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Effects of Innovations on Margins of International Trade: Evidence with Firm Level Data of Selected South Asian Countries

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Abstract

In an increasingly globalized world, firms and countries are continuously striving for export competitiveness to increase their export shares in international markets. This study investigates the effects of different types of innovations on extensive and intensive margins of exports by using data of manufacturing firms operating in four South Asian countries. We use the probit, and fractional response model as estimation techniques. The results of the study reveal that process, management, and marketing innovations have positive and statistically significant effects on both extensive and intensive margins of exports. These results suggest that South Asian countries should facilitate firms to engage in innovative activities which provide a sustainable, competitive advantage for firms in international market.

Keywords: Export competitiveness, innovations, margins of exports, fractional response model, South Asia

Introduction

International trade has been recognized as a key driver of growth and development. Nevertheless, progressive pace of economic globalization makes export competitiveness as major consideration for performance of individual firms as well as for whole macroeconomic outlook. Growth miracles in newly industrialize economies of East Asia encouraged many developing countries to pursue outward looking export promotion policies. Currently, among the emerging economies, China is seen as a flagship of export-led development. Export encompasses different channels through which it contributes to growth and development. First, export earning provides foreign exchange for the imports of machinery and intermediate inputs which in turn increases productivity and expands overall production frontier. Second, economies of scale in the industrial manufacture products make it advantageous for firms to export goods along with production for domestic needs (Krugman, 1979). Expansion in size of markets for local firms provides stimulus for growth rate of income and employment which increases the living standard of people (Romer, 1990). Third, there is also diffusions of production related ideas from exporters to the domestic non-exporting firms leading to productivity gain in the whole economy (Alvarez et al., 2013; Luttmer, 2007; Lucas & Moll, 2014).

Despite these positive externalities of exports, South Asian countries are for behinds in export performance from their East Asian counterparts. The New-New trade theory (Melitz, 2003) base on firm heterogeneity in productivity predicts that only more productive firms enter into export market because of irreversible fixed investment for firms' entry in export market. This emphasizes on the competitiveness of firms as a policy objective as an alternative to the traditional market

access approach for increasing exports in developing countries. However, Melitz (2003) takes firm productivity as draw from random distribution or exogenously assign to firm by luck. In contrast, the endogenous growth theory emphasizes on industrial innovation as a major source of productivity growth and firms' competitiveness in the international market (Romer, 1990; Aghion & Howitt, 1992). This strand of literature considers productivity as endogenous and allows firms to enhance their productivity through industrial innovations. With this background, this study is an attempt to uncover the effects of innovations on intensive and extensive margins of exports using the enterprise level data of selected South Asian countries. Although South Asia is the fastest growing region in the world with the project growth rate of 7.1 percent in 2019-20 (World Bank, 2019). Yet, exports growth is low and long run growth process is majorly derived by the domestic demand. As a result, these countries are facing persistent trade deficit and balance of payment crises. Existing literature document that extensive and intensive margins play a major role in the sustainable exports growth process (see for instance, Hummels & Klenow, 2005; Besedes & Prusa, 2011). Hence, this study explores the response of intensive and extensive margins of exports to the productivity enhancing and cost-reducing innovations

The innovations encompass different channels through which it effects the intensive and extensive margin of exports. The product cycle models of trade (Vernon, 1966; Krugman, 1979; Dollar, 1986) predict that product innovations expand the range of goods that a country exports. Hence, product innovations are positively associated with the extensive margin of export. Similarly, endogenous growth model predict that innovation is the major source of productivity growth (Romer, 1990; Aghion & Howitt, 1992; Eaton & Kortum, 2001) and trade theory based on firms heterogeneity (Melitz, 2003) predict that only more productive firms enter into exports market. Hence, innovation indirectly expands the extensive margin of exports through its amplification effect on productivity growth. Another strand of literature (Grossman and Helpman, 1991) emphasizes on the role of innovation in the quality of product and hence increases the value of exports — intensive margin. Similarly, some studies argue that cost reducing process innovations increases the export competitiveness of firms and increases domestic as well as foreign sale — intensive margin of exports (Basile, 2001;Becker & Egger, 2013).

