Importing, Exporting, and Innovation in Developing Countries[¥]

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January 2011
(First Version October 2009)

Abstract

Several recent studies have shown that not only exporters but also importers perform better than firms that do not trade. Using a detailed firm level dataset from 43 developing countries, I show that there are persistent differences in evolution of firms when they are grouped according to their trade orientation as: two-way traders (both importing and exporting), only exporters, only importers, and non-traders. Extending the existing models of firm evolution in open economies by incorporating importing decision, I provide a simple model and empirically show that: i) globally engaged firms are larger, more productive, and grow faster than non-traders; ii) two-way traders are the fastest growing and most innovative group who are followed by only-exporters; and iii) estimating export premium without controlling for import status is likely to overestimate the actual value by capturing the import premium. Finally I show the robustness of the findings by providing evidence from the panel data constructed from the original dataset and controlling for variables that are likely to affect firm growth.

Keywords: Globally engaged firms, trade in developing countries, R&D and innovation, firm and industry dynamics.
JEL classification: L11, O31, F12, F14

[¥] I would like to thank to Ana Margarida Fernandes, Daniel Rodriguez Delgado, Mohammad Amin, participants of 8th International Industrial Organization conference, and 36th Eastern Economic Association conference for their helpful suggestions.
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1 Introduction

The availability of detailed firm level datasets has led to the emergence of a new line of research that relates foreign exposure with firm performance. Both theoretical and empirical findings, as reviewed in Bernard et al. (2007) and Lopez (2005), show that firms that are engaged in international trade are larger and more productive than the ones that serve only domestic markets. This study contributes to the existing literature in two ways. Using a detailed firm level dataset from the manufacturing sectors of 43 developing countries, I show that not only exporting but also importing intermediate goods is related to higher growth performance and introduction of technological innovations. The firms that perform both importing and exporting activities are the fastest growing and the most innovative group of firms and they are followed by either only exporters or only importers.

This study aims to provide a complete view of trade by grouping firms according to their exposure to foreign markets. I distinguish firms that both import and export (two-way traders), that only export, and that only import from firms that do not trade. This allows me to compare growth of firms with all possible levels of foreign exposure. Such detailed analysis is scarce in the literature. Moreover, very few studies have looked at the relationship between firm growth and foreign exposure. As a result of globalization, firms in developing countries have been increasingly engaged with the rest of the world and determining how these engagements are related to their evolution is important for identifying the right trade policies.

In determining how firms evolve, I look at growth rates of size measured as employment and size and growth rate of labor productivity measured as sales per worker. In addition to these measures of growth, I analyze whether firms implement technological innovations. Enterprise Surveys collect information on several variables to measure innovation[1]. I look at the probabilities of introducing new products, improving any existing process, having any internationally recognized quality certificate, and using foreign-licensed technologies. The use of various measures of firm evolution reinforces the inferences derived on the relationship between firm evolution and trade.

Recent models of trade and firm heterogeneity have mostly evolved around export market participation. Many studies since Bernard and Jensen (1995) have shown that exporters outperform non-exporters in many dimensions. Different explanations have been proposed for these persistent differences across firms. Self-selection of productive firms into foreign markets is the most acknowledged one. Exporting requires extra sunk costs and only the most productive firms can

[1] See www.enterprisesurveys.org for a detailed description of the data and methodology.

compensate these costs. Clerides et al. (1998), Bernard and Jensen (1999), and Aw et al. (1998) provide empirical evidence for the self-selection hypothesis and theoretical models like Melitz (2003) and Bernard et al. (2003) build this stylized fact into general equilibrium trade models.

Another activity that is equally crucial as exporting for firms' higher performance is importing. In his survey on technology diffusion, Keller (2004) summarizes theoretical and empirical literature on how imports provide knowledge and technology transfer in a macroeconomic perspective. In studies like Romer (1990), Grossman and Helpman (1991), Kortum (1997), and Eaton and Kortum (1999, 2002), the use of imported intermediate goods implicitly involves the use of technology and knowledge embodied in them. However these studies analyze the gains from importing in an aggregate setting rather than the effects of importing on firm performance.

To motivate how importing and exporting relate to faster growth, I provide a theoretical model. Importing and exporting can relate to higher firm performance in different ways. Self-selection of efficient firms plays a crucial role in entering either market. However the use of foreign intermediate inputs can increase these firms' profits due to access to more variety of inputs or due to higher quality of these products. As for the exporters, sales to foreign markets increase these firms' market sizes which in turn increase the future return of R&D investments. As a result, both activities contribute to faster growth. Among the firms that either export or import, the most efficient ones who can compensate the sunk costs for both markets are likely to earn the highest profits and show the highest performance.

The rest of the paper is organized as follows. In section 2, I review the recent literature and discuss how this study contributes to the existing studies. In section 3, I explain the analytical framework of the model. Following that I introduce the dataset and variables used in the analysis. Then in section 5, I perform a descriptive analysis that relates firm performance with its trade orientation. In section 6, I elaborate on the relationship between evolution of firm and its trade orientation controlling for factors that can potentially affect firm evolution. Then, I provide sensitivity analysis to check the robustness of the findings and finish with some concluding remarks.

2 Literature Review

Recently, using micro level data from developed countries, some empirical studies have shown that importers show similar characteristics as exporters. In their review of firms from the United States in international trade, Bernard et al. (2007) draw attention to the strong correlation

(0.87) between industries with high shares of importing firms and those with high shares of exporters. They find that 79% of importers also export. Their descriptive analysis shows that both types of firms show many similarities in their performance measures. Both exporters and importers are more productive, larger, capital and skill intensive than firms that do not have any trading relationships with the rest of the world. However they do not split firms into four separate groups to show how firms that perform both activities differ from the other group of firms[2]. Moreover, they do not analyze how firms in different trade groups differ in growth performances.

In another study, Muuls and Pisu (2009) divide firms into four trading groups as it is done here. They find a positive relationship between labor productivity and importing for Belgium firms. Vogel and Wagner (2010) perform a similar analysis for German manufacturing firms. In addition to showing the positive link between importing and labor productivity they find evidence on direction of causality in this relationship. They investigate the significance of self-selection of more productive firms into importing and learning effects of importing. They find evidence on the self-selection hypothesis. Although analyses in these studies are informative, none of them analyze firm growth and technological innovation. Their conclusion on the two-way traders being more productive and larger only indirectly shows these firms' higher growth potential. Moreover, Vogel and Wagner (2010) use turnover per employee as their measure of labor productivity. This measure as well as other measures of labor productivity suffers from the unobserved price effects on measuring productivity. It is difficult to isolate firm's intrinsic efficiency with these measures. Recent studies like Foster et al. (2008) and Katayama et al. (2009) highlight this inconsistency in productivity measures[3]. To alleviate these concerns, I focus on direct measures of firm growth and innovation. My goal is to establish a link between firm evolution and its trade orientation and to emphasize the complementarity between importing, exporting and higher performance. Moreover, I provide this evidence using a detailed firm level dataset from a rich set of developing countries.

Only a few studies that use micro level data explore the link between technological innovation and trade in developing countries. Understanding this link is crucial because the most significant source of technological progress in developing countries is related to their ability to absorb the technology created in developed world. Alvarez and Robertson (2004) and Almeida and Fernandes (2008) provide two studies that analyze innovation in developing countries. The former study only focuses on exporters. Although the latter one controls for the import status of firms it does not show the complementary relationship between importing and exporting. In another related study, Goldberg et al. (2009) provide empirical evidence on how imported intermediate goods

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[2] They only measure performance premium of two-way traders relative to non-traders without including only exporters and only importers.

[3] See also Bernard et al. (2003) for distinguishing firm efficiency from the observed productivity measures.

increase new product innovation in India. However they do not include exporting activity in their analysis.

In endogenous growth literature, since the seminal works of Grossman and Helpman (1991), Aghion and Howitt (1992), and Romer (1990), many studies have found technological innovation to be the main determinant of growth. Following these studies, in the empirical analysis, I use proxies for innovation and technology adoption to analyze firm evolution. But I also analyze direct measures of firm evolution such as employment, sales, and productivity growth.

Following Klette and Kortum (2004), I introduce a simple theoretical model as a motivation for what derives the relationship between foreign exposure and growth. To their dynamic model of firm and industry evolution, I introduce exporting and importing decisions in a similar fashion to Kasahara and Lapham (2007). Kasahara and Lapham (2007) which extends Melitz (2003), show that there is an interaction between imports of intermediate goods and exports of final goods. Although they present a simple and analytically tractable model of trade, their model does not generate firm dynamics. That model is constructed at steady state and they can only capture the transition from one steady state to another by introducing shocks to fixed and transportation costs. Furthermore, they don't analyze how firm growth is related to trade. Hence this study is original in incorporating both importing and exporting decisions in a dynamic framework in order to explain the relationship between firm evolution, importing and exporting[4].

