Export destinations, employment and wages: firm-level evidence from Chile

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Abstract

This paper uses plant-level micro data from the Chilean National Manufacturing survey matched with administrative customs records to investigate the impact of starting to export on the dynamics of employment and wages of skilled and unskilled labor within firms. I develop a model of international trade with two dimensions of firm heterogeneity and sorting across destinations that predicts that trade liberalization should increase labor demand and average wages of skilled labor through upgrading skill composition, and that these effects are increasing in the income of destination countries. Using matched sampling techniques to control for self selection, I find that firms that start exporting increase their skilled employment by 6.3% and their skilled workers' average wages by 9.3% in the year they begin exporting, compared the pre-exporting year, and that such effects are mainly driven by firms that begin exporting to at least one high income country. Using an instrumental variable estimator which exploits the 2001 Argentine peso devaluation as an exogenous shock that induced Chilean firms to reduce exports to Latin American destinations and increase sales to high income countries, I also find a 4.8% increase in average skilled wages for firms previously exporting to Latin America that begin to export to a high income destination. By showing that exporting is a skill-intensive activity, I posit that this paper's results highlight an important mechanism that may have contributed to the persistence of high levels of income inequality in Chile.

JEL classification: F14, F16, J31

1 Introduction

Over the last decade, there has been a growing debate on the impact of globalization on labor markets in Latin America, and one of the topics that has drawn most attention is how changes in the productive structure following trade liberalization have affected workers in the region. Indeed, there are concerns that Latin American countries' increasing trade orientation could have affected the

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quality and quantity of employment and wage inequality. Recent work in international trade that has reoriented the focus of analysis on the heterogeneity among individual plants and firms has stressed the importance of differences in the type of workers firms employ, and of compositional changes in response to trade liberalization that may induce reallocation of labor towards "higher quality" firms. As pointed out by Goldberg and Pavnick (2007) in their excellent review on globalization and inequality, what is essential for establishing a connection between compositional changes within an industry and the inequality debate is that high quality firms have a higher demand for skill, so that quality upgrading leads to an increase in the skill premium. If production for export markets is relatively more skill-intensive than production for developing countries' domestic markets - because foreign customers require higher quality goods -, an increase in exports will increase the relative demand for skilled workers within industries and lead to a higher skill premium. In this paper, I develop a model that describes a mechanism through which trade liberalization leads to skill upgrading within firms, and captures how skill utilization varies according to export destinations. I then use a unique firm level dataset from the Chilean National Manufacturing Survey for the period 1996-2007 matched with administrative customs records to test the model's predictions.

It is well established in the literature and it is also the case in Chile (Alvarez and Lopez, 2005) that exporting firms are larger in terms of number of employees and sales, they are more productive, and pay substantially higher average wages than non-exporting ones. However, it is clear that exporting is not a randomly assigned variable but is a choice of the firm, which makes it difficult to estimate causal effects of exporting on labor market variables within firms. In order to deal with this problem, I use a propensity score matching methodology combined with a difference-in-difference approach to control for self selection into exporting. I include in the treatment group all new exporting firms that were originally non exporters in the first year they are observed in the sample but started to export in any subsequent year, and in the control group firms that never export throughout the sample period, but that have similar observable characteristics to the treated firms before treatment. I then use the sample of matched exporting and non exporting firms to perform non parametric difference-in-difference estimations to capture the differential effects on employment and wages for firms that begin to export. The difference-in-difference estimation allows me to control for time invariant unobservable factors at the firm level that may affect the outcome variables. I repeat the procedure for firms only exporting to countries in the Latin American and the Caribbean region (LAC), and for firms also exporting to High Income countries (HI) to determine whether the impact of exporting is heterogeneous according to the level of sophistication of the destination markets. Additionally, I estimate the causal impact on employment and wages for previous exporters to Latin American countries beginning to export to high income destinations using an instrumental variable approach - similar to that used by Brambilla, Lederman and Porto (2012) for Argentine firms' exports to Brazil - that exploits the exogenous adjustment in export destinations of Chilean exporters generated by the sharp devaluation of the Argentine peso of 2001-2002, which caused Chilean exporters to Argentina to move away from this market and find alternative new markets in high income countries.

Results confirm the theoretical prediction of skill upgrading for new exporters: while there is no significant effect on either unskilled workers' employment or wages, skilled employment increases by 6.3%, and average skilled workers' salaries increase by 9.3% in new exporting firms in the year they begin exporting as compared the pre-exporting year. The data on export destinations allows me to conclude that such effects are mainly driven by firms that begin exporting to at least one high income country (a 10.5% increase in both skilled employment and average skilled workers' wages), while estimates for firms beginning to export to the regional Latin American market are substantially lower (a 4.6% increase in skilled employment - with a coefficient that is not statistically significant - and a 9.1% increase in average skilled wages). Using instrumental variable estimates, I also find that for previous exporters to Latin America, beginning to export to a high income destination causes a 4.8% increase in average skilled wages. If higher average wages are a proxy for higher quality workers, the interpretation for these results is that firms upgrade their skill utilization contemporaneously with beginning to export, and such effect is heterogeneous across destinations: due to the greater sophistication of these markets, exporters to high income destinations hire more skilled workers of better quality.

Over the past two decades, Chile experienced an exceptional period of sustained economic growth, which led to a more than doubling of its income per capita, and to a reduction of its poverty rate to less than a third of the 1990 level. These advances were achieved concurrently with four continuous decades of free trade policies that have consolidated the position of Chile as one of the world's most open economies. After the far reaching reforms that unilaterally liberalized trade in the mid seventies, which dramatically altered the trade composition and the productive structure of the economy, in the nineties Chile moved to a new trade liberalization strategy founded upon the negotiation of bilateral trade agreements. Today, Chile has signed 24 trade agreements with 60 countries, including the United States, the European Union, and China, and more than 93% of its exports are covered by trade preferences. Most of these trade agreements entered into force in the late 90s and early 2000s: Table 1 presents the trade agreements enacted between 1995 and 2007, with the percentage of Chilean exports covered by each partner in the year it came into effect. In the same time span, total exports increased fourfold, and manufacturing exports followed a similar pattern (see Figure 1), representing roughly one third of the total throughout the period. Therefore, the data used in this study covers a period characterized by intense trade negotiations in pursuit of foreign market access, and can therefore provide a useful environment to analyze the effects of exporting on labor market outcomes at the firm level.

However, in spite of its macroeconomic success, income inequality in Chile has persisted at unacceptably high levels, creating the perception of social exclusion for many segments of the population, which have for the most part felt unaffected by the economic boom. In fact, the country – as well as its economy - is becoming more and more partitioned in two: the social groups and geographical areas linked to the modern segment of the economy, highly competitive, productive and inserted in the world markets, experience growing employment and consumption, while the economic segment of medium and low productivity, isolated from the process of globalization and which include the bulk of informal and temporary employment, creates scarce opportunities for the social groups and geographical areas linked to it. Figure 2 shows the evolution of two well-known measures of income inequality (the Gini coefficient and the 90-10 decile income ratio) in the same time period covered by this study. The figures are particularly striking and show how Chile made very little progress in the reduction of inequality in spite of high rates of economic growth, raising the question of whether international trade may have played a role in the persistence of inequality in the past two decades.

The rest of this paper is structured as follows. The next section discusses the recent theoretical and empirical literature on the subject. Section 3 presents a theoretical model of firm's sorting into different export destinations and demand for skills. Section 4 introduces the data and describes some stylized facts of Chilean manufacturing exports at the firm level. Section 5 explains the propensity-score matching empirical strategy, and discusses the results of the effects of export entry on labor market outcomes. Section 6 introduces the instrumental variable identification strategy for previous Latin American exporters entering high income markets, and presents the relative results. Finally, section 7 concludes.

2 Literature review

The relationship between trade liberalization, employment, and wage inequality has received a great deal of attention in the international trade and labor economics literature in the past years. Following the introduction of models examining the role of firm heterogeneity in international trade (Melitz, 2003), a new body of literature has started to explore the labor market implications in the context of heterogeneous firms and heterogeneous workers. In the Melitz model, due to the assumption of homogeneous labor and a perfect and frictionless labor market, the wages paid by a firm are disconnected from the firm's performance, and all workers are employed for a common wage and affected simultaneously by the opening of trade. However, the Melitz model was importantly extended by Yeaple (2005), Bernard, Redding and Schott (2007), and Bustos (2010) to allow more interesting implications of trade on the labor market. Bernard, Redding and Schott (2007)'s model embeds heterogeneous firms in a neoclassical model of comparative advantage and predicts that reductions in trade barriers result in net job creation in the comparative advantage industry and net job destruction in the comparative disadvantage industry, in line with standard Heckscher-Ohlin predictions. However, in their model there is simultaneous gross job creation and destruction in both industries, a feature that was absent in the original Heckscher-Ohlin model. In both industries, there is gross job creation at high-productivity firms that expand to serve the export market, combined with simultaneous gross job destruction at surviving firms that produce just for the domestic market. Bustos (2010) considers skill upgrading within firms as complementary to technology upgrading[1], and finds using data for Argentina that of the 17 percent rise in the demand for skilled workers after

[1] She assumes that after learning its productivity, the firm can choose an advanced technology H or a traditional technology L. The advanced technology requires higher fixed costs, but affords lower variable costs, so lower productivity firms only use technology L to serve the domestic market, intermediate productivity firms use technology L to serve the domestic market and export, and higher productivity firms use the most advanced technology H to serve the domestic market and export. With trade liberalization, the reduction in trading costs raises operating profits for all exporters, but proportionally more for those who use the advanced technology if an exporter's productivity is close to the high technology cutoff. As the cutoffs decline, similarly as in the Melitz model, some domestic firms begin to export, and lower productivity exporters switch to the better technology. This in turns leads to an increase in the demand for skilled workers that are complementary to that technology.

trade liberalization in the nineties, 15% took place within firms. Her empirical analysis confirms Yeaple (2005)'s model prediction that a reduction in trade frictions can induce firms to switch technologies, leading to an expansion of trade volumes, an increase in the wage premium paid to the most highly skilled workers and a decrease in the wage premium paid to moderately skilled workers.