Based on a priori theoretical predictions, many studies empirically investigate the effects of innovations on the firm level export performance. Most studies use R & D expenditure as proxy for innovations or indirect measure of innovation output (see, for instance, Kumar and Siddharthan, 1994; Basile 2001; Esteve-Pérez & Rodríguez, 2013; Di Cintio et al., 2017; Falk and de Lemos, 2019). However, some studies also use explicit information on innovations output and document positive effects of innovations on firm level export performance using survey data (Roper and Love 2002; Caldera, 2010; Cassiman and Golovko, 2011; Becker and Egger, 2013 Rodil et al., 2016; Elliott et al., 2019). Mostly, these studies are based on the data from the developed countries. Nevertheless, firms embedded in developing countries business environment also use advance innovations for competitiveness in international market (Amann and Figueiredo, 2012). Few studies find the evidence for the positive effects of innovations on firms level export performance in developing countries. For instance, Özcelik and Taymaz (2004) on Turkey, Alvarez (2007) on Chile, and Cirera et al. (2015) on Brazil document positive effects of innovations on export performance. More recently, some studies investigate the determinants of the intensive and extensive margin of exports using firm level date of different developing countries. For instances, some studies document the productivity of firms (Regis, 2018), and financial factors (Berman and Hericourt, 2010; Egger and Kesina, 2014) as important determinants of extensive and intensive margins of export in developing and emerging economies. Similarly, Chen (2013) investigates impact of innovations on extensive and intensive margins of exports using number of patents granted by US as proxy for innovation in

105 countries. Findings of study document the positive impact of innovations on both intensive and extensive margins of exports. According to the best of our knowledge, there is hardly any study that investigates the effects of innovations on extensive and intensive of margins of exports using explicit information on innovation output collected through survey. Moreover, there is also a gap in existing literature in context of South Asian developing countries. Hence, this consequent study investigates the effects of innovations on extensive and intensive of margins of exports by using the survey data of manufacturing firms operating in four South Asian economies.

The rest of studies is organized as follow. Section 2 provides the insights from the existing literature. In section 3, we discuss the econometric framework. Section 4 provides the empirical findings and discussions and section 5 concludes.

Literature Review

The innovations have been playing imperative role in growth and development since the seminal work of Schumepeter (1934) which argues that 'new combinations' works as engine of economic growth and amplify firms' productivity. Schumepeter (1934) also gives the detail description of the concept as "new combinations encompass introduction of new product or new quality of a good, introduction of new method of production, opening of new market, adaptation of new source of intermediate inputs, and promotion of new organization of an industry." In similar vein, the Vernon (1966) argues that innovations play major role in trade and growth in developed countries. The product cycle model of Vernon (1966) predicts that developed north due advantages of skills and social infrastructure always innovate and exports the high value innovative product to developing south while in later stage due to cheaper labor, the developing south imitate these product at more cheaper cost. Many studies based on product cycle model predict the dynamic comparative advantage in innovations and high tech sophisticated products for developed south (Krugman, 1979; Kellman & Landua, 1984; Dollar, 1986: Audretch et al, 2017).

Another strand of literature, emphasizes on the industrial innovations as key driver for productivity growth. Second generation endogenous growth theory base on Schumpeterian idea of creative destruction stress on innovations for self-sustain long run productivity growth. Aghion and Howitt (1992) argues that along with formal education, learning by doing, on job training, and industrial innovations contribute to the knowledge accumulation which in turn amplify productivity growth. Similarly, Grossman and Helpman (1991) argues that innovations play crucial role for the continuous improvement of the quality of products which stimulate self-sustaining growth. Many studies document the evidence of the primary role of innovation in productivity growth and cross country convergence (Hall & Jones, 1999; Hall, 2011). Similarly, the link between firm level total factor productivity and innovations is also well documented in existing empirical literature. For instance, Lööf and Heshmati (2002), Van Leeuwen and Klomp (2006), Crespi and Pianta (2008), Koellinger (2008), Hall et al.,(2009), Bogliacino and Pianta (2011) document the evidence for the positive effects of innovations on firm level total factor productivity.