3 Theoretical Model

A crucial contribution of this study is incorporating the importing decision to a firm's profit maximization problem in a dynamic framework. In a recent study, Halpern et al. (2006) analyze two channels by which imported products lead to productivity improvements in Hungary: higher quality of these goods and imperfect substitution between foreign and domestic inputs. They find that two-third of productivity increase caused by importing is attributable to an increase in the variety of intermediates used and the rest is due to an increase in quality. In another study, Amiti and Konings (2007), using data from Indonesia show that reducing input tariffs increase productivity three times more than a reduction in output tariffs. Both studies provide evidence that motivates for investigation of how importing relates to innovation and growth.

The model introduced in this section is presented to explain the economic factors involved in the relationship between participation in international markets and firm evolution. Unfortunately the data used in the empirical analysis does not allow performing a structural estimation or testing

[4] In a recent study, Atkeson and Burstein (2010) that provide a theoretical model that relate innovation with exporting decision.

all possible implications of the model. Yet having an economic model in mind is important to help us direct our thinking of why these relationships emerge.

In the model, firms choose whether to import intermediate products and export any of their output facing fixed sunk costs for both activities. The sole factor determining firms' participation in international markets is their efficiency levels which is exogenously assigned to them. These static trading decisions are incorporated with a dynamic framework of firm evolution which follows from Klette and Kortum (2004). Firms invest in R&D and these investments result in innovation of new products in a stochastic fashion.

I assume that there are $N+1$ identical countries and in each country there are two sectors formed of final good producers and intermediate goods producers. In each country, a composite good Y is produced by a large group of monopolistically competitive final goods producers. Each firm produces multiple products (where each product is a different variety). Production of the composite good Y is determined by a CES production function given in equation 1 as

$$Y = \left(\int_{j \in J} y(j)^{\frac{\sigma-1}{\sigma}} dj \right)^{\frac{\sigma}{\sigma-1}}, \qquad (1)$$

where j is an index over varieties chosen from a set J and $\sigma > 1$ is the elasticity of substitution between different varieties. Producers are distinguished only by their efficiency levels, indexed by $\varphi > 0$. The solution of this static optimization problem follows from Melitz (2003). Under monopolistic competition, producers with same efficiency levels charge the same price and make the same profit for each product they produce. The profit maximization problem for production of any product, for given wage rate w, yields revenue and profit given as

$$r(\varphi) = \left(\frac{p(\varphi)}{P} \right)^{1-\sigma} E \quad and \quad \pi(\varphi) = \frac{r(\varphi)}{\sigma} \qquad (2)$$

where $p(\varphi)$ is the price charged by the firm, P is aggregate price index and E is aggregate expenditure of the composite good (E=PY).

In production of the final goods, firms employ labor, domestically produced intermediate goods and choose whether or not to use imported intermediate goods. This representation follows from Kasahara and Lapham (2007). To be able to import intermediate goods, firms incur sunk cost f_i. Since firms' revenues monotonically increase in their efficiency levels, this sunk cost determines a threshold value $\overline{\varphi}$, such that firms with efficiency levels below $\overline{\varphi}$ can only use domestic intermediate goods in production. Firms that use only domestic intermediate goods produce y^d amount which is given in equation 3

$$y^{d}(\varphi) = \varphi l^{\alpha}\left[\int_0^1 x_d(k)^{\frac{\gamma-1}{\gamma}} dk\right]^{\frac{(1-\alpha)\gamma}{\gamma-1}}. \tag{3}$$

Here, l measures amount of labor, x_d measures amount of domestic intermediate good k used in production, α is the measure of labor share (0 < α < 1) in production and γ >1 is the elasticity of substitution between any two intermediate inputs. In the intermediate goods sector, there is a continuum of firms producing differentiated goods and they have access to the same linear production technology with $x_d = l$.

Solving the profit maximization problem of the final goods producer in a symmetric equilibrium, we get $x_d(k) = x_d$ for all k. Total revenue for each product of a φ-type producer participating in only domestic market is

$$r^{d}(\varphi) = \left(\frac{w}{\alpha^{\alpha}(1-\alpha)^{1-\alpha}P\varphi}\frac{\sigma}{\sigma-1}\right)^{(1-\sigma)} E. \tag{4}$$

On the other hand, firms with efficiency levels higher than $\overline{\varphi}$ will be able to import intermediate products using the production function given in equation 5

$$y^{imp}(\varphi) = \varphi l^{\alpha}\left[\int_0^1 x_d(k)^{\frac{\gamma-1}{\gamma}} dk + \int_0^N x_i(k)^{\frac{\gamma-1}{\gamma}} dk\right]^{\frac{(1-\alpha)\gamma}{\gamma-1}}, \tag{5}$$

where x_i measures imported intermediates used in production. In this specification of the production function, firms that import intermediate goods gain access to a wider range of intermediates than firms using only domestic intermediates. Solution to the profit maximization problem of an importing firm gives $x_i(k) = x_i$ for all k and $x_i = x_d$[5]. This solution leads to a production function

$$y^{imp}(\varphi) = \varphi(1+N)^{\frac{(1-\alpha)}{\gamma-1}} l^{\alpha}(x_d + Nx_i)^{1-\alpha\frac{(1-\alpha)\gamma}{\gamma-1}}.$$

Next, total revenue from each product for a φ-type producer who only imports can be written as

$$r^{impO}(\varphi) = (1+N)^{\frac{(1-\alpha)(\sigma-1)}{\gamma-1}} r^{d}(\varphi) \text{ with } (1+N)^{\frac{(1-\alpha)(\sigma-1)}{\gamma-1}} > 1. \tag{6}$$

As could be seen in equation 6, importers attain higher revenues than non-importing firms. The gain generated by importing is captured by the term $(1+N)^{\frac{(1-\alpha)(\sigma-1)}{\gamma-1}}$.

In order to export, firms have to incur an additional sunk cost f_x. Similar to the choice of importing only firms with efficiency levels above a threshold level $\overline{\overline{\varphi}}$ will be able to export. In a symmetric equilibrium, total revenue gained by a firm who exports to N countries but does not

[5] For simplicity I didn't include any iceberg transportation cost in the model.

import will be $r^{\exp O}(\varphi) = \left((1+N)r^{d}(\varphi)\right)$ and the revenue gained by a firm who both imports and exports will be $r^{\exp/imp}(\varphi) = \left((1+N)r^{impO}(\varphi)\right)$.

The profit levels that would be gained from different levels of engagement with foreign markets can be easily compared. After adjusting the optimal profit level from equation 2 with the relevant fixed cost of trading, we get $\pi^{\exp/imp} > \left\{\pi^{\exp O}, \pi^{impO}\right\} > \pi^{d}$. The comparison shows that two-way traders generate the highest profits, which are followed by firms that either export or import. Non-trading firms generate the lowest amount of profit.

Fixed costs incurred for trading can vary across firms. Firms might have different levels of information about and connections with foreign providers of intermediate goods and foreign buyers. This would lead to heterogeneity in foreign market participation even among the firms with the same efficiency levels. Although it is not included in the model, one can easily incorporate efficiency cut-offs for only export, and only import by introducing a stochastic component to the fixed cost of importing (it is sufficient to introduce this shock to one of the costs and it does not matter whether it is introduced to the cost of importing or exporting) [6]. Suppose that before firms make any decision to import or export they draw a firm-specific shock ε to the fixed cost of importing and this shock is identically and independently distributed across firms and across time with zero mean. Then the total fixed cost of importing is equal to $f_i + \varepsilon > 0$. This stochastic component in the cost allows us to have the four groups of firms with different trade orientation.

Having solved the static trading problem of a firm, next I present the dynamic framework that allows firm to grow through introducing new products to the economy. Firms introduce new products at rate *I* which depends on both their R&D investment *R* and the existing stock of knowledge capital. The knowledge capital stands for all skills, techniques, and know-how that firms use in their attempts to innovate. Knowledge capital of a firm can be captured by the number of products that it currently produces *n*[7]. Then innovation function can be written as

$$\mathrm{I} = \mathrm{F}(\mathrm{R}, \mathrm{n}).$$

This function is strictly increasing and homogeneous of degree one in both R and n. Under these assumptions, R&D cost can be written as a function of *I* and *n* as R=c(I/n)n. Here I/n determines innovation intensity of firm which I denote as λ .