The link between trade and wages with heterogeneous firms is also empirically examined by Verhoogen (2008), who exploits the 1994 peso crisis as an exogenous source of variation in Mexican firms' export activity. He finds that the exchange rate devaluation led more productive plants to increase exports, with some indication that they shifted their product mix towards higher quality varieties to appeal to U.S. consumers. This upgrade in quality led to an increase in the relative wage of white collar workers as compared to less productive plants within the same industry, thereby contributing to the increase in wage inequality experienced by Mexico in the 90s. Another paper that links quality upgrading with firms' skill utilization and wages is a recent work by Brambilla, Lederman and Porto (2012), to which this paper is most related. In their model, they posit two different ways in which exporting, and exporting to high income destinations in particular, may increase the demand for skills. The first is a quality upgrading argument in which skilled labor is needed to produce higher quality products demanded by foreign consumers; the skill utilization may additionally vary by export destination as a consequence of differences in transport costs between high income and neighboring markets. The second is a "skilled-biased globalization" mechanism, by which international trade activities require the utilization of resources that are intensive in skilled labor. The skill intensity of these activities, which are unrelated with product quality, may also be increasing in export destination countries' income. Using a panel of Argentine manufacturing firms, they exploit the exogenous changes in exports and export destinations triggered by a currency devaluation experienced by Brazil, one of Argentina's main trade partners, to identify the effects of exporting – and exporting to high income destinations in particular – on skill utilization. While they do not find any causal effect of exporting in general on skill utilization, they do find that exporters to high income destinations hire a higher proportion of skilled workers (and pay higher average wages) than domestic firms. However, their data only allows them to observe average wages paid by the firm, while in the current study I am able to observe wages separately by skill level, a major advantage when testing for skill upgrading. In another recent work that uses detailed firm level data with export destinations from Portugal, Bastos, Silva and Verhoogen (2014) develop a Melitz-type general equilibrium model where firm productivity and input quality are complements in producing output quality, and firms use higher quality inputs to produce higher quality products. Using real exchange rate changes as a source of exogenous variation in the composition of destination markets, they show that increases in the income level of export destinations lead Portuguese firms to charge higher prices for their output, and pay more for their inputs, a result they interpret as conducive to an increase in the average quality of both produced goods and intermediate inputs.

Another set of studies posits two additional mechanisms through which trade liberalization can contribute to increasing wage inequality within firms. Amiti and Davis (2012) assume a fair wage constraint by which firms earning positive profits pay wages to observationally identical workers that are increasing in firms' profitability and are necessary to elicit effort. Subject to this constraint, firms determine the mode of globalization (exporting final goods, importing intermediates, or both) that maximizes profits, and this choice also uniquely identifies wage and all other firm level variables. Their model predicts that a move from autarky to costly trade would lead to a decline in wages at firms that only sell domestically and at marginal importers and exporters, and a rise in wages at larger exporters and importers. Using data from the Indonesian manufacturing census, they find support for the model's prediction. In contrast, Helpman, Itskhoki and Redding (2010) develop a model with worker heterogeneity, heterogeneous screening costs and endogenous sorting of workers across firms according to unobserved worker characteristics to explain the presence of within firm wage inequality. While workers are ex ante homogeneous, they draw a match-specific ability when matched with a firm, which is not directly observed by either the firm or the worker. Firms, however, can invest resources in screening their workers to obtain information about ability. Due to the presence of "screening frictions", they experience a trade off between a potential increase in output from raising average worker ability and the costs incurred by screening workers. In equilibrium, larger, more productive firms screen workers more intensively to a higher ability threshold, and as a result employ workers with a higher average ability and pay higher wages. These differences in firm characteristics are systematically related to export participation: exporters are larger and more productive than non exporters; they screen workers more intensively; and they pay higher wages in comparison to firms with similar productivity that do not export. This framework highlights a new mechanism through which trade affects inequality, based on variation in workers' quality and wages across firms, and the participation of only the most-productive firms in exporting. Helpman et al. (2012) estimate the model with Brazilian data, and show that it provides a close approximation to the observed distribution of wages and employment. Consistently with this model, Krishna et al. (2011), using a detailed matched employer-employee dataset from Brazil, also find that declines in trade barriers are associated with wage increases in exporting firms, and that such increases are predominantly driven by the improvement in the workforce composition in exporting firms in terms of worker-firm matches.

Finally, a number of other papers have used the propensity score matching (PSM) technique with plant-level data, but to the best of my knowledge this is the first paper using this methodology to study the effect of exporting on employment and wages. The papers most related to this work are De Loecker (2007), who analyzes the productivity effects of starting to export using data for Slovenian manufacturing firms, and Huttunen (2007), Arnold and Javorcik (2009) and Girma and Gorg (2007), who analyze the impact of foreign acquisition on wages and employment at the plant level in Finland, Indonesia, and the U.K., respectively. Additional studies that used the PSM methodology with plant level data for manufacturing include Serti and Tomassi (2008), who study the impact of starting to export on productivity for Italian manufacturing firms, Fryges and Wagner (2010), who apply a continuous treatment approach to deal with the same question using German manufacturing data, Gorg, Hanley and Stroebl (2008), who analyze the effect of government grants on exporting for Irish firms using a multiple treatment propensity score method, and Chen (2011), who studies the casual relationship between origin country of FDI and the performance of acquired firms in the United States.

3 A model of exporting with sorting across destinations

This section develops the theoretical model, which is an extension of the Melitz (2003) model with one Chamberlinian monopolistic competitive industry and a continuum of heterogeneous firms supplying a horizontally differentiated good under increasing returns to scale internal to the firm as in Krugman (1979).

3.1 Consumer demand

The economy is assumed to be able to produce a very large number of varieties of the differentiated good, where each variety is ordered from 1 to n and indexed with i. Each household shares the same preferences given by the following C.E.S. utility function in which all varieties of the good enter symmetrically:

$$U = \left[\sum_{i=1}^{n} x_i^{\rho}\right]^{\frac{1}{\rho}} \tag{1}$$

where x_i is the amount of consumption of the i-th variety and $0 < \rho < 1$ is a constant preference parameter, implying an elasticity of substitution between any two varieties of $\sigma = \frac{1}{1-\rho} > 1$. Consumer behavior can be represented as in Dixit and Stiglitz (1977) considering the set of consumed varieties as an aggregate good Q, associated with an aggregate price P. Subject to the a budget constraint of $Y_i = \sum_{i=1}^{n} x_i p_i$, where income Y and prices are given, the representative household will choose the quantity of each variety x_i that maximizes U, thereby generating a demand function[2]:

$$x_i = E\left[\frac{p_i}{P}\right]^{-\sigma} \tag{2}$$

where E is the aggregate level of real income (and therefore consumption) in the country.

