pulp and furniture), 0 otherwise	0.21	0.40
PRINTING	1 if firm engaged in publishing, printing and related media sectors, 0 otherwise	0.02	0.15
CHEMICAL	1 if firm engaged in chemical sector (basic chemical and other chemical, coke, petroleum), 0 otherwise	0.02	0.14
RUBBER	1 if firm engaged in manufacturing rubber sector, 0 otherwise	0.13	0.33
MACHINARY	1 if firm engaged in manufacturing machinery sector, 0 otherwise	0.05	0.23
JEWELLERY	1 if firm engaged jewellery sector, 0 otherwise	0.03	0.17

Table 5. Product innovation model

Determinants of export performance, dependent variable: EXPORT

Variable	Probit estimation			IV estimation			Bivariate estimation		
	Coef.	**Std. Err.**	**P>|z|**	**Coef.**	**Std. Err.**	**P>|z|**	**Coef.**	**Std. Err.**	**P>|z|**
LOGREV04	0.513	0.036	0.000	0.416	0.047	0.000	0.454	0.054	0.000
WAGEMEAN04	0.000	0.000	0.040	0.000	0.000	0.071	0.000	0.000	0.049
WAGESHARE04	2.386	0.267	0.000	2.257	0.269	0.000	2.242	0.285	0.000
NEWPRODUCT	0.344	0.100	0.001	1.509	0.464	0.001	0.876	0.288	0.002
HCM	-0.166	0.250	0.507	-0.027	0.251	0.916	-0.090	0.245	0.713
HN	-0.216	0.267	0.418	-0.132	0.264	0.618	-0.167	0.260	0.520
HAIPHONG	-0.913	0.329	0.005	-0.812	0.327	0.013	-0.836	0.322	0.010
HATAY	-0.496	0.274	0.070	-0.308	0.278	0.267	-0.391	0.272	0.151
LONGAN	-0.319	0.361	0.376	-0.381	0.354	0.282	-0.344	0.349	0.325
PHUTHO	-0.311	0.346	0.368	-0.192	0.348	0.581	-0.241	0.338	0.476
QUANGNAM	-0.380	0.391	0.331	-0.113	0.395	0.776	-0.250	0.384	0.514
NGHEAN	-0.523	0.318	0.101	-0.396	0.317	0.212	-0.447	0.311	0.151
KHANHHOA	0.023	0.314	0.942	0.067	0.314	0.831	0.060	0.305	0.845
FOOD	0.385	0.208	0.063	0.717	0.237	0.002	0.505	0.207	0.015
BEERTOBACO	0.309	0.357	0.387	0.511	0.362	0.158	0.375	0.348	0.282
TEXTILE	0.885	0.199	0.000	0.895	0.199	0.000	0.852	0.197	0.000
WOOD	0.526	0.192	0.006	0.516	0.192	0.007	0.498	0.187	0.008
PRINTING	0.221	0.322	0.492	0.119	0.325	0.714	0.158	0.316	0.616
CHEMICAL	0.022	0.375	0.953	0.279	0.376	0.458	0.109	0.366	0.766
RUBBER	0.262	0.208	0.207	0.365	0.209	0.081	0.287	0.201	0.154
MACHINARY	-0.024	0.249	0.924	0.025	0.247	0.921	-0.016	0.241	0.948
JEWELLERY	0.897	0.257	0.000	0.912	0.257	0.000	0.860	0.252	0.001
_CONS	-9.250	0.585	0.000	-8.643	0.592	0.000	-8.692	0.733	0.000
Rho							-0.345	0.176	0.072
Observations		2739			2738			2738	
LR Chi square		478.87(22)			477.59				
Wald Chi square								761.55(50)	
Pro>Chi square		0.00			0.00			0.00	
Pseudo R square		0.3665			0.3655				
Log likelihood		-413.88			-414.46			-2029.97	