Firms face an exogenously fixed probability μ of losing their products. Based on this setup, dynamics of firm evolution is modeled as follows. A firm of efficiency type φ , with a

[6] Kasahara and Lapham (2007) use this method to obtain the efficiency cutoffs for four trading groups.
[7] See Klette and Kortum (2004) for a detailed discussion of the innovation function introduced here.

current flow of profits $\pi(\varphi)$n , faces a Poisson hazard μn of losing a product. By spending in R&D it influences the Poisson hazard *I* of becoming a firm with n+1 products. The firm chooses optimal amount of R&D to maximize its expected present value $V_\varphi(n)$. Bellman equation for firm's dynamic optimization problem is

$$rV_\varphi(n) = \max_{\lambda>0}\left(\pi(\varphi)n - wc(\lambda)n + \lambda n\left[V_\varphi(n+1) - V_\varphi(n)\right] - \mu n\left[V_\varphi(n) - V_\varphi(n-1)\right]\right)$$

where *r* is the interest rate and *w* is the wage rate. The value function is linear in n which allows us to get an analytically tractable solution to the problem. The solution is given in equation 7. It shows that optimal amount of innovation intensity λ is determined by setting marginal cost of innovation equal to marginal benefit[8]

$$c'(\lambda) = \frac{\pi(\varphi) - wc(\lambda)}{r + \mu - \lambda}. \qquad (7)$$

Firms with higher values of λ introduce new products at a faster rate and grow faster. Equation 7 shows that higher profit levels shift up marginal benefit of innovation and lead to higher innovation rates (by increasing λ)[9].

Based on the analytical framework presented above, it is easy to see how engagement in global markets is related to growth. A firm's evolution and its trading decision are both determined by its efficiency level. Since firms have to incur sunk costs to enter both import and export markets, only the most efficient firms can self-select themselves into both markets. Moreover, firms with higher efficiency levels invest more in R&D which leads to more innovation and faster growth. Thus, the model yields a positive correlation between foreign exposure and growth.

4 Data

For the analysis, I use plant level data collected through the World Bank's Enterprise Surveys[10]. The surveys cover a rich set of developing countries from different regions of the world. In each country, a random sample of firms is selected from manufacturing sectors which is stratified by size, region, and 2-digit industry. A total of 16,722 firms from 43 countries are used in the analysis[11]. The surveys conducted in 2002, 2005, and 2008 include countries from Eastern

[8] Details of solution of the Bellman equation under heterogeneous firm types are given in Lentz and Mortensen (2008) who introduce heterogeneity in profit levels to the setup of Klette and Kortum (2004).

[9] A formal proof of this relationship is given in Klette and Kortum (2004).

[10] Although, in the surveys unit of observation is plant, I use firm in the rest of the paper. In the LAC 2006 and ECA 2008 surveys, firms were asked whether they are a part of a larger firm. 89% of 6468 firms in LAC survey and 90% of 4959 firms in ECA 2008 survey who answered to this question own a single plant. The multi-plant firms make 34% of total employment in LAC region in 2006 and 20% of total employment in ECA region in 2008.

[11] The number of firms used in the empirical analysis varies across empirical specifications due to missing observations for the variables of interest.

Europe and Central Asia region (ECA surveys). The 2006 survey include countries from Latin America and Caribbean region (LAC survey)[12]. Table 1 shows the number of firms included in each survey. In addition to the cross-sectional data, there are 1,935 firms from 31 countries that were surveyed twice in three years. The number of firms included in this panel is given in Table 2. All countries that are included in the analysis are presented in Table 15. In this table there are four countries that were also surveyed in 2003. Data from 2003 surveys are only used in the panel data analysis which will be discussed below.

4.1 Industry Summaries

The manufacturing industries that are included in the analysis are listed in Table 3. The classification of the industries is made according to ISIC revision 3.1. Firms are divided into four groups according to their trade orientation: two-way traders, only importers, only exporters and non-traders. Table 3 shows the fraction of firms in each trade group. In almost all industries, non-traders make the largest group. Among the firms that trade, only importers have the largest share except textile industry. The high ratio of importers can be due to the imperfect substitutability between foreign and domestic inputs. It might also show that on average sunk cost of importing is lower than the sunk cost of exporting.

To see how engaged firms are with foreign markets, in Table 4, I show the percentage of intermediate goods that is imported by importing firms and percentage of output that is exported by exporting firms[13]. The table shows that the trading firms in the sample trade quite intensively. Amount of imported intermediate goods make 53% of total intermediate goods used for production and amount of exported goods make 43% of total revenues for two-way traders. The median values are close to the mean values especially for import intensity which supports the significance of participation in foreign markets of the firms.

4.2 Variables of Interest

The broad scope of the survey allows me to observe a rich set of variables to analyze the underlying factors of firm evolution. In measuring firm evolution I use several variables. As direct measures of growth, I look at evolution of size measured as employment and sales and evolution of labor productivity. I also analyze different proxies for technological innovation. These measures are product and process innovation, use of quality certificates and foreign licenses. In examining

[12] Data in the surveys refers to the last fiscal year completed when the survey was conducted (i.e. data in 2008 survey refers to fiscal year 2007).

[13] I have done this table separately for each survey year and the percentages do not change much across regions or over time.

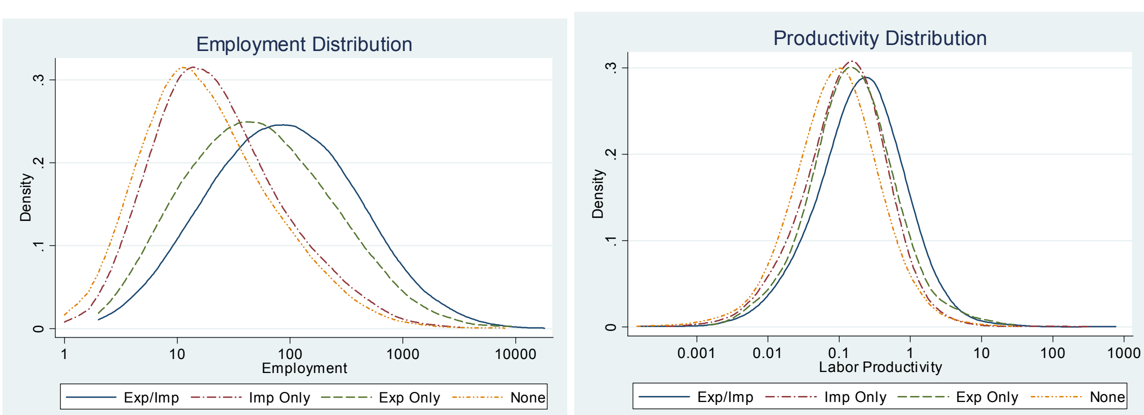
the relationship between firm evolution and trade, I control for a rich set of firm characteristics. A complete list of variables used in the analysis is given in Table 5 and their descriptive statistics are given in Table 6. The summary statistics show that 56% of firms have introduced new products in the past three years and 45% have invested in R&D. These numbers seem high especially for developing countries. Part of the reason for these high values could be different interpretations of the questions by the respondents. I try to control for these possible measurement error problems with using different measures of firm evolution[14].

Data from 2002, 2005 ECA surveys and 2003 LAC survey are given in US dollars but the data from 2006 LAC and 2008 ECA are in local currencies. Nominal values are deflated using the GDP deflator from the World Bank Development Indicators database. All values are presented in 2000 constant US dollars and the exchange rate is taken from the International Financial Statistics database.

5 Descriptive Analysis of Trade Orientation and Firm Characteristics

Before introducing the reduced form model, I provide a descriptive analysis of the relationship between foreign exposure and certain measures of firm performance. Dividing firms into four groups according to their trade orientation, in Figure 1, I show the distribution of employment and labor productivity measured as sales per worker. Two-way traders (Exp/Imp) outperform other groups in both measures. They are followed by only exporters (Exp Only) who are followed by only importers (Imp Only).

Figure 1 Trade Orientation and Firm Performance



[14] Moreover, the data does not include firms that have less than five workers (micro-firms). Micro-firms make quite a large share of firms in many developing countries.

Average performance measures of firms with respect to their trade orientation are presented in Table 7. In the table, in addition to labor productivity (Proy), I also present total factor productivity (TFP). To measure TFP, I estimate Cobb-Douglas production function with tree input factors, capital K, labor L, and intermediate inputs M[15]. Output is measured with firm's sales, capital is measured with the replacement value of machinery, vehicles, equipment, land, and buildings, labor is measured by the number of workers, and intermediate goods is determined by the cost of raw material and intermediate materials. TFP is estimated as the residual term of the production function. The table shows that two way traders are the most productive and largest firms which are followed by only exporters and only importers.