3.2 Technology and firms' optimal choices

Each variety is produced by one firm, and technology is represented by a Cobb-Douglas production function with a firm-specific productivity index φ and four factors of production, two variable (manufacturing unskilled labor and manufacturing skilled labor), and two fixed (capital and service skilled labor):

$$q = f(l, h, \bar{k}, \bar{h}_s, \varphi) = \varphi h^{\alpha} l^{1-\alpha} \bar{k}^{\beta} \bar{h}_s^{\gamma} \tag{3}$$

The production of a good to be provided to consumers can be thought of as combining two sets of tasks: manufacturing and services. Manufacturing utilizes unskilled production workers (l), skilled specialized workers (h) such as shift supervisors and automatized machinery technicians, and capital ($\bar{k}$), which depends on previous years' investment and is considered fixed in the short run. Services (such as R&D, marketing, distribution, and customer support) only utilize skilled white collar labor

[2] The derivation of the demand curve is presented in Appendix 2.7

($\bar{h}_s$); service costs are also fixed, and have to be borne every period independently of volume. Wages of all workers are assumed to be determined outside the model in the larger homogeneous goods production sectors; manufacturing labor costs vary linearly with output ($0 < \alpha < 1$), and the relative importance of the two variable factors of production depends on the size of the parameter α. Cost minimization requires that the ratio of the variable inputs' prices $\frac{w}{v}$ equals the marginal rate of technical substitution, which, since the production function is homothetic, depends only on the ratio of the two variable inputs:

$$\frac{w}{v} = RTS = \frac{MP_l}{MP_h} = \frac{1-\alpha}{\alpha}\frac{h}{l} \tag{4}$$

Solving for h and l, I can substitute back in the production function to obtain the contingent labor demand at the firm level:

$$l^D = (1-\alpha)\, A\frac{q}{\varphi}\left(\frac{v}{w}\right)^{\alpha} \bar{k}^{-\beta}\bar{h}_s^{-\gamma} \tag{5}$$

$$h^D = \alpha A\frac{q}{\varphi}\left(\frac{v}{w}\right)^{\alpha-1} \bar{k}^{-\beta}\bar{h}_s^{-\gamma} \tag{6}$$

where $A = \frac{(1-\alpha)^{\alpha-1}}{\alpha^{\alpha}}$ is a constant that only depends on the parameter α. Substituting in the total variable cost function obtains:

$$TC(w, v, q) = wl + vh = A\frac{q}{\varphi}w^{1-\alpha}v^{\alpha}\bar{k}^{-\beta}\bar{h}_s^{-\gamma} \tag{7}$$

and (constant) marginal costs are:

$$MC = \frac{\partial TC}{\partial q} = \frac{A}{\varphi}w^{1-\alpha}v^{\alpha}\bar{k}^{-\beta}\bar{h}_s^{-\gamma} \tag{8}$$

The profit-maximizing condition is to set marginal revenue equal to marginal cost. Since each firm faces a residual demand curve with constant elasticity $-\sigma$, the profit-maximizing markup equals $\frac{1}{\sigma}$, the negative of the inverse of elasticity of demand for each firm regardless of its productivity. The common equilibrium price for each produced variety is therefore:

$$p_i = \frac{MC}{1-\frac{1}{\sigma}} = \frac{MC}{\rho} = \frac{A}{\varphi\rho}w^{1-\alpha}v^{\alpha}\bar{k}^{-\beta}\bar{h}_s^{-\gamma} \tag{9}$$

which gives a total revenue of:

$$TR = EP^{\sigma}\left(\frac{\varphi\rho}{A}\right)^{\sigma-1}\left(v^{\alpha}w^{1-\alpha}\right)^{1-\sigma}\bar{k}^{\beta(\sigma-1)}\bar{h}_s^{\gamma(\sigma-1)} \tag{10}$$

and operating profits of:

$$\pi(\varphi) = \frac{EP^{\sigma}\left(\frac{\varphi\rho}{A}\right)^{\sigma-1}\left(v^{\alpha}w^{1-\alpha}\right)^{1-\sigma}\bar{k}^{\beta(\sigma-1)}\bar{h}_s^{\gamma(\sigma-1)}}{\sigma} \tag{11}$$

3.3 Entry and industry equilibrium in the closed economy

In order to enter the market, a firm has to pay a non-recoverable fixed capital cost of entry $c\bar{k}_e$. Each firm discovers its productivity φ - drawn from a continuous cumulative distribution function $G(\varphi)$ – only after making the initial investment and upon entering the market, and after observing its productivity[3] it decides whether to exit or remain in the market and produce. If a firm stays in the market, it faces in every period a constant probability of an adverse productivity shock that would then force it to exit. Therefore, a firm will only produce if its variable profit can cover the short-run services fixed cost $a_1\bar{h}_s$:

$$\pi_D(\varphi) = \varphi^{\sigma-1}B - a_1\bar{h}_s > 0 \tag{12}$$

where a_1 is the price of service labor and $B = \sigma^{-1}EP^{\sigma}\left(\frac{\rho}{A}\right)^{\sigma-1}\left(v^{\alpha}w^{1-\alpha}\right)^{1-\sigma}\bar{k}^{\beta(\sigma-1)}\bar{h}_s^{\gamma(\sigma-1)}$. I can therefore define a cutoff productivity level:

$$\varphi_D^* = \left[\frac{a_1\bar{h}_s}{B}\right]^{\frac{1}{\sigma-1}}, \tag{13}$$

the lowest productivity level at which firms will produce in the domestic market, as the one satisfying the condition $\pi_D(\varphi^*) = 0$.

[3]As indicated in Melitz (2003), productivity differences may reflect cost differences (the ability to produce output using fewer variable inputs) as well as different valuations of the good by customers.

3.4 Exporting behavior

Now assume that firms can also export their product to another country in Latin America, that has a demand function facing each firm:

$$x_i = E^{LAC} \left[\frac{p_i}{P}\right]^{-\sigma} \tag{14}$$

which has the same elasticity as in the domestic market, and depends on the income level of the destination country, assumed to be identical to the home country ($E = E^{LAC}$)[4]. Exporting firms face iceberg variable trade costs (typically including transport costs, tariffs and other duties) for the shipment of each unit of the product, so that $\tau > 1$ units need to be shipped for one unit to reach its destination. Additionally, firms wishing to export also need to incur additional service costs $a_2\overline{h}_s$ to adapt the product to the foreign market. These do not vary with export value[5], and as in the domestic case are assumed to utilize only skilled labor. The price of skilled service labor needed by firms exporting to Latin American destinations is $a_2 > a_1$: this parameter can be thought of as an indicator of labor quality, so firms that wish to export need to change their labor composition towards a higher quality mix, replacing existing workers with better quality workers such as highly skilled product designers or research scientists.

After the firm pays the initial entry costs, at the same time as it gains knowledge of its productivity φ it also observes another parameter, "export ability" η, randomly drawn from a different distribution $G(\eta)$. This additional source of heterogeneity can be thought of as the ability to adapt product quality and provide additional services necessary for the export market with fewer fixed costs. Therefore, in addition to productivity φ, which solely determines the choice to produce for the domestic market, the decision of whether to export also depends on another parameter which is heterogeneous across firms. Therefore, firms with productivity higher than the domestic cutoff can

[4] This assumption mirrors Melitz's set up of a world comprised of a number of identical countries. For the case of Chile and Latin America, this is for the most part a quite realistic hypothesis.

[5] "A firm must find and inform foreign buyers about its product and learn about the foreign market. It must then research the foreign regulatory environment and adapt its product to ensure that it conforms to foreign standards (which include testing, packaging and labeling requirements). An exporting firm must also set up new distribution channels in the foreign country and conform to all the shipping rules specified by the foreign customs agency. [...] Regardless of their origin, these costs are most appropriately modeled as independent of the firm's export volume decision". (Melitz, 2003)

make additional profits serving another Latin American market if[6]:

$$\pi_X^{lac}(\varphi, \eta) = \left(\frac{\varphi}{\tau}\right)^{\sigma-1} B - \frac{a_2\overline{h}_s}{\eta} > 0 \tag{15}$$

where B is defined as above. Since profits depend on two variables, by imposing $\pi_X^{lac}(\varphi^*, \eta) = 0$ I can define an export cut-off *function* as:

$$\varphi_X^{*lac}(\eta) = \tau \left[\frac{a_2\overline{h}_s}{\eta B}\right]^{\frac{1}{\sigma-1}} \tag{16}$$

By substituting the zero profit condition for the marginal firm (equation 2.13) in the equation above, I can express the export entry cut-off as a function of φ_D^*:

$$\varphi_X^{*lac}(\eta) = \varphi_D^* \tau \left[\frac{a_2\overline{h}_s}{a_1\overline{h}_s\eta}\right]^{\frac{1}{\sigma-1}} \tag{17}$$

Figure 3 shows the domestic and exporting cutoffs that determine whether firms with a certain combination of the parameters φ and η will exit, serve the domestic market only, or export to a Latin American or a high income destination. Firms with productivity levels below the cutoff φ_D^* do not produce, because operating profits do not cover fixed costs, while firms with productivity above the cutoff remain in the market. Figure 3 also depicts the iso-profit curve $\varphi_X^{*lac}(\eta)$ which determines the exporting cutoff for the Latin American case: firms on the iso-profit curve with any combination of (φ, η) earn zero profits from entering the export market, so all firms above the curve will export. What is especially noteworthy is that these curves are iso-profit curves but not iso-revenue curves: firms with low productivity but high export ability need lower revenues to cover their fixed cost, so revenue decreases along the curve. The two dimensions of firm heterogeneity break the stark relationship between productivity, size, and export status present in the Melitz model: low productivity firms are still smaller but they can compensate for their low productivity with high export ability and hence can still export. Note that the condition $\tau^{\sigma-1}\frac{a_2\overline{h}_s}{\eta} > a_1\overline{h}_s$ is required in order to maintain the familiar partitioning of firms by export status, with higher productivity firms entering the export market, and lower productivity firms only serving the domestic market.