First-Stage, dependent variable: NEWPRODUCT

Variable	Probit estimation			IV estimation			Bivariate estimation		
	Coef.	Std. Err.	P>|z|	Coef.	Std. Err.	P>|z|	Coef.	Std. Err.	P>|z|
LOGREV04				0.127	0.019	0.000	0.120	0.020	0.000
SKILLWORKERS				0.003	0.003	0.331	0.004	0.004	0.232
INV_CAPACITY				0.276	0.062	0.000	0.271	0.062	0.000
INV_REPLACE				0.285	0.088	0.001	0.271	0.088	0.002
INV_PRODUC~Y				0.447	0.108	0.000	0.429	0.108	0.000
INV_QUALITY				0.596	0.198	0.003	0.605	0.195	0.002
INV_NEW				0.815	0.181	0.000	0.776	0.183	0.000
INV_OTHER				0.261	0.187	0.162	0.254	0.185	0.171
LACKSKILLE~R				0.278	0.058	0.000	0.291	0.058	0.000
TRAINING2				0.437	0.118	0.000	0.466	0.117	0.000
HCM				-0.304	0.151	0.044	-0.304	0.151	0.045
HN				-0.330	0.161	0.041	-0.330	0.161	0.040
HAIPHONG				-0.285	0.169	0.092	-0.285	0.169	0.093
HATAY				-0.439	0.157	0.005	-0.434	0.157	0.006
LONGAN				0.134	0.184	0.467	0.134	0.183	0.466
PHUTHO				-0.522	0.168	0.002	-0.521	0.168	0.002
QUANGNAM				-0.698	0.179	0.000	-0.693	0.179	0.000
NGHEAN				-0.391	0.160	0.014	-0.394	0.160	0.014
KHANHHOA				-0.279	0.193	0.148	-0.272	0.193	0.159
FOOD				-0.694	0.083	0.000	-0.694	0.083	0.000
BEERTOBACO				-0.417	0.172	0.015	-0.413	0.172	0.016
TEXTILE				-0.065	0.104	0.530	-0.070	0.104	0.501
WOOD				0.036	0.082	0.665	0.034	0.082	0.678
PRINTING				0.171	0.179	0.340	0.165	0.179	0.355
CHEMICAL				-0.426	0.200	0.033	-0.426	0.200	0.034
RUBBER				-0.230	0.093	0.014	-0.232	0.093	0.013
MACHINARY				-0.081	0.125	0.520	-0.082	0.125	0.511
JEWELLERY				-0.028	0.156	0.856	-0.031	0.157	0.842
_CONS				-1.670	0.281	0.000	-1.586	0.287	0.000
Observations					2738			2738	
LR Chi square					464.07(28)				
Wald Chi square								761.55(50)	
Pro>Chi square					0.00			0.00	
Pseudo R square					0.1254				
Log likelihood					-1617.65			-2029.97	

Table 6. Process innovation model

Determinants of export performance, dependent variable: EXPORT

Variable	Probit estimation			IV estimation			Bivariate estimation		
	Coef.	**Std. Err.**	**P>|z|**	**Coef.**	**Std. Err.**	**P>|z|**	**Coef.**	**Std. Err.**	**P>|z|**
LOGREV04	0.506	0.036	0.000	0.395	0.055	0.000	0.418	0.055	0.000
WAGEMEAN04	0.000	0.000	0.048	0.000	0.000	0.063	0.000	0.000	0.057
WAGESHARE04	2.368	0.266	0.000	2.267	0.268	0.000	2.206	0.274	0.000
NEWPRODUCT	0.203	0.100	0.042	1.221	0.411	0.003	0.819	0.261	0.002
HCM	-0.239	0.245	0.329	-0.196	0.244	0.423	-0.217	0.236	0.356
HN	-0.293	0.264	0.266	-0.467	0.274	0.089	-0.394	0.256	0.124
HAIPHONG	-0.971	0.326	0.003	-1.000	0.326	0.002	-0.960	0.315	0.002
HATAY	-0.571	0.269	0.034	-0.626	0.271	0.021	-0.588	0.259	0.023
LONGAN	-0.313	0.354	0.376	-0.328	0.352	0.352	-0.325	0.339	0.338
PHUTHO	-0.411	0.344	0.231	-0.404	0.344	0.239	-0.423	0.331	0.202
QUANGNAM	-0.430	0.379	0.257	-0.385	0.380	0.311	-0.404	0.366	0.270
NGHEAN	-0.601	0.315	0.057	-0.666	0.317	0.035	-0.653	0.305	0.032
KHANHHOA	-0.103	0.312	0.740	-0.289	0.322	0.370	-0.222	0.305	0.466
FOOD	0.351	0.207	0.089	0.385	0.207	0.063	0.355	0.199	0.074
BEERTOBACO	0.322	0.348	0.356	0.149	0.361	0.680	0.205	0.344	0.552
TEXTILE	0.890	0.199	0.000	0.883	0.199	0.000	0.845	0.195	0.000
WOOD	0.548	0.192	0.004	0.582	0.192	0.002	0.548	0.185	0.003
PRINTING	0.227	0.320	0.479	0.060	0.327	0.855	0.113	0.314	0.718
CHEMICAL	0.021	0.372	0.956	0.062	0.367	0.865	0.032	0.357	0.928
RUBBER	0.265	0.207	0.200	0.277	0.207	0.180	0.256	0.200	0.201
MACHINARY	-0.004	0.249	0.988	0.002	0.247	0.993	-0.003	0.239	0.991
JEWELLERY	0.911	0.257	0.000	0.887	0.257	0.001	0.853	0.251	0.001
_CONS	-8.980	0.580	0.000	-7.786	0.722	0.000	-7.879	0.797	0.000
Rho							-0.388	0.150	0.021
Observations		2739			2738			2738	
LR Chi square		470.90(22)			475.82(22)				
Wald Chi square								832.69(50)	
Pro>Chi square		0.00			0.00			0.00	
Pseudo R square		0.3604			0.3642				
Log likelihood		-417.86			-415.34			-1812.19	