To investigate the differences among firms further, I estimate the premium in several performance measures according to firms' trade orientation. I run the descriptive regression given in equation 8

$$y_{ijc} = \beta_0 + \beta_1 d^{xm}{}_{ijc} + \beta_2 d^{x}{}_{ijc} + \beta_3 d^{m}{}_{ijc} + \gamma X_{ijc} + \delta I_j + \lambda I_c + \mu I_t + \varepsilon_{ijc}\,. \tag{8}$$

Here y_{ijc} refers to a vector of attributes of firm *i* in industry *j* in country *c* such as sales, employment, labor productivity, TFP, growth rates, wage, and capital intensity[16]. Capital intensity is calculated as the ratio of log of aggregate capital to log employment level. The survey includes information about firms' employment levels and revenues in last fiscal year and three years before that. Using this information, annualized growth rates are calculated. On the right hand side of the equation three dummy variables d^{xm}_{ijc}, d^{x}_{ijc}, and d^{m}_{ijc} represent two-way traders, only exporters, and only importers in respective order. X_{ijc} represents total employment level to control for current size. For the growth rate regressions, instead of current size, I use past values of employment, sales, and productivity as controls. In addition, there is a vector of variables to control for 2-digit industry, country, and survey year effects listed in respective order I_j, I_c , and I_t. Countries show variation in their trade policies. An export oriented country could be more inclined to provide export subsidies or invest in export promotion agencies to spur trade. Moreover, the policy makers could work to encourage trade activities by establishing bilateral or multilateral trade agreements and improving tariff rates. Inclusion of country fixed effects allows isolating the potential differences across countries in trade and innovation policies that may affect the trading decision and evolution of firms. Within countries some industries might have higher comparative advantage in trade than others. Industry fixed effects account for differences in factors like the level of competition, technology use, market demand, and trade intensity which can affect the relationship between trade

[15] The production function specification used in the estimation is $Y = AK^{\alpha}L^{\beta}M^{\gamma}$.

[16] In the surveys, there's no information about the exiting firms. Hence the growth rates are all measured as conditional on the survival.

and growth. Finally the survey year fixed effects control the possible effects of the differences in macroeconomic environment and changes international trade over time.

Since most of the performance measures are in log scale, coefficients measure the percentage differences between traders and non-traders. All standard errors are clustered to allow for possible correlations in performance measures across firms within the same country, industry, and year. In the regressions for growth rates of employment, sales, and productivity, I control for outliers by excluding firms with growth rates that are more than four standard deviations away from the average value in each country.

Table 8 shows the regression results for equation 8. The coefficients on all performance measures except the one for only-importers in log (TFP) are significant at the 1% level. As expected, traders perform better than non-traders. In addition to being larger and more productive, they grow faster, pay higher wages, and they are more capital intensive than non-traders. Among traders, two-way traders are the best performers. I also test if firms in each trade group significantly differ from the other groups (i.e. test $\beta_1 = \beta_2$; $\beta_1 = \beta_3$; $\beta_2 = \beta_3$). Test results which are presented at the bottom of the table show that in almost all performance measures, firms in each group significantly differ from the other trading groups at 1% level.

The results of Table 8 are in accordance with the model introduced above. Efficient producers self-select into foreign markets and among those only the most efficient ones can compensate the sunk costs of entry into both markets. An important result of this estimation is that estimating export premium without controlling for import status is likely to overestimate the actual value by capturing the import premium.

In their performance rankings, two-way traders are followed by only-exporters. The lowest premium is observed in only-importers. This difference in the premiums might be due to higher sunk costs of exporting relative to importing for a larger fraction of firms. Hence the threshold efficiency level is higher for exporting. It might also be due to low substitutability of foreign intermediate inputs with domestic inputs which would lead to more frequent and larger transactions of imports. Although it is difficult to determine what derives higher performance of trading firms from this descriptive analysis, the results are in accordance with several recent studies. In two studies that use the same grouping of firms with respect to their foreign exposure, Vogel and Wagner (2010) derive a similar conclusion for West and East Germany manufacturers. Using data from Belgium manufacturers, Muuls and Pisu (2009) also find similar results except only importers rank higher in performance measures than only exporters in their analysis.

I also perform this descriptive analysis using the panel data for robustness. In these regressions the same estimation equation as for cross-sectional data is used. However, the dependent variable at time (*t*) is regressed on the trading status of firms at time (*t-3*). In the growth rate regressions, I also use the values for the size of the firm at (*t-3*)[17]. The results which are presented in Table 9 support the findings presented in Table 8[18]. The advantage of traders in growth rates is more pronounced in the results from the panel data.

6 Empirical Model

In the model firm evolution is determined by its efficiency level. However this variable is not observed in the data. The cross-sectional nature of the data does not allow deriving causal inferences on how trading cause faster growth. I also do not intend to strictly test the model's implications. The empirical analysis aims to show that after controlling for certain firm, industry, and country characteristics that are likely to affect firm evolution, firms' growth and innovation capacities vary with their trading status. The analytical model provides an explanation to this evidence by the presence of fixed costs of trading and coexistence of firms with different efficiency levels operating in the same market.

To measure firm evolution, I look at growth rates of employment, sales, and labor productivity. In addition to these, I look at variables that proxy for technological innovations. Enterprise surveys provide information on the probabilities of introducing new products, improving existing processes, using various quality certificates such as ISO 9000 or 9002, and use of foreign licenses. These measures are likely to represent firm's adoption of production technologies, methods, or knowledge that were not available to them. This interpretation of innovation is preferable to an interpretation we would consider for the developed countries. In other words, in developing countries firms' innovations should be thought as approaching the frontiers of technology or production methods rather than extending these frontiers.

Innovations are the drivers of firm growth in the model. Since firm level output prices are not available, measured values of total factor and labor productivities and sales can be affected by both output and input price movements. On the other hand, the measures of innovation as well as employment growth are not affected from such price movements. Using various measures of firm evolution (growth rates and technological innovation rates) shows the robustness of the relationship between foreign exposure and growth[19].

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[17] In the cross-sectional regressions, size at (t-3) is obtained from the survey conducted at time t. In the panel regressions size at (t-3) is obtained from the survey conducted at time (t-3). This alleviates the potential measurement error problem with using retro-respective values.

[18] Alternatively, random-effects method was also applied to the panel dataset and results are quite similar to those presented in Table 9.

[19] Growth rates of TFP could not be computed as the survey only includes information on capital and material inputs for the last fiscal year.

The measures of technological innovation are positively and significantly correlated with firm growth. Table 10 shows the results of regressing growth rates of size and productivity on the proxy measures of technological innovation. Each cell in the table shows the results from the regression of dependent variables on one of the innovation measures. In each regression, I control for 2-digit industry, survey year, and country fixed effects. Regression results show that firms that introduce new products over the past three years grew 2% faster in employment and they are 18% more productive than the firms that did not introduce a new product. The table clearly shows the positive correlation between the innovation measures, productivity, and growth rates.

Using the innovation measures I estimate a reduced form probit model. The dependent variable measures whether the firm is engaged in technological innovation. The particular model I estimate is as follows:

$$\Pr(z_{ijc} = 1) = \Pr(\beta_1 d^{xm}{}_{ijc} + \beta_2 d^{x}{}_{ijc} + \beta_3 d^{m}{}_{ijc} + \gamma X_{ijc} + \delta I_j + \lambda I_c + \mu I_t + \varepsilon_{ijc} > 0) \qquad (9)$$

where z_{ijc} is a discrete random variable equal to one if the *i*th firm in industry *j* in country *c* carries out a technological innovation. As in equation 8, in the right hand side of the equation there are three dummy variables $d^{xm}{}_{ijc}$, $d^{x}{}_{ijc}$, and $d^{m}{}_{ijc}$ that represent two-way traders, only exporters, and only importers in respective order. In addition, there is a vector of control variables representing firm, 2-digit industry, country, and survey year fixed effects listed in respective order X_{ijc}, I_j, I_c, and I_t. Inclusion of industry fixed effects can control for the possible differences across industries in the interpretation of technological innovations.

In addition to analyzing technological innovation variables, I report employment, sales, and labor productivity growth using ordinary least squares method. The equation for this estimation is given in equation 10

$$\dot{y}_{ijc} = \beta_0 + \beta_1 d^{xm}{}_{ijc} + \beta_2 d^{x}{}_{ijc} + \beta_3 d^{m}{}_{ijc} + \gamma X_{ijc} + \delta I_j + \lambda I_c + \mu I_t + \varepsilon_{ijc}, \qquad \textbf{(10)}$$

where $\dot{y}_{ijc}$ is the growth rate for the *i*th firm in industry *j* in country *c* and the right hand side variables are same as the ones used in equation 9. Finally, I include logarithm of productivity using the same specification given in equation 10. The empirical hypothesis in both equations 9 and 10 that I would like to test is $\beta_1 \geq (\beta_2, \beta_3) > 0$.

The survey allows using a rich set of variables to control for firm characteristics that would affect its evolution. Attributes like physical capital, human capital, size, age, and ownership structure are likely to affect firm evolution. Motivated by the analytical framework, size could be used to reflect the built-in knowledge capital of the firm. Size is measured using log of total full time employees[20]. Second, I include a dummy variable showing whether the firm conducts R&D. If R&D status of the firm is omitted from the analysis, the coefficients representing foreign exposure could be biased upward according to the model as firms with foreign exposure would be more likely to do R&D because of their higher efficiency levels. To control for other unobserved factors like the level of human capital, I use the amount of training that the employees get.