[6]Firms choosing to export face a higher marginal cost $\frac{\tau A}{\varphi} w^{1-\alpha} v^{\alpha} \bar{k}^{-\beta} \bar{h}_s^{-\gamma}$, and will therefore charge a higher price in the foreign market $\frac{\tau A}{\varphi \rho} w^{1-\alpha} v^{\alpha} \bar{k}^{-\beta} \bar{h}_s^{-\gamma}$.

However, the exact location of the export productivity cutoff will be different for each firm depending of its specific value of η.

Assume now that firms have the additional option to export their product to any other high income country outside Latin America[7], which has a demand function facing each firm:

$$x_i = E^{HI}\left[\frac{p_i}{P}\right]^{-\sigma} \tag{18}$$

which also depends on a function of the relative price of each variety that has the same elasticity as in the domestic market, and on the income level of the destination country which in this case is assumed to be larger than the home country by a factor $\lambda > 1$ ($\lambda E = E^{HI}$).

In addition to per-unit trading costs $\tau^{hi} > \tau$, firms wishing to export also need to incur additional service costs $a_3\overline{h}_s$ that do not vary with export value and as in the previous cases are assumed to utilize only skilled labor. However, service costs are assumed to vary according to destination: exporting to high income destinations requires services in terms of higher product quality and design, and knowledge of the more advanced markets – including differences in social norms that determine how business is conducted, more stringent rule of law, and the knowledge of foreign languages - that are more costly than services needed to supply the domestic and local Latin American market. Therefore, I assume that $a_3 > a_2$. Firms can make additional profits serving a high income market if :

$$\pi_X^{hi}(\varphi,\eta) = \left(\frac{\varphi}{\tau^{hi}}\right)^{\sigma-1}\lambda B - \frac{a_3\overline{h}_s}{\eta} > 0 \tag{19}$$

where B is defined as above. By imposing $\pi_X^{hi}(\varphi^*,\eta) = 0$ the high income destinations export cut-off *function* can be defined as:

$$\varphi_X^{*hi}(\eta) = \tau^{hi}\left[\frac{a_3\overline{h}_s}{\eta\lambda B}\right]^{\frac{1}{\sigma-1}} \tag{20}$$

and substituting the zero profit condition for the marginal firm in the equation above, I obtain the export entry cut-off as a function of φ_D^*:

$$\varphi_X^{*hi}(\eta) = \varphi_D^*\tau^{hi}\left[\frac{a_3\overline{h}_s}{a_1\overline{h}_s\eta\lambda}\right]^{\frac{1}{\sigma-1}} \tag{21}$$

[7] In the case of Chile the assumption that destination countries outside Latin America coincide with high income countries is very plausible, since the only relevant low-income destination outside the region is China, and exports to this country were still quite limited in the period under analysis.

Figure 3 depicts the iso-profit curve $\varphi_X^{*hi}(\eta)$, which determines the exporting cutoff for the high income destinations case: firms on the curve with any combination of (φ, η) earn zero profits from entering the high income export market, so all firms above the curve will export to a high income country. Note that $\left[\frac{\tau^{hi}}{\tau}\right]^{\sigma-1}\frac{a_3\overline{h}_s}{\lambda} > a_2\overline{h}_s$ must hold for the high income cutoff curve to lie above the Latin American export cut-off curve for all combinations of (φ, η), which will be satisfied if the bigger size of the market cannot compensate for the additional fixed costs and variable transport costs. As long as $(\tau^{hi})^{\sigma-1}\frac{a_3\overline{h}_s}{\eta\lambda} > a_1\overline{h}_s$ is also verified (which follows from the condition that the Latin American export cutoff lies above the productivity cutoff to produce for the domestic market), the model would therefore predict a well-determined sorting pattern with different productivity cutoffs across destinations. As in the previous case, the productivity cutoffs will be different for each firm depending on their firm-specific export ability η[8]. This is therefore the first empirically testable prediction of the model: at each productivity level above the minimum necessary to produce at all in the market, there will be a proportion of firms only operating domestically, a proportion exporting to Latin America only, and a proportion selling to high income destinations as well, and the percentage of exporters to each type of destination is increasing the higher the productivity draw.

3.5 Trade liberalization

Let's now consider a multilateral trade liberalization that reduces variable trading costs τ by the same proportion in all countries. As pictured in Figure 4, this increases the return to exporting, which shifts the profit curves to the left and reduces the productivity cutoffs to $\varphi_x^{\prime *lac}(\eta)$ and $\varphi_x^{\prime *hi}(\eta)$. As a result, some firms above the domestic cutoff φ_D^* that were previously serving only the domestic market now find it profitable to start exporting to Latin American destinations (firms located in area A of Figure 4), other domestic firms with higher export ability can now make money serving both the Latin American and high income destination markets (firms located in area B of Figure 4), while some previous exporters to Latin American destinations will now start exporting to high

[8] As noted earlier, in the static version of the model described so far, the domestic production cutoff only depends on the productivity parameter φ, while the export ability draw η only affects the export cutoffs and the number of firms that export. However, in the dynamic version of the model, there is a constant turnover of firms, and the increase in the expected present value of profits brought about by a higher number of exporters will induce a larger number of firms to enter the market, which will cut into the profits of domestic producers and increase the domestic cutoff. Therefore, in the dynamic version of the model, the cumulative distribution of η, by affecting the number of firms that export, will also affect the domestic cutoff.

income countries (firms located in area C of Figure 4). With regard to labor market effects, I posit the following:

Prediction 1: Conditional on productivity (and therefore size), exporters will hire more service labor and pay higher skilled wages than non-exporters. This follows directly from an examination of Figure 3. For each level of φ, firms with a higher export ability η will be able to cross the cut-off and will need to expand their skilled workforce and upgrade average skills in order to export. This result is qualitatively different from the standard prediction that exporters pay wage premia over non-exporters because they are more productive.

Prediction 2: A reduction in variable trading costs will cause new firms to start exporting and increase demand for unskilled and skilled production labor. Demand for labor at the firm level can be obtained using Shepherd's lemma, i.e.. by differentiating the total variable cost function with respect to labor prices. Labor demand for firms only serving the domestic market has already been obtained in equations (2.5) and (2.6) above. For firms exporting to Latin American destinations only, total variable costs are:

$$TC(w,v,q_d,q_x^{lac}) = A\frac{q_d}{\varphi}w^{1-\alpha}v^{\alpha}\bar{k}^{-\beta}\bar{h}_s^{-\gamma} + A\frac{q_x^{lac}}{\varphi}w^{1-\alpha}v^{\alpha}\bar{k}^{-\beta}\bar{h}_s^{-\gamma}\tau \tag{22}$$

where $q_x^{lac} = \tau^{-\sigma}q_d$ (from equation 2.2 above). Using Shepard's lemma and substituting equations (2.5) and (2.6), labor demand for exporters to Latin America can be written as:

$$l_{lac}^D = \frac{\partial TC}{\partial w} = l^D(1+\tau^{1-\sigma}) \tag{23}$$

$$h_{lac}^D = \frac{\partial TC}{\partial v} = h^D(1+\tau^{1-\sigma}) \tag{24}$$

Total variable costs for exporters to Latin America and high income destinations are:

$$TC(w,v,q_d,q_x^{lac}) = A\frac{q_d}{\varphi}w^{1-\alpha}v^{\alpha}\bar{k}^{-\beta}\bar{h}_s^{-\gamma} + A\frac{q_x^{lac}}{\varphi}w^{1-\alpha}v^{\alpha}\bar{k}^{\beta}\bar{h}_s^{-\gamma}\tau + A\frac{q_x^{hi}}{\varphi}w^{1-\alpha}v^{\alpha}\bar{k}^{\beta}\bar{h}_s^{-\gamma}\tau^{hi} \tag{25}$$

where $q_x^{hi} = \lambda(\tau^{hi})^{-\sigma}q_d$ (from equation 2.2 above). Using Shepard's lemma and substituting equations (2.5) and (2.6), labor demand for exporters to Latin America can be written as:

$$l_{hi}^{D} = \frac{\partial TC}{\partial w} = l^{D}\left[1 + \tau^{1-\sigma} + \lambda(\tau^{hi})^{1-\sigma}\right] \tag{26}$$

$$h_{hi}^{D} = \frac{\partial TC}{\partial v} = h^{D}\left[1 + \tau^{1-\sigma} + \lambda(\tau^{hi})^{1-\sigma}\right] \tag{27}$$

It then follows from (2.23) and (2.26) that $l_{hi}^{D} > l_{lac}^{D} > l^{D}$, and from (2.24) and (2.27) that $h_{hi}^{D} > h_{lac}^{D} > h^{D}$.