Research in industrial economics provides important insights on the role of cost reducing innovations in export competitiveness of firms. Spencer and Brander (1983) argue that investment in process innovations increases the export competiveness and provides the sustainable competitive edge for firms operating in relatively open markets. Many empirical studies also document the positive effects of innovations on firms export performance using the firm level data of developed countries. For instances, Roper and Love (2002) document the evidence for positive effects of innovations on export performance using firm level data of UK and Germany. Caldera (2010) investigate the effect of innovations on propensity of export using firm level data of Spain. Overall results show

that product innovation are more important for the entry into export market than cost reducing process innovations. Similar findings is documented by the Becker and Egger (2013) using firm level data of Germany. Basile (2001) investigate the impact of innovations inputs such R & D expenditure on firm export intensity using data of Italian manufacturing firms and document positive impact on export intensity. Similarly, Falk and de Lemos (2019) document complementary role of R & D expenditure and firm productivity in export performance of Australian manufacturing firms. Rodil et al.(2016) investigate the effect of different types of innovations on export performance of using firm level data of Galicia — north-west region of Spain — and findings support the key role of innovations in export performance. Cassiman, Golovko & Martínez-Ros (2010)find that product innovations amplify productivity of firms and help firms to inter into export market. Similarly, Cassiman and Golovko (2011) test the hypothesis that product innovations indirectly contribute to export propensity by increasing the productivity of firms in Spain. Findings of the study support that innovations indirectly contribute to export propensity.

Amann and Cantwell (2012) argue that some firms in developing countries more close to the technological frontier and innovations play major role in their exports. Many studies empirically investigate the effects of innovations on export performance of developing countries. Alvarez (2007) investigates the impact of innovations on exports performance of Chile and document positive role of innovations on export performance. Similarly, Özcelik and Taymaz (2004) find the positive effects of R & D expenditure on Turkish manufacturing exports. Empirical findings of study support the hypothesis that R & D expenditure helps firms to enter into export market. Cirera et al.(2015) investigates the effects of innovations on extensive margin of export using firm level data of Brazil. Findings of the study support the claim that innovations contribute to the export diversifications by increasing entry of firms in export market. Chadha (2009) analyze the role of innovations in product cycle framework using firm level data of Indian manufacturing firms in pharmaceutical industry and finds evidence for the positive role of innovations on export performance. Ang et al. (2015) investigates the effect of innovations on export competitiveness using the country level data of East Asian countries and document positive effects of innovations on export performance of selected countries.

More recently, some studies investigate the determinants of intensive and extensive margin of exports using firm level date of different developing countries. For instance, Berman and Hericourt (2010), and Egger and Kesina (2014) document the positive impact of availability of credit and financial soundness of firms on both intensive and extensive margin of export. Chen (2013) investigate the role of innovations on extensive and intensive margins of exports using industry level data of 105 developed and developing countries. Findings of study document the positive role of innovations in increasing both intensive and extensive margins of exports. Regis (2018) investigate the effects of firm productivity on intensive and extensive margins of export using firm level data of 104 developing and emerging economies. Overall results support the claim that firms' productivity amplify both intensive and extensive margin of exports. However, according to best of our knowledge, there is hardly any study that investigates the effect of innovations on intensive and extensive margins of exports using the firm level data of south Asian countries.