Finally, I control for the share of foreign ownership in the firm. This variable has been analyzed in many studies such as Criscuolo, Haskel, and Slaughter (2010) and Almeida and Fernandes (2008). Foreign ownership can facilitate the transfer of better technology to the firm which reduces the cost of R&D and promotes growth. For the ownership structure, I set a dummy variable equal to one for firms with more than 10% of foreign ownership. This level is used by statistical agencies in many countries (e.g., the U.S. Bureau of Economic Analysis) and it is the amount defined in IMF's Balance of Payment Manual (1993).

Table 11 shows the main estimation results. The first three columns show the growth rates of employment, sales, and productivity. The fourth column shows the log labor productivity and the fifth to ninth columns show the measures of technological innovation: product innovation, process innovation, use of foreign licenses, and use of quality certificate in respective order. The coefficients in the probit regressions show the marginal effects at the mean values and all standard errors are clustered at industry, country, and year level.

The estimation results show that firms with some level of foreign exposure perform better than non-traders. They grow faster; they are more productive and more innovative. As in the results from the descriptive regressions, two-way traders are the best performers. They are followed by only exporters who are followed by only importers in all measures of interest except product innovation and use of foreign licenses. The coefficients identifying foreign exposure are highly significant. For the employment growth, two-way traders grow almost 3.5% faster and only exporters grow 2.2% faster than the non-traders. The growth premium is slightly less for the only importers (1.1%). The significance of the results and the persistent ranking according to trade orientation in all growth rates and indicators of technology adoption leads to two conclusions. There exists a positive and significant relationship between trade orientation of firms and their evolution and there is complementarity between importing and exporting in generating this heterogeneity in evolution.

Regression results in Table 11 only show that traders grow significantly faster than non-traders and they innovate more. In the bottom of the table, I look at whether traders significantly

[20] Employment level has the largest data coverage and it is much less prone to measurement error problems than sales and productivity.

differ among themselves in their evolution. For each specification, I test whether firms that trade significantly vary among themselves in their performances. The values in the table show the p-values for these tests. Test results show that two-way traders perform significantly better than only exporters except product innovation and they perform better than only importers in all measures. Only exporters grow faster than only importers in employment and sales and they are more likely to use quality certificates than only importers. Although only importers introduce more product innovations than only exporters this difference is not statistically significant.

The coefficient of ownership in the estimation differs for growth rates and indicators of technology adoption. Although firms with foreign ownership grow faster than domestic firms, they show less product and process innovation than domestic firms but the results are only significant for product innovation. However they acquire more quality certificates and foreign licenses. Under the interpretation of innovation as firms' catching-up with the technological frontier rather than expanding it we can interpret this result as follows. Firms with foreign ownership use technology that is closer to frontier and apply methods that are more productive than the technology and methods used by domestic firms. Hence, they grow faster and have less need to improve their product scopes and processes when compared to domestic firms[21].

Another result of the estimation is that large firms are more innovative. This is in accordance with the empirical evidence presented by Cohen and Klepper (1996). Also in the innovation function, size reflected knowledge capital stock that is accumulated through the firm's past innovations and more knowledge leads to more innovation. The other determinant of innovation function, R&D investment is also significantly related to firm growth and innovation. On the relationship between the growth rates and size, we see the mean reverting behavior. Conditional on survival, smaller firms grow faster than large firms. This negative relationship between growth rate and size has been shown in many studies such as Dunne, Roberts, Samuelson (1989), Rossi-Hansberg and Wright (2007), and Lentz and Mortensen (2008). This finding is in accordance with the analytical model. For a slightly different version of the model, Klette and Kortum (2004) show that conditional on survival, growth rate decreases in size. Similar inferences are driven for revenue and productivity growth. Training is significantly correlated with firm growth and technology adoption. Finally, control for age shows that younger firms are more dynamic than old firms. They grow faster in size and they innovate more. However the magnitude of the coefficient of age is small.

[21] An alternative interpretation is given in Almeida and Fernandes (2008). They find that firms that have more than 50% foreign ownership are less innovative than the firms with less than 50% foreign ownership. They interpret this finding as multinational foreign parents being likely to transfer more mature technologies to their majority-owned subsidiaries than to their minority-owned subsidiaries.

Overall, the estimation results show that despite of the firm, industry, and country level controls the positive relationship between trade orientation of firms and their evolution is strong. Firms integrated with global markets grow faster and are more likely to adapt better technologies than the firms serving only domestic markets.

7 Sensitivity Analysis with Additional Controls

In this section I analyze the sensitivity of the results to additional controls and alternative specifications of the model. The estimation results in Table 11 show strong correlation between trade orientation of firms and their evolution. Although it is difficult to make a causal inference due to lack of strong instruments or a large panel dataset, this problem can be partially alleviated by controlling various firm characteristics, industry, country, and year fixed effects. In this section I check the robustness of estimation results by introducing further controls that can simultaneously relate to trade and firm evolution.

Firm characteristics such as the level of foreign ownership, capital intensity, access to finance, capacity utilization, and being a multi-plant firm or factors like the level of competition in the markets can be simultaneously correlated with firm evolution and global engagement of the firm. I analyze whether the relationship between trade and firm evolution persists under these additional controls. I perform the analysis including all control variables and for all measures of growth and innovation that are included in the main regression analysis presented in Table 11. I perform the sensitivity analysis for employment growth and product innovation as these variables have the largest data coverage. All estimation results with the additional control variables are given in Table 12 and Table 13. The former table shows the results for employment growth and the latter one shows the results for product innovation.

In the first estimation, I elaborate on the definition of foreign ownership. Instead of using a dummy variable representing all firms with more than 10% foreign ownership, I use two dummy variables with more than 50% of foreign ownership representing majority foreign owned and less than 50% representing minority foreign owned firms. The relationship between trade orientation of firms and their evolution is not affected by this additional control. However dividing foreign owned firms into two groups shows that only those firms where the majority is owned by foreigners grow faster than domestic firms. Yet, these firms are less innovative than the domestic firms. This finding is in accordance with results of Almeida and Fernandes (2008).

The level of physical capital was excluded from the analytical model for simplicity but it is a crucial determinant of growth. As a proxy for that, I use capital intensity measured as the ratio of log aggregate capital to log employment level. Capital is measured as the replacement value of machinery, vehicles, equipment, land, and buildings. Capital intensity is positively correlated with growth but not significantly related to product innovation. Access to finance is an important factor for firm evolution. Firms with easier access to external finance could find it easier to access to foreign markets. They can find it cheaper to compensate the sunk costs required to export or import. Using external financial sources for productive investment purposes, they are also likely to grow faster. Hence, when omitted, this variable can play a role in explaining the positive relationship between foreign exposure and growth. To control for this, I include a dummy variable showing firms that use external sources to finance their investment. The estimation results show that access to external finance is positively and significantly related to growth and innovation. As an alternative measure, instead of using a dummy variable for measuring access to finance, I use the amount of total investment that is financed through some financial intermediary. The results are very similar.

In their detailed analysis of firm dynamics, Dunne, Roberts, and Samuelson (1989) conclude that multi-plant firms are more likely to survive and grow faster than single plant firms. Although their number is small there are establishments that are part of a larger firm. To see whether this affects the relationship between trade orientation of firms and their evolution, I include a dummy variable for multi-plant firms. This information is only available for 2006 and 2008 surveys. Being a part of a multi-plant firm contributes significantly to growth.

Next, I add total number of hours worked per week to control for capacity utilization. Becheikh et al. (2006) present evidence that firms that use their resources more efficiently are more likely to innovate and grow. This is especially valid for process innovation. If firms are producing at a capacity close to their limits, they might be inclined to improve their processes that will lead to more access capacity. Estimation results show that firms with higher capacity utilization grow faster[22]. However the magnitude is small, a 10 hour increase in total hours worked per week leads to 0.3% increase in employment growth. Although not presented, I use an alternative measure of capacity utilization which is the ratio of firm's actual output to its maximum possible output. Using this measure also gives similar results.

Finally I analyze whether the link between trade and firm evolution is affected by the degree of market competition that the firm faces. The literature on relationship between market competition and innovation gives mixed results. On one hand, it is predicted that innovation should decline with competition, because competition reduces monopoly rents that the innovations yield (see Aghion and Howitt (1992)). On the other hand, Shaked and Sutton (1987) argue that

[22] I only included firms with total hours/week ≥ 25.

innovation increases product differentiation and this should cause it to increase with competition. A more recent study by Aghion et al. (2005) introduces a model that combines these two relations and gets a negative-U shaped relationship between competition and innovation. To measure competition, I look at the markup that the firm charges. For this variable, data is only available for ECA 2002 and 2005 surveys. For both growth rate and product innovation, two-way traders perform better than only exporters who perform better than only importers. As the amount of markup increases (implying less competition in the market), probability of innovating new products increases significantly.

The sensitivity analyses with these additional controls show that the relationship between foreign exposure and firm evolution is not sensitive to the addition of these controls. The coefficients of the variables representing foreign exposure in the main estimation results presented in Table 11 do not vary much from the respective coefficients in the specifications presented in Table 12 and Table 13.