Prediction 3: A reduction in variable trading costs reduces the minimum productivity level required to enter both the Latin American and high income destination export markets. This follows directly from (2.16) and (2.20) where $\frac{\partial \varphi_{x}^{*lac}}{\partial \tau} > 0$ and $\frac{\partial \varphi_{x}^{*hi}}{\partial \tau} > 0$. This reduction in the export cutoffs will cause previous domestic firms to start exporting, and previous Latin American exporters to start exporting to high income destinations, in both cases requiring a skill upgrading. Total skilled service labor costs for Latin American exporters are $(a_1 + a_2)\overline{h}_s$, so the skill quality upgrading for new Latin American exporters (firms in area A of Figure 4) is given by a_2. Total skilled service labor costs for Latin American and high income destinations exporters are $(a_1 + a_2 + a_3)\overline{h}_s$, so the skill quality upgrading is given by $(a_2 + a_3)$ as compared domestic firms and by a_3 as compared previous Latin American exporters. The skill upgrading should therefore be stronger for firms in the productivity range between $\varphi_{x}^{\prime hi}(\eta)$ and $\varphi_{x}^{lac}(\eta)$, (area B in Figure 4) as these are previous domestic producers that due to trade liberalization can now enter both Latin American and high income destinations. The skill upgrading for previous Latin American exporters entering the high income destinations market (area C in Figure 4) will be higher than the upgrading for domestic firms entering the Latin American market as long as $a_3 > a_2$. Figure 5 summarizes the predictions that I now take to the data to test empirically.

4 Data and descriptive statistics

This paper uses a firm-level panel dataset containing information on employment, average wages, export values and destinations for each manufacturing firm for the period 1997-2007. The dataset was constructed using two main sources. The first is the National Annual Manufacturing Survey

(*Encuesta Nacional Industrial Anual*, ENIA) managed by the official Chilean Statistical Agency (*Instituto Nacional de Estadísticas*, INE). The survey is representative of the universe of Chilean manufacturing and covers the period 1996-2007[9]. This dataset corresponds to a census of all plants with over ten employees, with some adjustments to remove observations of single plants operating in a particular sector or region and thus avoid their identification. The unit of observation is a plant with ten or more employees and there are on average more than 4,500 plants per year in the sample. For each plant and year, the survey collects data on production, value added, sales, employment and wages, exports, investment, depreciation, energy use, and other characteristics. Plants are classified according to the International Standard Industrial Classification (ISIC). I deflate variables using price deflators provided by the Chilean Statistical Agency at the 3 digit ISIC level.

The second source of data is official customs records for the 1997-2007 period. The customs records contain quantities and unit values exported for each 8-digit harmonized system product code by country of destination. I matched the firms in the ENIA with the customs data, obtaining a panel of employment, wages, exports, and export destinations by firm[10]. The manufacturing survey is collected at the plant level, while the customs records are at the firm level. Since all plants owned by the same firm share the same tax identification number, I aggregated the information across plants belonging to the same firm in the ENIA, yielding a firm-level panel. I also drop from the dataset plants whose tax identification number changes in the panel time period, as this probably indicates a change of ownership or acquisition, which could bias my results. In the final matched dataset, only 3.4% of firms are multi-plant firms. However, some firms own a large number of plants, so almost 10% of plants of the original ENIA dataset belong to multi-plant firms. Together with the recent study by Morales, Sheu and Zahler (2014), this is the only paper using the ENIA dataset for an analysis at the firm level. All other previous studies using the ENIA data including Pavcnik (2002), Alvarez and Lopez (2005), Kasahara and Rodrigue (2008), and Navarro (2012) are unable to identify firm-level information and perform their analysis at the plant level. Finally, it is important to note that in the combined dataset, some firms that are identified as exporters in the

[9] Although the ENIA survey started in 1979 and the most recent information is available up to 2012, it was not possible to construct a larger panel, because the information prior to 1995 is recorded under different plant identifiers, and because of confidentiality restrictions on plant identification for the most recent surveys. Additionally, export information is only collected since 1990.

[10] Note that even though I am unable to identify export destinations for the year 1996, this year is retained in the panel as it allows to determine firms entering the export market in 1997.

ENIA survey do not have any exports listed with customs, and vice-versa. In these cases, I assume that the customs database is more accurate, and thus assign to these firms the export data reported in the customs database, following the same procedure as in Morales, Sheu and Zahler (2014).

I consider unskilled direct production workers and blue-collar workers occupied in auxiliary activities to production and services as unskilled labor (l), and specialized production workers, administrative employees, and managers as skilled labor (h). In order to construct an average wage measure for each firm, total wages were added to total benefits and then divided by the number of employees in each firm. This step is then repeated for skilled and unskilled labor in order to obtain an average wage for each type of worker.

Table 2 reports average firm characteristics for exporters and non-exporters in the sample. Exporters represent around 27% of observations in the panel, and it is clear that they are much larger, more productive, and pay higher wages to both unskilled and skilled workers. Columns 3 and 4 describe the characteristics of firms that export only to countries in Latin America and those that export to at least one high income destination[11]. There is a vast difference between sole exporters to the Latin American region and firms that also export to high income destinations, with the latter being on average two and a half times bigger than the former, and paying substantially higher average wages. Table 3 splits the sample according to firm size, where small firms are defined as firms with less than 50 employees, medium firms are firms with a number of employees between 50 and 200, and large firms employ over 200 people. As shown in the table, small and medium firms dominate the Chilean economy, while large firms represent less than 9% of the total. It is also clear from the data that the level of export participation varies greatly by size: while the majority of non exporters is made up by small firms, exporters to the Latin American region are mainly small or medium size firms, and the majority of exporters to high income destinations are medium and large firms. Additionally, Table 4 shows that over 70% of large firms export, most of them to both Latin American and high income destinations, medium size firms are split evenly between non exporters

[11] I define as high income destinations high income OECD countries based on the World Bank country classification: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Israel, Japan, Korea Rep., Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and the United States. I define as Latin American destinations member countries of the CELAC (Community of Latin American and Caribbean States): Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Dominican Republic, Dominica, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Santa Lucia, Federation of Saint Kitts and Nevis, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, and Venezuela.

and exporters, and only 12% of small firms export.

Table 5 and 6 show average yearly wages for unskilled and skilled workers by firm size. Quite interestingly, while it is clear that the average wage increases with size, exporters pay much higher wages within each category, and the average wage generally increases with the sophistication of export destinations, with exporters to higher income economies paying higher wages within each category. This "high income destination exporter premium", even though not as large as the exporter premium, is especially sizable in the case of skilled workers; however, for unskilled workers high income destinations exporters pay higher salaries than Latin American exporters only in large firms. These simple tables confirm Bernard et al. (2007)'s finding for the United States that wage differences across firms are not driven only by size: in fact these mean statistics show that small firms exporting to high income destinations pay higher average salaries both to unskilled and skilled workers than large firms that don't export, confirming that exporting is a more important factor than size when it comes to determining firm-level wages.

Table 7 presents the share of exporting firms in the total number of firms by year, while Table 8 shows the mean export intensity (exports over total sales) for exporting firms by sector. Both the share of firms that export and export intensity vary quite strongly across industries, with the metallic sector (which includes copper processing) dominating both categories. Interestingly, a very high percentage of chemical firms are also exporters, even though their export intensity is quite low. On the contrary, while the percentage of food companies that export is similar to the national average, these firms export a relatively high share of their output.

Looking at destinations, Table 9 presents the number of Chilean exporting firms for the first 24 export destination countries ranked by the average number of exporters in the whole period. It is interesting to point out that out of the first 10 destinations by number of exporting firms, 9 were Latin American destinations, witnessing the importance of the regional Latin markets for Chilean exporters. In each panel of Figure 6, I plot the percentage represented by the export revenues, and by the number of exporting firms, over the total export revenue and total number of exporting firms, respectively, for the two major groups of export destination countries. Panel a shows that even though a percentage of firms ranging from 82 to 89 per cent exported to Latin America during the 1997-2007 time frame, Latin American exports represented a share of just over 20% of the total export revenues throughout the period analyzed. Just from this graph, it can be gathered that almost all exporters export to Latin America, but their shipments to these destinations are clearly well below the average exported value per firm. Panel b, on the other hand, shows that high income destinations' share of the total value of exports is much higher and hovers around 60% throughout the period under analysis, while the percentage of firms exporting to these destination increases from 46% to just below 60%. Quite interestingly, a visible increase in the percentage of exporting firms to high income destinations can be noted in the years of entry in force of the Chile-EU and Chile-USA FTAs (from 54 to 60 per cent).

Table 10 shows the number of markets served by individual firms. It presents the number of firms shipping to a particular number of export destinations between one and nine, to 10 or more, or 20 or more. Overall, roughly 27% of all exporting firms export to only one destination market, and over 50% export to three markets or less. On the other hand, about 6% of firms export to 20 markets or more. Figure 7a plots the distribution of the number of markets served by each firm. The distribution is heavily skewed, with many firms serving a small number of markets, and few firms serving many markets. As for number of exported products (products defined at the 6-digit level of the Harmonized System Classification), a similar pattern appears, with about one fifth of the firms exporting only one product, just less than half of the firms exporting three products or less, and around eight percent exporting over 20 products. Data are presented in Table 11, and their distribution is plotted on panel b of Figure 7. Table 12 combines the analysis by products/markets, presenting the percentage of firms in the sample exporting each combination of number of products and number of markets.