Methodology

Econometric Framework

We investigate the effect of innovations on extensive margin and intensive margin of exports separately using the firm level data of South Asian economies

Extensive Margin of Exports

Extensive margin of exports— probability of being exporter— is a discrete choice, hence probit model is most appropriate estimation strategy. In line with Berman and Hericourt (2010), and

Egger and Kesina (2014), the extensive margin of exports or probability of exporting by firm j in country c can be express as

$$\dot{Ex\_mar_j} = \alpha + X_j\gamma + D_c + D_i + \varepsilon_j \qquad (1)$$

Where $\dot{Ex\_mar_j}$ is extensive margin of firm j and X_j is the set of firm specific control variable and γ is the vector of unknown parameters to be estimated. D_c and D_i are respectively the country specific and industry specific dummies that capture unobserved heterogeneity. $\dot{Ex\_mar_j}$ is not directly observable and we express it as binary choice

$$Ex\_mar_j = \begin{cases} Export_d = 1 & for\ \dot{Ex\_mar_j} \geq 0 \\ Export_d = 0 & for\ \dot{Ex\_mar_j} < 0 \end{cases}$$

Now we can incorporate role of innovations in equation (1) as

$$P\left(Ex\_mar_j \middle| X_j, innov_j\right) = \Phi\left(X_j\gamma + innov_j\delta_j + D_c + D_i\right) + \mu_j \qquad (2)$$

Where $innov_j$ is different type of innovations such product, process, management and marketing innovations and $\Phi(.)$ is the cumulative standard normal distribution function.

Intensive Margin of Exports

The intensive margin of exports — ratio of exports to sale — of firm j is a tion($int\_mar_j \in [0,1]$), hence most appropriate estimation technique is fractional response model of Pake and Wooldridge (1996). To investigates the effects of innovations (innov) on intensive margin of exports, the fractional response model can express as

$$E\left(Int\_mar_j \middle| X_j, innov_j\right) = \Psi(X_j\gamma + innov_j\delta_j + D_c + D_i + \mu_j) \qquad (3)$$

Where Int_mar_j is intensive margin of exports measure as ratio of exports to sale, while X_j is firm specific control variables of firm j, $innov_j$ is innovations decision of firm j, $\Psi(.)$ is the distribution function. The equation (3) can estimated through Quasi-Maximum Likelihood estimation technique.

Data and Variables

This study is based on the cross sectional data of 9749 manufacturing firms of Pakistan, India, Bangladesh, and Sri Lanka provide by the World Bank Enterprise Level Survey. After cleaning the data and dealing with missing observation on certain variables, it reduce to the 8423 firms. The world Bank Enterprise Level Survey provides useful information on firms' innovations, exports, and others firm specific characteristics and most suitable data set for investigating effects of innovations on intensive and extensive margins of exports.

Our dependent variables are the extensive margin of export measure as probability of being an exporter and intensive margin of exports measure as ratio of export to total sale. We use the product, process, management and marketing innovations as our variable of interest. Our firm specific control variables include the size, age, and productivity of a firm. We also use the foreign ownership, skills workers, imported technology, use of ICT, and availability of credit as control variables. The detail description of variables of study is provided in table A1 in appendix A.

Results and Discussion

The key objective of this research exercise is to investigate the effects of innovations on extensive and intensive margins of exports using firm level data of selected South Asian countries.

Extensive margin of exports

We estimate the extensive margin of exports by employing the Probit model with robust standard errors adjusted for heteroskedasticity. Table 1 reports the estimated results for the extensive margin of exports.

Table 1. Estimated results of Probit model(odd ratios) for extensive margin of exports