8 Analysis Using the Panel Data

In this section, I use the balanced panel dataset constructed from the original data to provide further support for the relationship between trade orientation and firm evolution and alleviate the endogeneity problem. I ran two experiments with the panel data. In the first experiment, I regress growth rate between time (t-3) and t and probability of introducing a new variety between time (t-3) and (t) on trading status of the firm in (t-3). As additional firm level controls, I introduce firm's ownership status, its size, and age at time (t-3)[23]. In addition, I include the country, industry, and survey year controls. The results which are given in Table 14 are in accordance with the results presented in Table 11. All trading firms grow faster than non-trading firms. Similarly all three trading groups are significantly different from non-traders in their innovation performances. As before, foreign ownership contributes to growth but is negatively related to product innovation.

In the second experiment, I use random effects estimation method[24]. This method allows us to control for the unobserved firm fixed effects. However the panel dimension is short and the sample size is small. Hence the results from the panel estimation should be interpreted with care

[23] In the panel regressions, indicator variable for other controls like R&D investment and training were excluded as the inclusion of these variables decreased the sample size by more than half which led to few observations in each trade group.
[24] Judge et al. (1982) argue that when the time horizon is short and number of observations is large the estimates obtained by fixed and random effect methods can differ significantly.

and they would only be taken as an indication of the patterns of correlation once the firm heterogeneity is imperfectly accounted for.

The results from the random-effects regression are quite similar to the results obtained from using past values of the dependent variables[25]. In the bottom of the table, I present Breusch and Pagan (1980)'s likelihood ratio test statistic for employment growth and likelihood ratio test statistic for product innovation which tests the existence of random effect in the model. Both tests show the existence of random effects.

9 Conclusion

Recent trade models with heterogeneous firms have shown that exporters are larger, more productive, more capital intensive, and pay higher wages than firms serving only the domestic market. However, the relationship between firm growth and global engagement is less clear. In this study, using a detailed firm level dataset from 43 countries, I analyze whether firms with foreign exposure grow faster than domestic firms. In analyzing foreign exposure, in addition to exporting, I also analyze the role of importing. Several studies have shown that importers are quite similar to exporters in their evolution. Hence both activities need to be examined carefully in order to provide a sound answer to how trade is related to growth.

I investigate the relationship between firm growth and its trade orientation by dividing firms into four distinct groups: two-way traders, only exporters, only importers, and non-traders. This classification allows me to see whether importing or exporting is more strongly related to faster firm growth. I use several direct and indirect measures to find growth. As direct measures, I look at growth rates of employment, sales, and productivity. As indirect measures, I look at innovations that firms introduce. More specifically, I look at the probabilities of introducing new varieties, improving existing production processes, using internationally recognized quality certificates, and using foreign licenses. There is vast amount of theoretical and empirical evidence that relates technological innovations to firm growth. I also show the strong correlation between these measures in the data. Measuring firm evolution with a rich set of variables make the analysis more definite.

Motivated by the analytical framework introduced, I estimate a reduced form model. Results show that globally engaged firms are larger, more productive, more capital intensive, and pay higher wages than purely domestic firms. Two-way traders grow faster and innovate more than any other group of firms. They are followed by only exporters. This result shows that not only all

[25] The magnitudes of the coefficients for product innovation regression in random effects method are different because they do not show the marginal effects at their mean values.

firms but also exporters are heterogeneous among themselves and the best performers among them are the ones who import intermediate products. There is complementarity between two aspects of trade. In their rankings of performance, two-way traders and only exporters are followed by only importers. Non-traders are the least growing and innovating group of firms.

Another finding of the study is on the relationship between foreign ownership and growth. Firms with some level of foreign ownership grow faster than domestic firms. However, they are not more innovative than domestic firms. This result shows that firms with foreign ownership use technology that is closer to the frontier and hence have less incentive to innovate to be able to grow. For the other variables of interest, R&D and training are positively and significantly related to growth and innovation.

To check the robustness of the findings, I include further firm characteristics as control variables such as capital intensity, access to finance, a more detailed foreign ownership variable, capacity utilization, and being part of a multi-plant firm, which are likely to be correlated with the growth, innovation and trade orientation of the firm. I also include variables to control for the market competition that the firm faces. The positive relationship between trade and growth is not sensitive to these additional controls. I also test the findings with a panel dataset constructed from the original dataset. Evidence from the panel data is in accordance with the main estimation results.

The lack of a long panel dataset makes it difficult to interpret the relationships as causal. However, the strong correlation between direct and indirect measures of firm evolution and trade under a rich set of control variables shows the importance of this relationship. This has important implications for trade policies. Reforms that increase global engagement of firms through both importing and exporting are likely to lead to more job creation. Increased and improved trade could be a way to attain sustainable growth in developing countries.

10 References

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APPENDIX

Table 1 Survey Summary

Data Year	Percent
ECA 2002	10
ECA 2005	22
ECA 2008	39
LAC 2006	30
Total	16,722

Table 2 Survey Summary- Panel Firms

Panel Years	Percent
ECA 2002-2005	12
ECA 2005-2008	36
LAC 2003-2006	51
Total	1,935

Table 3 Manufacturing Industries – Trade Orientation of Firms

		Trade Shares in Industries (in %)				Totals
ISIC	Industry	Export/Import	Import Only	Export Only	None	(%)
15	Food	20.3	31.9	7.2	40.6	22.84
17	Textiles	39.0	25.6	10.5	24.9	10.54
18	Garments	31.4	33.1	7.0	28.5	10.18
24	Chemicals	36.8	42.2	3.4	17.6	20.23
20,36	Wood & Furniture	26.4	27.6	15.1	30.9	5.96
25,26	Non-metal & Plastic	25.1	30.5	8.5	35.8	5.83
28,29	Metals and machinery	33.4	31.6	9.5	25.6	7.24
-	Other manufacturing	36.1	31.3	8.3	24.3	17.18
	Total	3963	4260	1099	4006	13,328

Table 4 Percentage of Goods Traded

	% Imported		% Exported	
	Mean	Median	Mean	Median
Export/Import	53	50	43	30
Export Only	-	-	44	30
Import Only	54	50	-	-

Table 5 Variable Descriptions

Variable	Definition
Export/Import	Dummy variable equal to one if the firm exported any output and imported any intermediate good.
Import Only	Dummy variable equal to one if the firm only imported any intermediate good.
Export Only	Dummy variable equal to one if the firm only exported any output.
None	Dummy variable equal to one if the firm didn't trade any good.
Sales $_{t-3}$	Total annual sales three years ago.
Labor $_{t-3}$	Number of full time workers three years ago.
Proy $_{t-3}$	Labor productivity three years ago (measured as sales per worker).
TFP	Total factor productivity
Product Innovation	Dummy variable equal to one if the firm introduced onto the market any new or significantly improved products.
Process Innovation*	Dummy variable equal to one if the firm introduced any new or significantly improved production processes including methods of supplying services and ways of delivering products.
Foreign License *	Dummy variable equal to one if the firm uses technology licensed from a foreign-owned company.
Quality Certificate	Dummy variable equal to one if the firm has an internationally-recognized quality certification.
Foreign(≥ %10)	Dummy variable equal to one if more than 10% of the firm is owned by private foreign individuals, companies or organizations.
R&D Ind	Dummy variable equal to one if the firm spent on research and development activities, within the establishment or other companies contracted.
Training	Dummy variable equal to one if the firm runs formal training programs for its employees.
Age	Survey year minus year the firm started operation
Wage	Total annual cost of labor (including wages, salaries, bonuses, social payments).
Capital Int	Replacement value of machine, equipment, vehicles, building, and land.
Total Hrs/Week	Total number of hours per week that the establishment normally operate
Access to Finance	Dummy variable equal to one if the firm uses banks or other financial institutions to finance its investments.
% Invest Financed	% of investment that is not financed through internal sources.
Multi-plant Firm	Dummy variable equal to one if the firm is part of a larger firm.
ln(Markup)†	Amount the sales price exceeds operating costs (i.e. the cost material inputs plus wage costs but not overheads and depreciation)

* Data for process innovation and foreign license are only available for 2006 survey.