When looking at the two major groups of destinations, data confirm the sorting of firms into markets with different levels of sophistication: Table 13 presents the percentage of exporters serving LAC destinations only, high income destinations only, or both LAC and high income destinations (firms serving other low income destinations only are marginal). Most exporters are almost evenly divided between firms exporting to LAC destinations only, and LAC and high income destinations, even though the two major categories show a diverging trend, with the latter steadily increasing its share during the period under analysis. There is a smaller share of firms (13% on average) that only export to high income destinations without serving the Latin American market. When looking at new entrants in export markets, the sorting is even clearer: of all new exporters that I observe entering the international market, 84% export to at least one Latin American country, meaning that firms that begin to export almost always enter the LAC market. Of these new entrants, 87% enter the LAC market alone, while the remaining firms enter the local market in combination with another high income destination.

5 Export entry and labor market effect: empirical analysis

I first estimate a value added Cobb Douglas production function with three factors, skilled labor, unskilled labor, and capital, separately for each two-digit ISIC sector, and compute Total Factor Productivity (TFP) as a residual of the estimated function. I follow the Levinsohn and Petrin (2003) technique to account for the endogeneity of productivity shocks that are observed by the firm but not by the econometrician, using electricity consumption as the intermediate input that allows the identification of the elasticity of capital. Production function coefficients are presented in Table 14. Table 15 shows the percentage of total firms that export by decile of the log TFP distribution, distinguishing between total exporters, exporters to Latin American destinations, and exporters to high income destinations. There is a clear increasing proportion of firms that export the higher their productivity level, and as predicted by the model the percentage of firms that export to high income destinations is lower than the percentage of firms that export to Latin American destinations across the productivity distribution, pointing to a higher productivity cutoff for exporting to these destinations. However, the table makes it clear that many less productive firms also export, which is inconsistent with the Melitz model but in line with my model's predictions, confirming that there must be sources of heterogeneity other than productivity that affect firms' export status.

Table 16 summarizes average percent differences in employment and wages between exporters and non exporters. The table reports the coefficient estimates of OLS regressions of the two different firm characteristics on a dummy variable indicating whether a firm was exporting in 1996, the first year in the sample, and continued doing so for at least ten consecutive years (*old exporter*), and a dummy indicating whether a firm started to export at any time between 1997 and 2006 and continued exporting for at least two consecutive years (*new exporter*), controlling for 4-digit sector and year fixed effects. Looking at the first column for each characteristic, it is apparent that exporters and non-exporters are very different. Old and new exporters employ more labor (both skilled and unskilled), pay higher wages, and are more productive than non-exporters even within the same specific sector. It can also be noted in Table 16 that the superior characteristics of exporters are stronger in old exporters than in new exporters. In the second column of each firm-level outcome, I add an additional control for TFP, so that the coefficients represent average differences in employment and wages *conditional* on productivity. While productivity accounts for part of the difference between firms with different export behavior, there are still substantial differences between exporters and non-exporters even at the same level of productivity, suggesting that crossing the export cutoff has implications for wages and employment independently on whether the firm is a high or low productivity type.

The lower panel of the table reports the coefficients from another OLS regression, where the exporter categorical variables are split into two additional groups, by export destination (LAC and HI countries). Old exporters to high income destinations are defined as firms that were exporting in 1996 and continued doing so for at least ten consecutive years as above, and that exported to a high income country for at least one year, while old exporters to Latin America are continuous exporters for at least ten consecutive years since the first year in the sample that only exported to Latin American countries for the whole period. On the other hand, new exporters to high income destinations are new exporters that are observed exporting to at least one high income country in the year they begin exporting, while new exporters to Latin America are new exporters that only export to Latin America in the year they enter the export market. Once again, the coefficients are all significant and show that exporters to high income destinations employ more labor and pay higher wages for both types of labor than exporters to Latin American destinations. As I control for TFP, the coefficients are reduced, and especially so for the case of unskilled wages, which in the case of new exporters are only less than 10% higher than for non exporters. However, in the case of skilled wages, new exporters to Latin America and high income destinations still pay a 25% premium respectively as compared to non exporters even after controlling for TFP.

Having established this clear correlation between export status and labor market variables even when controlling for productivity, there may be unobservable variables that simultaneously affect export participation, employment, and average wages and that may therefore be driving this relationship. In order to account for possible self-selection, in the remainder of this section I use a propensity score matching procedure combined with a difference-in-difference approach to detect the effect of starting to export on employment and wages for different types of workers. The identification strategy matches *new exporters* with non exporters on the basis of a number of observable characteristics.

Drawing from the impact evaluation literature, the parameter I am interested in estimating is the so-called Average Treatment effect on the Treated (ATT), the effect of the treatment on firms that actually receive it. Define $Exp = 1$ as the treatment (beginning to export), and let Y represent the firm-level outcome of interest. The value of Y under treatment is represented by *Y(1)*, while *Y(0)* is the value of Y in absence of treatment. The average treatment effect τ is defined as:

$$\tau_{ATT} = E(\tau \mid Exp = 1) = E\left[Y(1) \mid Exp = 1\right] - E\left[Y(0) \mid Exp = 1\right] \tag{28}$$

The expected value of the ATT is the difference between the expected values of the outcome with and without treatment for those firms that were actually treated. Ideally, one would like to know the counterfactual mean for those being treated $E\left[Y(0) \mid Exp = 1\right]$, i.e. what would have been the performance of the exporting firms had they not started to export, which is clearly not observed. Therefore, in order to estimate the ATT I need to choose a suitable estimate of the unobserved counterfactual. Given that the decision to export is not random, using the mean outcome of untreated firms (those that did not export), $E\left[Y(0) \mid Exp = 0\right]$, is not advisable because it is likely that unobservable factors that determine the treatment decision also affect the outcome, leading to a selection bias.

Different techniques can be used to deal with this issue. A number of these focus on the estimation of treatment effects under the assumption that the treatment satisfies some form of exogeneity: under this assumption, all systematic differences in outcomes between the treated and the comparison observations with the same values of covariates would be attributable to treatment. In this case I implement the propensity score matching (PSM) method, which constructs a statistical comparison group that is based on a model of the probability of beginning to export, given observed characteristics. The propensity score is defined by Rosenbaum and Rubin (1983) as the conditional probability of receiving a treatment given pretreatment characteristics:

$$p(X) = Pr(Exp = 1 \mid X) = E(Exp \mid X) \tag{29}$$

where X is a multidimensional vector of pretreatment covariates. As a result, the *PSM* estimator for the *ATT* can be defined as the mean difference in outcomes, weighting the comparison units by the propensity score of the treated observations:

$$\tau_{ATT}^{PSM} = E_{P(X)|Exp=1} \left\{ E\left[Y(1) \mid Exp = 1, P(X)\right] - E\left[Y(0) \mid Exp = 0, P(X)\right] \right\} \tag{30}$$

Note that two assumptions need to hold for this method to return unbiased results. The first assumption is *common support*: treatment observations need to have similar comparison observations in the propensity score distribution, so that a large region with participant and nonparticipant observations exists ($0 < P(Exp = 1 \mid X) < 1$). Balancing tests can be conducted to check whether within each quantile of the propensity score distribution the average propensity score and mean of covariates are the same. For *PSM* to work, the treatment and comparison groups must be balanced, so that similar propensity scores are based on similar observed Xs. Although a treated group and its matched non treated comparison group might have the same propensity scores, they are not observationally similar if their distributions are different across the covariates. The second assumption is *unconfoundedness*: this states that given a set of observable covariates X that are not affected by the treatment, potential outcomes Y are independent of treatment assignment ($Y(0), Y(1) \amalg Exp \mid X$). In practice, this assumption implies that treatment probability is based entirely on observed characteristics; if unobserved characteristics determine program participation, unconfoundedness will be violated and it will be necessary to rely on identification strategies that explicitly allow selection on unobservables.

While the unconfoundedness assumption is not directly testable, the panel nature of the data allows me to combine *PSM* with the difference-in-difference method (*DD*), which as long as unobserved heterogeneity is time-invariant, will eliminate any remaining selection bias. I therefore estimate the following:

$$DD = E_{P(X)|Exp=1} \left\{ E\left[(Y_t(1) - Y_{t-1}(1) \mid Exp = 1, P(X)\right] - E\left[Y_t(0) - Y_{t-1}(0) \mid Exp = 0, P(X)\right] \right\} \tag{31}$$

where t is the post-treatment period (year the firm begins to export) and *t-1* is the pretreatment period[12]. More explicitly, with panel data over two periods $t = \{1, 2\}$, the local linear DD for the mean difference in outcomes Y_{ij} across new exporters i and non exporters j in the common support is given by (Smith and Todd, 2005):

$$ATT_{PSM}^{DD} = \frac{1}{N_T}\left[\sum_{i\in T}(Y_{i2}^T - Y_{i1}^T) - \sum_{j\in C}\omega(i,j)(Y_{j2}^C - Y_{j1}^C)\right] \quad (32)$$

where N_t is the number of new exporters i and $\omega(i,j)$ is the weight used to aggregate outcomes for matched non exporters j, T is the treatment group of new exporters and C the control group of never exporters.