	Dependent Variable: Extensive Margin of Exports (Export Propensity)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
size	0.366**	0.362***	0.366***	0.366**	0.304**	0.301**	0.302**	0.302**
	(0.0154	(0.0152)	(0.0151)	(0.0151	(0.0167	(0.0167	(0.0167	(0.0167
age	0.126**	0.120***	0.128***	0.125**	0.125**	0.123**	0.130**	0.127**
	(0.0260	(0.0259)	(0.0260)	(0.0259	(0.0262	(0.0261	(0.0262	(0.0261
prod	0.069**	0.067***	0.068***	0.068**	0.040*	0.039*	0.040*	0.040*
	(0.0161	(0.0159)	(0.0161)	(0.0161	(0.0160	(0.0159	(0.0160	(0.0160
F-own	0.867**	0.830**	0.844**	0.837**	0.884**	0.860**	0.864**	0.864**
	(0.263)	(0.264)	(0.266)	(0.264)	(0.270)	(0.270)	(0.272)	(0.271)
skills_w	0.204**	0.171*	0.163*	0.177*	0.204**	0.174*	0.163*	0.179*
	(0.0744	(0.0746)	(0.0756)	(0.0755	(0.0760	(0.0762	(0.0773	(0.0771
credit	0.527**	0.510***	0.496***	0.514**	0.515**	0.495**	0.480**	0.498**
	(0.0581	(0.0586)	(0.0587)	(0.0585	(0.0586	(0.0591	(0.0592	(0.0591
im_tech					0.0613*	0.0580*	0.0658*	0.0752*
					(0.0325	(0.0363	(0.0263	(0.0421
ICT					0.467**	0.450**	0.453**	0.456**
					(0.0455	(0.0449	(0.0450	(0.0449
innov_1	0.0686				0.0544			
	(0.2264				(0.2215			
innov_2		0.166***				0.113**		
		(0.0392)				(0.0396		
innov_3			0.177***				0.140**	
			(0.0398)				(0.0404	
innov_4				0.129**				0.0843*
				(0.0396				(0.0401
_con	-	-	-3.896***	-	-	-	-	-
	(0.265)	(0.249)	(0.251)	(0.251)	(0.261)	(0.249)	(0.250)	(0.250)
N	8423	8423	8423	8423	8423	8423	8423	8423
R2	0.215	0.213	0.221	0.217	0.235	0.237	0.243	0.229
CFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01. Coefficient are odd ratios except constant.

First specification of empirical model in column (1) shows that product innovation (Innov_1) is statistically insignificant with positive sign. This is unexpected result which might be due to fact that most firms in selected sample does not introduce new and significantly improve products. Existing literature also finds similar results. For instances, Damijan, Kostevc and Polanec (2010) authenticates the primary role of product innovations in firms' participation in export markets. All the con-

trol variables such as age, size, productivity (prod), foreign ownership (F_own), ratio of skills workers to unskilled workers (skills_w), and access to credit are statistically significant with expected positive sign. Second specification of our empirical model in column (2) show that process innovation (innov_2) is statistically significant at 1 percent level of significance with positive sign. This results support the claim that process innovation (innov_2) increases the probability of firms to enter into exports market and make these firms competitive in international market. This result is also consistent with existing literature. Alvarez (2007), and Cirera et al. (2015) find similar results for Chile and Brazil respectively. All control variables are statistically significant at 1 and 5 percent level of significance except the skills workers (skills_w) that is statistically significant at 10 percent level. The third specification of empirical model in column (3) show that management innovation (innov_3) is statistically significant at 1 percent level of significance with positive sign. This result corroborate the hypothesis that management innovation (innov_3) help firm to enter into export market. All control variables such as size, age, productivity (prod), foreign ownership (F_own), credit are statistically significant at one percent level of significance. However, ratio of skills worker to unskilled worker is statistically significant at 10 percent level. The results in fourth specification of estimated model in column (4) show that marketing innovations (innov_4) also enters in model with statically significant positive sign. All control variables are statically significant with expected positive sign. The empirical specifications in column (5) to column (8) added imported technology (im_tech) and use of ICT by firms in existing control variables. The results reported in column (5) again show that product innovation is statistically insignificant despite the use of alternative control variables. The specification in column (6) to column (8) show that process innovation (innov_2), management innovation (innov_3) and marketing innovations (innov_4) are statistically significant in theses alternative specifications. The additional control variables imported technology (im_tech), and use of ICT statistically significant with positive signs. In all specifications, we include the country and industry dummies to capture the unobserved heterogeneity across countries and industries.