First-Stage, dependent variable: NEWPROCESS

Variable	Probit estimation			IV estimation			Bivariate estimation		
	Coef.	**Std. Err.**	**P>|z|**	**Coef.**	**Std. Err.**	**P>|z|**	**Coef.**	**Std. Err.**	**P>|z|**
LOGREV04				0.218	0.021	0.000	0.207	0.021	0.000
SKILLWORKERS				0.007	0.004	0.087	0.010	0.004	0.018
INV_CAPACITY				0.396	0.067	0.000	0.392	0.067	0.000
INV_REPLACE				0.496	0.093	0.000	0.476	0.093	0.000
INV_PRODUC~Y				0.440	0.115	0.000	0.422	0.114	0.000
INV_QUALITY				0.927	0.204	0.000	0.925	0.202	0.000
INV_NEW				0.905	0.182	0.000	0.851	0.183	0.000
INV_OTHER				0.279	0.202	0.167	0.279	0.199	0.161
LACKSKILLE~R				0.118	0.061	0.055	0.138	0.061	0.024
TRAINING2				0.556	0.118	0.000	0.579	0.117	0.000
HCM				-0.055	0.163	0.736	-0.055	0.163	0.737
HN				0.384	0.171	0.025	0.379	0.172	0.027
HAIPHONG				0.009	0.182	0.962	0.004	0.182	0.980
HATAY				0.129	0.169	0.443	0.134	0.169	0.425
LONGAN				0.035	0.198	0.861	0.038	0.198	0.849
PHUTHO				-0.181	0.186	0.330	-0.181	0.185	0.327
QUANGNAM				-0.259	0.195	0.185	-0.259	0.195	0.184
NGHEAN				0.099	0.171	0.566	0.088	0.171	0.607
KHANHHOA				0.452	0.200	0.024	0.453	0.200	0.024
FOOD				-0.130	0.088	0.137	-0.130	0.088	0.138
BEERTOBACO				0.283	0.170	0.097	0.284	0.170	0.095
TEXTILE				-0.071	0.111	0.522	-0.077	0.111	0.491
WOOD				-0.120	0.090	0.180	-0.121	0.089	0.175
PRINTING				0.375	0.188	0.045	0.367	0.188	0.050
CHEMICAL				-0.058	0.214	0.787	-0.056	0.215	0.796
RUBBER				-0.102	0.101	0.314	-0.108	0.101	0.288
MACHINARY				-0.071	0.134	0.595	-0.074	0.134	0.582
JEWELLERY				0.021	0.166	0.899	0.017	0.165	0.918
_CONS				-3.795	0.313	0.000	-3.657	0.315	0.000
Observations					2738			2738	
LR Chi square					528.66(28)				
Wald Chi square								832.69(50)	
Pro>Chi square					0.00			0.00	
Pseudo R square					0.1591				
Log likelihood					-1396.70			-1812.19	