The first step is therefore to estimate a probit model for the probability of being treated (treatment is defined as a firm beginning to export and remaining in the export market a minimum of two consecutive years) conditional on a set of observables X. As the control group needs to be very similar to the treatment group in terms of its predicted probability of beginning to export, I need to include a number of variables that are not influenced by the treatment. For this study, I consider lagged levels (t-1) of productivity, total employment (proxy for size), ratio of skilled workers to total employment, a dummy for foreign ownership, and a full set of dummies for industry and year to control for common supply and demand shocks. Results of the probit estimation are presented in Table 17. As shown in the table, firms with ex-ante larger size, productivity, and foreign ownership are more likely to begin to export. However, ex-ante employment's skill composition does not have an effect on the decision to start exporting. Generally, except for total size, no labor related variables, including average wages, have an effect on the decision to start exporting. There is no indication that firms that initially pay higher wages or have a higher skilled/unskilled labor composition are more likely to begin exporting.

Once I estimate the propensity scores, I then match the treatment and control groups using the kernel method[13]. That is, for each new exporting firm with propensity score p_i, a firm j from the control group is selected such that its propensity score is as close as possible to i, and the same control can be matched with more than one treatment. I implement the methodology following the procedure developed by Leuven and Sianesi (2003) in Stata. Figure 8 presents a

[12] This is based on the identifying assumption: $E\left[(Y_t(0) - Y_{t-1}(0) \mid Exp = 1, P(X)\right] = E\left[Y_t(0) - Y_{t-1}(0) \mid Exp = 0, P(X)\right]$

[13] I use epanechnikov kernel with bandwidth 0.06.

dot chart summary of the covariate imbalance for selected variables for each sample, showing the standardized percentage bias for each covariate before and after matching. It can be easily seen that the group of non exporters reweighed after matching is not significantly different from the group of exporters across all covariates. In this figure, it is important to look at the balance between the two groups before and after matching across size and productivity, two variables that are clearly highly correlated. Before matching, there is a bias higher than 100% in size, and higher than 70% in TFP between exporters and non exporters. After matching, there is no statistically significant difference in size and productivity between the treatment sample of exporters and the control sample of non exporters. This matching can therefore allow me to estimate the impact of beginning to export on labor market outcomes by comparing export entrants with very similar domestic firms in terms of past productivity level. In terms of the model, I am practically comparing firms just above the productivity/export ability cutoff function (export entrants, corresponding to firms in areas A and B in Figure 4) with similar firms just below the cutoff that do not enter the export market, and by controlling for pre-export productivity and other observable characteristics of new exporters I should be able to remove the endogeneity of the export decision.

After obtaining the matched samples, I non parametrically compute the differences between treated and control matched observations (in the common support of the propensity score) of the change of outcome between the pre-exporting year and the year a firm begins exporting. I then run a significance test on the so-obtained ATT effect. The outcome variables that I consider are unskilled and skilled employment, and unskilled and skilled average wages. I then repeat the procedure separating the treated firms between those that begin exporting to a Latin American destination only (corresponding to firms located in area A in Figure 4), and those that begin exporting to at least one high income destination (corresponding to firms located in area B in Figure 4).

Results for the treatment effect coefficients are shown in Table 18. The top panel focuses on the employment effects: as predicted by the model, results suggest that beginning to export has a positive effect on firm employment: firms expand and hire more labor to supply the larger international market. As shown in the top left panel, on average new exporting firms increase unskilled labor by 4.8% relative to firms in the control group in the first year after beginning to export as compared the pre-exporting year. Even though the coefficient is imprecisely estimated, the effect is much higher for firms entering a high income destination (a 9.3% increase) than for those entering Latin American markets only. Quite importantly, the point estimate for skilled employment is higher, and statistically significant: new exporters increase skilled employment on average by 6.3%, and also in this case the effect is mainly driven by new exporters to high income destinations, that increase their skilled employment by 10.5%.

The bottom panel of Table 18 shows results for the wage outcomes. As indicated in the bottom left panel, wages for unskilled workers are not on average affected by the export treatment, and the estimated effects for both new exporters to Latin American destinations and high income countries are very close to zero. On the other hand, effects on the wages of high skilled workers are positive and highly statistically significant for all exporters: starting to export leads to an increase in high skilled workers' wages by 9.3% in all treated firms relative to the control group in the first exporting year, as compared the pre-exporting year. When distinguishing by destination, the effect for high income exporters (10.7%) is once again higher than the one for exporters to Latin America (9.1%). Taken together, the combined positive effects on high skilled employment and wages show that exporting has a positive effect both on the quantity and the average wage of the firm's skilled workforce. As long as wage is believed to be a proxy for quality, and wage increases arguably reflect a change in the composition of the skilled labor force within the firm towards better paid and therefore better quality workers, the results on high skill employment and wages are consistent with a process of skill upgrading due to starting to export[14]. Firms that begin exporting hire additional skilled workers of better quality, and this effect is increasing with the sophistication of the export markets, with exporters to high income destinations needing workers of better quality than exporters to Latin America. The finding that the effect of starting to export would lead to a relatively higher increase of skilled workers' wages relative to unskilled workers', together with the relatively greater effects on skilled employment can help to offer an explanation for the increase in inequality associated with globalization.

As a robustness test, I run difference-in-difference regressions of the outcome variable of interest on a dummy for the treatment variable and a full set of controls (total employment, TFP, ratio of skilled workers to total employment, a foreign property dummy, and industry and year fixed

[14]Unfortunately, the data does not allow me to clearly disentangle the effect between a price increase for skilled workers and heterogeneity in worker quality, since I do not have information on individual workers. The higher wages paid by firms could therefore in theory also reflect a "fair wage" mechanism, implying unequal wages for identical workers between exporters and non exporters, or "efficiency wages" paid by exporters to induce increased effort and improve quality for foreign markets.

effects). I then repeat the same regressions using the propensity score reweighing method, where each non treated observation is weighted by $w = \frac{p(x)}{1-p(x)}$. Results are reported in Table 19 and Table 20 respectively. The same qualitative pattern of the nonparametric estimates is confirmed: on average new exporting firms increase unskilled labor relative to firms in the control group in the first year after beginning to export as compared the pre-exporting year (4.1% and 4.7% in the two specifications) and the effect is higher for firms entering a high income destination, even though the coefficients are not statistically significant. The point estimate for skilled employment is higher than the one for unskilled employment across both specifications, and statistically significant: new exporters increase skilled employment on average by 6.6% in the simple regressions, and by 5.2% in the reweighed specification. Also in this case, the effect is mainly driven by new exporters to high income destinations, that increase their skilled labor by 9.9% and 9.2%, respectively, in the two specifications. The absence of effects on unskilled wages regardless of destination is also confirmed. Finally, effects on the wages of skilled workers are positive and highly statistically significant for all exporters in both specifications: starting to export leads to an increase in skilled workers' wages by 7.6% and 9.0% respectively, in both specifications, with a higher effect for high income destinations exporters than for exporters to Latin America. In the first two rows of Figure 9, I summarize the results of the main specification on the different outcomes for new exporters by destination (firms located in areas A and B of Figure 4): comparing these to Figure 5 shows that the model's prediction are qualitatively confirmed[15].

6 Skill upgrading in new exporters to high income destinations: an IV approach

In order to estimate the causal impact on employment and wages at the firm level for previous exporters to Latin American countries beginning to export to high income destinations (corresponding to firms located in area C of Figure 4), the strategy I previously implemented to match exporting firms with non-exporting firms is not viable, as the main variables previously used to predict the

[15]As a further robustness test, I also estimate the previous models restricting the treatment observations only to firms that began exporting to countries with which Chile signed a Free Trade Agreement (FTA) in the year the FTA entered into force and in the two subsequent years. In all specifications, the results are qualitatively similar to those obtained using the whole sample of new exporters.

export treatment – such as size and productivity - do not seem to have a strong effect on the probability that previous LAC exporters will upgrade destinations. I therefore follow a different empirical strategy, similar to the one used by Brambilla, Lederman and Porto (2012), who exploit the exogenous variability in the export destinations of Argentine exporters generated by the 1999 devaluation of the Brazilian real to identify the causal effect of an increase in exports to high income countries on firm-level wages and skill composition. In this case, I exploit a different devaluation episode more relevant for Chilean firms: the 2001 Argentine peso devaluation[16]. Between the end of December 2001 and the beginning of January 2002, Argentina abolished the fixed parity between the peso and the U.S. dollar which had been in place since 1991, and this led to an immediate sharp drop in the value of the Argentine currency: from 635 Chilean pesos to the Argentine peso in 2001, by 2002 the currency had fallen to 225 Chilean pesos per Argentine peso. The rationale for this identification strategy is that due to the loss of competitiveness of Argentina, Chilean exporters to Argentina had to exogenously adjust by moving away from this market and find new alternative markets, including in high income countries. Table 21, which shows Chile's overall export statistics and total number of exporting firms by major export destination, provides some evidence that supports such strategy. While Argentina does not account for a high percentage of total Chilean exports in value, it is a very important partner for Chilean firms, and as shown in Table 21 it was the destination the highest number of firms exported to in 2001. In 2001, prior to devaluation, Chile sent 3.3% of its total exports to Argentina; in 2002, after Argentina devalued, this share shrank to 1.2%, and exports dropped to just one third of the previous year's value. Exports to Argentina only partially recovered in 2003, reaching 1.6% of the total. Additionally, the number of firms exporting to Argentina dropped from 411 in 2001 to 321 in 2002, partially recovering to 356 in 2003; on the other hand, consistent with my identification strategy by which Chilean exporters to Argentina had to exogenously find alternative markets in high income countries, the number of Chilean firms exporting to high income countries increased from 473 in 2001 to 532 in 2002 and 587 in 2003.