† Data for markup is only available for 2002 and 2005 surveys

Table 6 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Export/Import	16675	0.29	0.45	0	1
Import Only	16675	0.31	0.46	0	1
Export Only	16675	0.09	0.28	0	1
None	16675	0.31	0.46	0	1
Product Innovation	16680	0.57	0.50	0	1
Process Innovation	11385	0.67	0.47	0	1
Foreign License	10856	0.17	0.38	0	1
Quality Certificate	16355	0.61	0.79	0	2
$Log(Labor)_{t-3}$	15558	3.39	1.53	0	9.55
$Log(Sales)_{t-3}$	11942	1.21	2.35	-15.04	17.14
$Log(Proy)_{t-3}$	11636	-2.21	1.80	-14.63	9.32
$Log(TFP)_{t}$	8518	-0.01	0.69	-6.67	7.08
Proy Growth	10217	-0.01	0.15	-0.44	0.44
Labor Growth	14154	0.04	0.11	-0.24	0.34
Sales Growth	11286	0.05	0.18	-0.48	0.54
Foreign (≥ %10)	15608	0.13	0.33	0	1
R&D Ind	16651	0.45	0.50	0	1
Training	13269	0.51	0.50	0	1
Age	16543	19.99	19.72	1	202
Capital Int	10491	0.13	0.76	-10.36	4.34
Access to Finance	10370	0.36	0.48	0	1
% Invest Financed	10370	22.29	35.41	0	100
Multi-plant Firm	11427	0.11	0.31	0	1
Total Hrs/Week	14432	58.86	32.83	1	168
log(Markup)	4654	2.91	0.59	0	5.01
log(Wage)	12019	-0.41	1.96	-7.95	8.27

Table 7 Trade orientation and performance

	Log(Proy)	Log(TFP)	Log(Labor)	Log(Sales)
Export/Import	-1.61	0.06	4.45	2.84
Export Only	-1.86	0.03	3.97	2.07
Import Only	-2.11	-0.05	3.15	1.01
None	-2.39	-0.07	2.93	0.52

Table 8 Descriptive Regressions with Ordinary Least Squares (Cross-sectional data)

	Log (Sales)	Log (Labor)	Log (Proy)	Log (TFP)	Sales Growth	Labor Growth	Proy Growth	Log (Wage)	Log (Capital Int)
Export/Import	2.272	1.722	0.446	0.154	0.065	0.041	0.041	0.332	0.121
	(0.062)***	(0.045)***	(0.043)***	(0.027)***	(0.006)***	(0.003)***	(0.004)***	(0.031)***	(0.023)***
Export Only	1.486	1.137	0.322	0.109	0.042	0.029	0.026	0.177	0.093
	(0.080)***	(0.053)***	(0.048)***	(0.034)***	(0.008)***	(0.004)***	(0.006)***	(0.038)***	(0.027)***
Import Only	0.612	0.385	0.211	0.042	0.017	0.015	0.011	0.133	0.079
	(0.059)***	(0.035)***	(0.034)***	(0.023)*	(0.005)***	(0.003)***	(0.004)***	(0.026)***	(0.021)***
$Log(Labor)_t$			0.061	0.006				1.031	0.227
			(0.011)***	(0.008)				(0.008)***	(0.010)***
$Log(Sales)_{t-3}$					-0.014				
					(0.001)***				
$Log(Labor)_{t-3}$						-0.017			
						(0.001)***			
$Log(Proy)_{t-3}$							-0.057		
							(0.002)***		
Observations	13328	16609	13358	8500	10122	14114	10202	11961	10468
R-squared	0.391	0.279	0.466	0.013	0.097	0.077	0.182	0.794	0.342

Robust standard errors clustered by country, industry, and year are in parentheses. The regressions include controls for 2-digit industry, survey year, and country fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

P- values for the tests on coefficients of trade orientation

$p(\beta_{Export/Import}=\beta_{Export})$	0.00	0.00	0.00	0.16	0.00	0.00	0.01	0.00	0.14
$p(\beta_{Export/Import}=\beta_{Import})$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
$p(\beta_{Export}=\beta_{Import})$	0.00	0.00	0.02	0.05	0.00	0.00	0.02	0.22	0.54

Table 9 Descriptive Regressions with Ordinary Least Squares (Panel Data)

	Log (Sales)	Log (Labor)	Log (Proy)	Log (TFP)	Sales Growth	Labor Growth	Proy Growth
Export/Import	2.538	1.813	0.518	0.272	0.299	0.113	0.161
	(0.135)***	(0.092)***	(0.082)***	(0.065)***	(0.088)***	(0.023)***	(0.057)***
Export Only	1.501	0.965	0.486	0.152	0.181	0.090	0.140
	(0.211)***	(0.132)***	(0.100)***	(0.085)*	(0.071)**	(0.033)***	(0.070)**
Import Only	0.958	0.583	0.296	0.139	0.013	0.042	-0.030
	(0.136)***	(0.086)***	(0.078)***	(0.070)*	(0.045)	(0.018)**	(0.052)
$Log(Labor)_t$			0.118	0.012			
			(0.025)***	(0.018)			
$Log(Sales)_{t-3}$					-0.126		
					(0.033)***		
$Log(Proy)_{t-3}$						-0.065	
						(0.008)***	
$Log(Labor)_{t-3}$							-0.356
							(0.079)***
Observations	1806	2106	1826	1368	1064	2100	1068
R-squared	0.430	0.323	0.493	0.040	0.209	0.104	0.343

Robust standard errors clustered by country, industry, and year are in parentheses. The regressions include controls for 2-digit industry, survey year, and country fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Table 10 Firm Evolution and Technological Innovation

	Dependent Variables		
	Labor Growth	Sales Growth	Log(Proy)
Prod Innov	0.018	0.031	0.175
	(0.002)***	(0.004)***	(0.022)***
Proc Innov	0.026	0.025	0.060
	(0.003)***	(0.004)***	(0.023)**
Foreing Lic	0.013	0.012	0.424
	(0.004)***	(0.005)**	(0.039)***
Quality Cert	0.004	0.012	0.119
	(0.002)	(0.005)**	(0.045)***

OLS method is applied. Robust standard errors clustered by country, industry, and year are in parentheses. The regressions include controls for 2-digit industry, survey year, and country fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Table 11 Trade Orientation and Firm Evolution

	Labor Growth	Sales Growth	Proy Growth	Log(Proy)	Prod Innov	Proc Innov	Foreign Lic	Quality Cert
Export/Import	0.035	0.048	0.029	0.360	0.211	0.115	0.120	0.178
	(0.003)***	(0.006)***	(0.005)***	(0.046)***	(0.016)***	(0.015)***	(0.021)***	(0.029)***
Export Only	0.022	0.021	0.014	0.195	0.134	0.104	0.065	0.104
	(0.004)***	(0.009)**	(0.007)**	(0.053)***	(0.019)***	(0.019)***	(0.027)**	(0.039)***
Import Only	0.011	0.005	0.009	0.186	0.167	0.080	0.084	0.017
	(0.003)***	(0.006)	(0.005)**	(0.037)***	(0.015)***	(0.017)***	(0.016)***	(0.030)
Foreign (≥%10)	0.015	0.023	0.024	0.278	-0.041	-0.030	0.126	0.048
	(0.003)***	(0.007)***	(0.005)***	(0.033)***	(0.016)***	(0.022)	(0.021)***	(0.025)*
R&D Ind	0.024	0.021	0.001	0.178	0.175	0.264	0.046	0.080
	(0.003)***	(0.005)***	(0.004)	(0.026)***	(0.016)***	(0.013)***	(0.010)***	(0.021)***
Training	0.026	0.035	0.007	0.128	0.144	0.180	0.059	0.206
	(0.003)***	(0.005)***	(0.003)**	(0.022)***	(0.013)***	(0.016)***	(0.010)***	(0.021)***
Age	-0.001	-0.000	0.000	-0.000	-0.000	-0.001	-0.000	0.001
	(0.000)***	(0.000)***	(0.000)***	(0.001)	(0.000)*	(0.000)**	(0.000)	(0.001)
$Log(Labor)_{t-3}$	-0.019			0.028	0.014	0.012	0.029	0.090
	(0.001)***			(0.012)**	(0.004)***	(0.006)**	(0.004)***	(0.008)***
$Log(Sales)_{t-3}$		-0.016						
		(0.002)***						
$Log(Proy)_{t-3}$			-0.058					
			(0.003)***					
Observations	10531	7865	8012	9678	11552	7189	7165	5653
R2 /Pseudo R2	0.106	0.120	0.190	0.478	0.146	0.208	0.172	0.431

OLS method is applied in the first four estimation results. Probit method is applied in the last four columns. Robust standard errors clustered by country, industry, and year are in parentheses. The regressions include controls for 2-digit industry, survey year, and country fixed effects. Probit regressions show the marginal effects at their mean values. *** p<0.01, ** p<0.05, * p<0.1.