Table 7. Product modification model

Determinants of export performance, dependent variable: EXPORT

Variable	Probit estimation			IV estimation			Bivariate estimation		
	Coef.	**Std. Err.**	**P>|z|**	**Coef.**	**Std. Err.**	**P>|z|**	**Coef.**	**Std. Err.**	**P>|z|**
LOGREV04	0.512	0.036	0.000	0.428	0.045	0.000	0.461	0.053	0.000
WAGEMEAN04	0.000	0.000	0.050	0.000	0.000	0.059	0.000	0.000	0.062
WAGESHARE04	2.406	0.267	0.000	2.318	0.267	0.000	2.293	0.285	0.000
NEWPRODUCT	0.337	0.119	0.005	1.621	0.515	0.002	0.853	0.310	0.006
HCM	-0.170	0.249	0.496	0.006	0.255	0.981	-0.081	0.249	0.745
HN	-0.194	0.266	0.466	-0.077	0.267	0.773	-0.130	0.263	0.621
HAIPHONG	-0.937	0.329	0.004	-0.922	0.324	0.004	-0.901	0.322	0.005
HATAY	-0.520	0.272	0.056	-0.521	0.269	0.053	-0.496	0.267	0.063
LONGAN	-0.279	0.358	0.436	-0.205	0.353	0.562	-0.238	0.350	0.496
PHUTHO	-0.292	0.344	0.395	0.017	0.365	0.963	-0.149	0.349	0.669
QUANGNAM	-0.420	0.387	0.277	-0.417	0.384	0.278	-0.399	0.377	0.290
NGHEAN	-0.517	0.318	0.104	-0.405	0.318	0.202	-0.446	0.315	0.157
KHANHHOA	-0.039	0.314	0.901	-0.099	0.311	0.751	-0.057	0.307	0.853
FOOD	0.386	0.209	0.065	0.715	0.238	0.003	0.500	0.212	0.018
BEERTOBACO	0.351	0.355	0.324	0.670	0.371	0.071	0.466	0.352	0.185
TEXTILE	0.893	0.200	0.000	0.868	0.200	0.000	0.857	0.200	0.000
WOOD	0.523	0.193	0.007	0.440	0.194	0.023	0.465	0.194	0.016
PRINTING	0.244	0.321	0.448	0.189	0.322	0.556	0.207	0.317	0.512
CHEMICAL	0.094	0.366	0.798	0.163	0.373	0.662	0.134	0.358	0.708
RUBBER	0.268	0.208	0.199	0.370	0.210	0.078	0.297	0.203	0.144
MACHINARY	-0.003	0.250	0.992	0.069	0.248	0.782	0.013	0.244	0.959
JEWELLERY	0.899	0.258	0.000	0.910	0.257	0.000	0.867	0.254	0.001
_CONS	-9.299	0.588	0.000	-9.171	0.581	0.000	-8.957	0.695	0.000
Rho							-0.326	0.188	0.108
Observations		2739			2738			2738	
LR Chi square		475.19(22)			476.94(22)				
Wald Chi square								833.51(50)	
Pro>Chi square		0.00			0.00			0.00	
Pseudo R square		0.3637			0.3650				
Log likelihood		-415.72			-414.78			-1945.01	

First-Stage, dependent variable: MODIPRODUCT

Variable	Probit estimation			IV estimation			Bivariate estimation		
	Coef.	Std. Err.	P>|z|	Coef.	Std. Err.	P>|z|	Coef.	Std. Err.	P>|z|
LOGREV04				0.141	0.020	0.000	0.134	0.021	0.000
SKILLWORKERS				0.001	0.003	0.770	0.003	0.004	0.528
INV_CAPACITY				0.253	0.063	0.000	0.249	0.063	0.000
INV_REPLACE				0.341	0.090	0.000	0.332	0.090	0.000
INV_PRODUC~Y				0.576	0.116	0.000	0.559	0.117	0.000
INV_QUALITY				1.170	0.257	0.000	1.177	0.256	0.000
INV_NEW				0.602	0.203	0.003	0.569	0.204	0.005
INV_OTHER				0.002	0.187	0.989	0.002	0.186	0.992
LACKSKILLE~R				0.249	0.061	0.000	0.264	0.062	0.000
TRAINING2				0.600	0.145	0.000	0.620	0.144	0.000
HCM				-0.442	0.159	0.006	-0.432	0.159	0.006
HN				-0.492	0.170	0.004	-0.487	0.169	0.004
HAIPHONG				-0.004	0.181	0.981	0.007	0.180	0.970
HATAY				-0.063	0.166	0.706	-0.054	0.165	0.745
LONGAN				-0.219	0.190	0.247	-0.214	0.189	0.258
PHUTHO				-1.024	0.176	0.000	-1.016	0.175	0.000
QUANGNAM				-0.163	0.182	0.369	-0.156	0.182	0.390
NGHEAN				-0.417	0.166	0.012	-0.413	0.165	0.013
KHANHHOA				0.065	0.208	0.755	0.070	0.207	0.736
FOOD				-0.720	0.081	0.000	-0.721	0.081	0.000
BEERTOBACO				-0.688	0.168	0.000	-0.685	0.168	0.000
TEXTILE				0.006	0.110	0.957	0.000	0.110	0.997
WOOD				0.257	0.088	0.004	0.256	0.088	0.004
PRINTING				0.093	0.194	0.631	0.084	0.193	0.663
CHEMICAL				-0.200	0.197	0.308	-0.195	0.198	0.324
RUBBER				-0.251	0.096	0.009	-0.254	0.096	0.008
MACHINARY				-0.184	0.132	0.164	-0.194	0.132	0.140
JEWELLERY				-0.014	0.167	0.932	-0.020	0.167	0.904
_CONS				-1.290	0.292	0.000	-1.212	0.300	0.000
Observations					2738			2738	
LR Chi square					615.61(28)				
Wald Chi square								833.51(50)	
Pro>Chi square					0.00			0.00	
Pseudo R square					0.1674				
Log likelihood					-1530.69			-1945.01	