Intensive margin of exports

Table 2 reports the results of fraction response model for intensive margin of exports. To avoid any possibility of hetroskedasticity, we use robust standard errors adjusted for hetroskedasticity.

Table 2: Results of Fractional Response Model for intensive margin of Exports

	Dependent variable: Intensive Margin of Export (Export Intensity)			
	(1)	(2)	(3)	(4)
size	0.325***	0.343***	0.347***	0.345***
	(0.0160)	(0.0153)	(0.0152)	(0.0152)
age	0.0572**	0.0403	0.0496	0.0466
	(0.0285)	(0.0278)	(0.0278)	(0.0280)
prod	0.121***	0.108***	0.110***	0.111***
	(0.0166)	(0.0161)	(0.0161)	(0.0162)
skills_w	0.446***	0.458***	0.448***	0.452***
	(0.0873)	(0.0864)	(0.0865)	(0.0870)
credit	0.544***	0.477***	0.465***	0.481***
	(0.0638)	(0.0630)	(0.0631)	(0.0631)
f_own	0.971***	0.773**	0.814**	0.773**
	(0.272)	(0.258)	(0.256)	(0.258)

	Dependent variable: Intensive Margin of Export (Export Intensity)			
	(1)	(2)	(3)	(4)
Innov_1	0.0422**			
	(0.0152)			
innov_2		0.220***		
		(0.0434)		
Innov_3			0.196***	
			(0.0430)	
Innov_4				0.215***
				(0.0431)
_cons	-4.962***	-4.897***	-4.936***	-4.946***
	(0.264)	(0.256)	(0.258)	(0.258)
N	8423	8423	8423	8423
R2	0.325	0.308	0.332	0.326
CFE	Yes	Yes	Yes	Yes
IFE	Yes	Yes	Yes	Yes

The robust standard error adjusted for hetoskedasticity in parenthesis. * p < 0.1, ** p < 0.05, *** p < 0.01. Coefficients are the odds ratio except constant.

The results in column (1) show that product innovation (innov_1) is statistically insignificant with positive sign. This is again unexpected result which might be due to the fact that only few firms engage in product innovation in selected sample. This also reflects that on average product innovation is low in selected South Asian countries. All control variables such as size, productivity of firms (prod), ratio of skills workers to unskilled workers (skill_w), availability of credit, foreign ownership (f_own) are statistically significant at 1 percent level of significance except age which is significant at 5 percent level of significance with positive sign. The results in column (2) show that process innovation (innov_2) is significant at 1 percent level of significance with positive sign. These results substantiate the claim that cost reducing process innovations improve firms' competitiveness in international market and increase the intensive margin of export. These results are consistent with existing literature e. g. Elliott (2019) document positive effects of process innovation on the intensive margin of exports. All control variables are statistically significant at 1 percent level of significance except age of firm that is statistically insignificant. The column (3) and column (4) report the results of management innovation (innov_3), and marketing innovation (innov_4) which are statistically significant at 1 percent level of significance with expected positive sign. These results corroborates the claim that management and marketing innovations are more important for the export performance of developing countries. All the control variables are statically significant except age of firms which is statistically insignificant in both specifications. We also estimate the intensive margin of exports using some alternative specifications. The table A2 in appendix A reports the results of intensive margin of exports with alternative specifications. We replace the skills workers (skills_w) with workers' education (w_edu) and include some additional control variables such as imported technology, and use of ICT by firms. The results reported in column (1) to column (4) in table A2 in appendix A show that product innovation (innov_1), process innovation (innov_2), management innovation (innov_3), and marketing innovations (innov_4) are statistically significant. The alternative control variable workers' education (w_edu) is statistically insignificant in all four specifications which reflect that skills are more important than simple year of education for increasing

export share. The additional control variables such imported technology and firms use of ICT are statistically significant in all four specifications.