P- values for the tests on coefficients of trade orientation

$p(\beta_{Export/Import}=\beta_{Export})$	0.00	0.00	0.02	0.00	0.00	0.78	0.00	0.06
$p(\beta_{Export/Import}=\beta_{Import})$	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.00
$p(\beta_{Export}=\beta_{Import})$	0.01	0.07	0.53	0.87	0.14	0.20	0.17	0.03

Table 12 Sensitivity Analysis: Labor Growth (OLS Regressions)

Export/Import	0.035	0.032	0.032	0.033	0.031	0.031	0.037	0.029
	(0.003)***	(0.004)***	(0.004)***	(0.004)***	(0.005)***	(0.004)***	(0.006)***	(0.006)***
Export Only	0.022	0.016	0.020	0.020	0.021	0.023	0.022	0.016
	(0.004)***	(0.005)***	(0.006)***	(0.006)***	(0.005)***	(0.005)***	(0.008)***	(0.010)*
Import Only	0.011	0.006	0.012	0.013	0.008	0.009	0.016	0.014
	(0.003)***	(0.004)*	(0.004)***	(0.004)***	(0.004)**	(0.003)***	(0.005)***	(0.006)**
$Log(Labor)_{t-3}$	-0.019	-0.025	-0.020	-0.019	-0.020	-0.021	-0.018	-0.025
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.002)***
Foreign (≥%10)		0.015	0.013	0.012	0.011	0.011	0.016	0.009
		(0.005)***	(0.004)***	(0.004)***	(0.005)**	(0.004)***	(0.005)***	(0.007)
R&D Ind	0.024	0.024	0.016	0.017	0.026	0.024	0.022	0.016
	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.004)***	(0.004)***
Training	0.026	0.027	0.016	0.017	0.030	0.028	0.019	0.021
	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.004)***	(0.003)***	(0.004)***	(0.005)***
Age	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.000	-0.000
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Foreign (≥50%)	0.017							
	(0.004)***							
Foreign (<50%)	0.007							
	(0.005)							
Capital Int.		0.020						0.004
		(0.003)***						(0.004)
Access to Finance			0.020					0.021
			(0.003)***					(0.004)***
% Financed				0.000				
				(0.000)***				
Multi-plant firm					0.008			0.006
					(0.005)*			(0.007)
Total Hrs/Week						0.000		0.000
						(0.000)***		(0.000)***
log(Markup)							-0.001	
							(0.004)	
Observations	10575	7304	6827	6827	6599	9320	3490	3036
R-squared	0.106	0.124	0.117	0.114	0.108	0.119	0.110	0.135

Robust standard errors clustered by country, industry, and year are in parentheses. All regressions control for 2-digit industry, survey year, and country fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Table 13 Sensitivity Analysis: Product Innovation (Probit Regressions)

Export/Import	0.209	0.201	0.191	0.193	0.164	0.201	0.256	0.122
	(0.016)***	(0.020)***	(0.018)***	(0.018)***	(0.020)***	(0.018)***	(0.027)***	(0.023)***
Export Only	0.132	0.134	0.117	0.118	0.094	0.124	0.184	0.069
	(0.019)***	(0.023)***	(0.021)***	(0.021)***	(0.026)***	(0.021)***	(0.031)***	(0.033)**
Import Only	0.166	0.159	0.146	0.147	0.152	0.165	0.162	0.108
	(0.015)***	(0.019)***	(0.018)***	(0.018)***	(0.017)***	(0.016)***	(0.027)***	(0.024)***
$Log(Labor)_{t-3}$	0.014	0.014	0.006	0.006	0.014	0.012	0.022	0.008
	(0.004)***	(0.006)**	(0.005)	(0.005)	(0.006)**	(0.005)**	(0.006)***	(0.008)
Foreign (≥%10)		-0.046	-0.032	-0.034	-0.039	-0.044	-0.061	-0.030
		(0.021)**	(0.018)*	(0.018)*	(0.024)	(0.018)**	(0.024)**	(0.029)
R&D Ind	0.175	0.194	0.150	0.151	0.246	0.175	-0.005	0.211
	(0.016)***	(0.017)***	(0.018)***	(0.018)***	(0.013)***	(0.016)***	(0.025)	(0.017)***
Training	0.144	0.139	0.103	0.104	0.145	0.148	0.108	0.101
	(0.013)***	(0.016)***	(0.015)***	(0.015)***	(0.017)***	(0.014)***	(0.020)***	(0.020)***
Age	-0.001	-0.001	-0.000	-0.000	-0.000	-0.000	-0.001	0.000
	(0.000)*	(0.000)**	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Foreign (≥50%)	-0.052							
	(0.018)***							
Foreign (<50%)	0.008							
	(0.029)							
Capital Int.		-0.005						-0.034
		(0.011)						(0.016)**
Access to Finance			0.061					0.052
			(0.011)***					(0.015)***
% Financed				0.001				
				(0.000)***				
Multi-plant firm					0.013			0.026
					(0.021)			(0.032)
Total Hrs/Week						0.000		-0.000
						(0.000)		(0.000)
log(Markup)							0.032	
							(0.018)*	
Observations	11599	8036	7533	7533	7193	10193	3865	3303
Pseudo R2	0.146	0.144	0.142	0.141	0.172	0.152	0.0935	0.136

Robust standard errors clustered by country, industry, and year are in parentheses. All regressions control for 2-digit industry, survey year, and country fixed effects. The coefficients show the marginal effects at mean values. *** p<0.01, ** p<0.05, * p<0.1.

Table 14 Trade Orientation and Firm Evolution: Panel Regressions

OLS regressions with past values

	Labor Growth	Prod Innov
$(Export/Import)_{t-3}$	0.097	0.172
	(0.025)***	(0.044)***
$(Export)_{t-3}$	0.069	0.098
	(0.035)**	(0.037)***
$(Import)_{t-3}$	0.037	0.141
	(0.019)**	(0.030)***
$Log(Labor)_{t-3}$	-0.070	0.041
	(0.010)***	(0.013)***
Foreign $(\geq\%10)_{t-3}$	0.076	-0.085
	(0.026)***	(0.041)**
Age_{t-3}	0.001	-0.001
	(0.000)***	(0.001)
Observations	1954	1956
R2 /Pseudo R2	0.106	0.0698

Robust standard errors clustered by country, industry, and year are in parentheses. I control for 2-digit industry, survey year, and country fixed effects. Coefficients for the probit regression shows the marginal effects at mean values. In the regressions past values of the dependent variables (at t-3) are used.*** p<0.01, ** p<0.05, * p<0.1

Random Effects Panel regressions

	Labor Growth	Prod Innov
$(Export/Import)_{t}$	0.041	0.738
	(0.006)***	(0.096)***
$(Export)_{t}$	0.024	0.613
	(0.007)***	(0.128)***
$(Import)_{t}$	0.015	0.531
	(0.005)***	(0.077)***
$Log(Labor)_{t}$	-0.018	0.099
	(0.002)***	(0.026)***
Foreign $(\geq\%10)_{t}$	0.016	-0.176
	(0.006)**	(0.091)*
Age_{t}	-0.000	-0.003
	(0.000)***	(0.002)**
Observations	3361	3612
R-Square	0.0825	
B-P Test	0.000	
Likelihood Ratio		0.001

In labor growth regression, robust standard errors clustered by country, industry, and year are in parentheses. In both regressions, I control for 2-digit industry, survey year, and country fixed effects. *** p<0.01, ** p<0.05, * p<0.1

Table 15 Countries Included in the Analysis

Country	2002	2003	2005	2006	2008	Total
Albania	62	0	76	0	65	203
Argentina	0	0	0	649	0	649
Armenia	64	0	227	0	112	403
Azerbaijan	49	0	211	0	120	380
Belarus	42	0	55	0	104	201
Bolivia	0	0	0	366	0	366
Bosnia	68	0	73	0	116	257
Bulgaria	49	0	58	0	96	203
Chile	0	0	0	640	0	640
Colombia	0	0	0	634	0	634
Croatia	38	0	72	0	66	176
Czech	69	0	82	0	90	241
Ecuador	0	0	0	359	0	359
El Salvador	0	308	0	436	0	744
Estonia	30	0	40	0	92	162
FYROM (Macedonia)	47	0	56	0	97	200
Georgia	34	0	49	0	122	205
Guatemala	0	227	0	312	0	539
Honduras	0	216	0	259	0	475
Hungary	52	0	359	0	114	525
Kazakhstan	54	0	350	0	184	588
Kyrgyzstan	49	0	57	0	93	199
Latvia	28	0	34	0	92	154
Lithuania	41	0	45	0	100	186
Mexico	0	0	0	1,122	0	1,122
Moldova	50	0	207	0	108	365
Nicaragua	0	241	0	350	0	591
Panama	0	0	0	240	0	240
Paraguay	0	0	0	381	0	381
Peru	0	0	0	360	0	360
Poland	114	0	527	0	121	762
Romania	82	0	386	0	192	660
Russia	128	0	148	0	692	968
Slovakia	30	0	38	0	84	152
Slovenia	47	0	57	0	102	206
Tajikistan	49	0	59	0	116	224
Turkey	151	0	162	0	905	1,218
Ukraine	139	0	180	0	579	898
Uruguay	0	0	0	360	0	360
Uzbekistan	51	0	70	0	121	242
Kosovo	0	0	0	0	103	103
Montenegro	0	0	0	0	38	38
Serbia	0	0	0	0	135	135
Total	1,617	992	3,678	6,468	4,959	17,714