Conclusion

The key objective of this study is to investigate the effects of innovations on the extensive and intensive margins of exports. This study uses firm level data of four South Asian economies for empirical analyses. Consistent with theoretical underpinnings, the results of the study reveal that innovation activities such as process innovation, management innovation and marketing innovation increase firms' probability of exporting and also enhance the volume of export. The firm specific control variables such as age, size, productivity, skills workers, and availability of credit, foreign ownership, imported technology, and use of ICT positively explain both extensive and intensive margins of export. We found no evidence for the role of product innovation in either increasing the likelihood of being exporter or volume of export of incumbent firms

These results have important implications for the South Asian developing countries which are facing the persistent deficit in balance of trade because of sluggish export growth process. Existing literature documents that the extensive and intensive margins play a major role in the sustainable exports growth process (see for instance, Hummels & Klenow, 2005; Besedes & Prusa, 2011). The results of the study suggest that South Asian countries should encourage firms to engage in innovating activities for promotion of the extensive and intensive margins of export that in turn a major source of the sustainable exports growth process.

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Appendix A

Table A 1 Variables and their description

Variables	Description
Intensive Margin (In_M)	"Ratio of export sales to total annual sales."
Extensive Margin (Ex_ M)	"Dummy variable equal to one if firm export either directly or indirectly"
Firm Size (F_Size)	"Logarithm of number of full- time employees."
Productivity (prod)	"Logarithm of value added per permanent employee"
Age of firm	"Logarithm age of an establishment in years"
Access to Credit (credit)	"Percentage of working capital financed by banks and non-bank borrowing"
Foreign Ownership (F_Own)	"Percentage of firm is owned by private foreign individuals, companies or organization"
Workers skills(w_skills)	"Ratio of skilled production workers to unskilled production workers."
Product innovation(innov_1)	" Dummy variable equal to one if firm introduced significantly improve products"
Process innovation (innove_2)	"Dummy variable equal to one if firm introduced significantly improved process or methods of production"
Management innovation(innov_3)	"Dummy variable equal to one if firm introduced significantly improved management practices"
Marketing innovation (innov_4)	Dummy variable equal to one if firm introduced significant improved marketing methods "
Firm use of ICT(F_ICT)	"Dummy variable equal to one if firm using ICT"
Imported technology	"Dummy variable equal to one if firm use imported technology"

Table A2: The results of Fractional Response Model for intensive margin of exports

	(1)	(2)	(3)	(4)
size	0.241***	0.261***	0.262***	0.261***
	(0.0181)	(0.0175)	(0.0175)	(0.0175)
age	0.0544*	0.0392	0.0475*	0.0443**
	(0.0296)	(0.0290)	(0.0245)	(0.0214)
prod	0.0894***	0.0785***	0.0795***	0.0807***
	(0.0166)	(0.0161)	(0.0162)	(0.0162)
w-edu	0.0454	0.0459	0.0462	0.0507
	(0.0794)	(0.0766)	(0.0764)	(0.0764)
credit	0.556***	0.484***	0.470***	0.484***
	(0.0646)	(0.0638)	(0.0640)	(0.0642)
F_own	1.010***	0.790**	0.822**	0.787**
	(0.301)	(0.285)	(0.283)	(0.284)
ICT	0.688***	0.659***	0.666***	0.663***
	(0.0606)	(0.0590)	(0.0590)	(0.0590)
imp_tech	0.125**	0.180**	0.221***	0.274***
	(0.0621)	(0.0795)	(0.0591)	(0.0592)

	(1)	(2)	(3)	(4)
innov_1	0.0721**			
	(0.0364)			
innov_2		0.183***		
		(0.0439)		
innov_3			0.183***	
			(0.0432)	
innov_4				0.193***
				(0.0434)
_cons	-4.208***	-4.151***	-4.191***	-4.195***
	(0.253)	(0.244)	(0.246)	(0.246)
N	8423	8423	8423	8423
R2	0.335	0.324	0.319	0.326
CFE	Yes	Yes	Yes	Yes
IFE	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001.