Empirically, I estimate the following model, similarly to Brambilla, Lederman and Porto (2012):

$$y_{it} = \beta_1 HI_{it} + \beta_2 EXP_{it} + X_{it}^{'}\delta_1 + \alpha_i + \gamma_t + \epsilon_{it} \quad (33)$$

[16]While Brazil accounted for a slightly higher share of total Chilean exports in value than Argentina, almost twice as many Chilean firms exported to Argentina as to Brazil before both devaluation episodes.

where y_{it} is the labor outcome variable in firm i at time t, HI_{it} is a dummy taking the value of 1 if the firm exports to at least one high income destination market (the variable of interest), EXP_{it} is an export indicator dummy variable, $\mathbf{X}$ is a vector of firms' characteristics (size, productivity, foreign ownership) used as controls, α_i is a firm fixed effect, and γ_t is a year dummy to allow the intercept to vary over individual firms over time. To deal with the endogeneity of the *HI* variable, I instrument for it with a variable constructed as the interaction between the pre-devaluation (2001)'s share of the value of the firms exports that were destined to Argentina and the exchange rate of the Chilean peso relative to the Argentine peso, *erate*:

$$I_{it}^{HI} = \frac{VEXP_{it}^{ARG}}{VEXP_{it}} erate_t^{ARG} \tag{34}$$

The rationale for this instrument, as mentioned earlier, is that firms with a higher pre-devaluation share of exports to Argentina were more affected by the Argentine devaluation, and because of it had higher scope to enter a high income market. Even though the pre-shock export shares are endogenously chosen by the firm, once the pre-determined export share to Argentina is given, the differential response due to the Argentine devaluation is reasonably exogenous.

I run the model for each of the four outcome variables previously considered: unskilled and skilled employment, and unskilled and skilled wages. Results for employment and wages are reported in Table 22 and 23 respectively, where the first column of each outcome includes firm fixed effects, and the second column includes both firm and year fixed effects. First, the first stage relationship between the interaction of the Argentine export share with the exchange rate and the High Income country export indicator is very strong and goes in the expected direction (a decrease in the exchange rate - an appreciation of the Chilean peso vs. the Argentine peso - causes a number of previous exporters to Argentina to enter a high income market). The second stage estimation for employment yields effects on unskilled and skilled employment that are not statistically significant for either the *HI* and the *EXP* dummies. In line with the results obtained in section 5 for new exporters, entering high income markets for previous Latin American exporters also has no significant effect on unskilled wages. However, coefficient estimates on skilled wages are positive and significant (and of the expected signs) for both the *HI* and the *EXP* dummies: firms that begin to export to a high income destination because of the Argentine peso devaluation increase the average wage paid to their skilled workers, while in firms that cease to export altogether as consequence of the Argentine peso devaluation there is a decrease in skilled workers' average compensation[17]. In the third row of Figure 9, I include the results of the main specification on the different outcomes for previous exporters to Latin America starting to export to high income countries (firms located in area C of Figure 4).

As a robustness test, I also run regression (2.33) replacing the *HI* dummy with a variable defined as $\frac{VEXP_{it}^{HI}}{VEXP_{it}}$ (the share of the value of a firm's exports to high income destinations over total export value), and the *EXP* dummy with a variable defined as $\frac{VEXP_{it}}{Y_{it}}$, the ratio of the total value of firm exports over total sales. These regressions exactly replicate Brambilla, Lederman, and Porto (2012)'s main regression, and measure how the change in a firm's export composition due to the Argentine devaluation affects the different firm level outcomes. In this case, I would expect the share of exports to high income destinations to increase following the crisis in Argentina, and I want to estimate how this exogenous change affects employment and wages at the firm level[18]. For the *HI* variable, I use the same instrument as in (2.34). Additionally, to account for the endogeneity of the ratio of the exports over sales variable (*EXP*), I use another instrument constructed to reflect the average exchange rate faced by a firm in the international market:

$$I_{it}^{EXP} = \sum_{c} \frac{VEXP_{it}^{c}}{Y_{it}} erate_{t}^{c} \tag{35}$$

where $\frac{VEXP_{it}^{c}}{Y_{it}}$ is the share of the value of exports of firm i to country c on total sales in 2001, and *erate* is the exchange rate of the Chilean peso relative to country c's currency at time t. Given the pre-determined export market share to country c for a given firm i in 2001, I would expect that a decrease in the exchange rate of the Chilean peso towards that country's currency would lead that firm to reduce its exports to country c; I would therefore expect *EXP* to be positively correlated with the instrumental variable in the first stage regression.

Results for employment and wages are reported in Table 24 and 25 respectively, where once again the first column of each outcome includes firm fixed effects, and the second column includes both

[17] The size of the coefficients is also very similar to the results found in Brambilla, Lederman and Porto (2012) for Argentine firms (table 9, column 6, page 3430).

[18] It is important to note that in this case I am measuring these impacts on firms that may already be exporting to high income destinations, so this approach does not correspond to the theoretical model.

firm and year fixed effects. Also in this case, the instruments have a high explanatory power of the instrumented variables: an appreciation of the Chilean peso relative to the Argentine peso causes previous exporters to Argentina to increase both the percentage of their total exports represented by high income destinations and their share of exports on total sales, while an overall Chilean peso appreciation towards all trading partners causes the share of exports over sales to decrease, but the percentage of exports to high income destinations over total exports to increase. Additionally, the p-value associated with the F-statistic of joint significance of the instruments is extremely low. Second stage regression results closely mimic the previous results with the *HI* and *EXP* dummies: unskilled and skilled employment effects are not statistically significant for both the *HI* and the *EXP* variables, and changes in the share of high income destinations exports over total exports, or the the share of exports over sales also have no significant effect on unskilled average wages. However, coefficient estimates on skilled wages for the *HI* variable are positive and significant: firms that as a consequence of the Argentine peso devaluation increase the share of their exports represented by shipments to high income countries increase the average wages paid to their skilled workers, while a change in the export over sales ratio has no effect on skilled workers' average compensation[19].

Taken together, these results confirm that beginning to export to a high income market (or increasing the share of exports to high income destinations) leads to a skill upgrading even for firms that were already previously exporting. However, for these firms, such upgrading works more through higher average wages paid to their skilled workforce rather than the additional compositional shift between unskilled and skilled employment that I found for new exporters altogether.

7 Conclusion

This paper has analyzed the effects of exporting on firm level labor outcomes in one of the most successful open economies in the developing world. Over the period under examination, Chilean manufacturing exports more than tripled, raising questions on whether the trade liberalization policies undertaken by the country in the same period may have contributed to the high levels of

[19]In the model controlling for year fixed effects, the coefficient on *HI* means that for a 1 percent increase in the ratio of exports to high income destinations over total exports average skilled wages increase by 0.66%. At the mean share of exports to high income countries (29%), this result implies that high income exporters on average pay 19% higher skilled wages. The size of the coefficients is again very similar to the results found in the corresponding regression in the paper of Brambilla, Lederman and Porto (2012) for Argentine firms (table 8, panel A, column 3, page 3429).

income inequality still prevailing in the country. Given the well known strong correlation between firm size, productivity, average wages paid, and export status, the main question that this study has tried to answer is whether larger firms paying higher wages select themselves in the export market, or if exporting does in fact lead to employment and skill level changes at the firm level. I develop a model with two dimensions of firm heterogeneity - productivity and export ability - that predicts that a shock that induces firms to enter the export market causes them to upgrade their skill utilization, and that such effect is increasing in the sophistication of foreign markets: exporters to high income destinations should therefore hire more skilled workers of better quality.

A first important result of this paper is that data confirms a sorting of firms across destinations: at each productivity level above the minimum necessary to produce at all in the market, I observe both exporters and non exporters, but the percentage of exporters is increasing with productivity, and the percentage of exporters to Latin American countries is higher than the percentage of exporters to high income destinations at each productivity level. However, even conditional on productivity, exporters - especially those to high income countries - still hire more production workers and pay higher wages than non-exporters. Using matched sample techniques, I construct counterfactuals that take into account potential firm selection in export markets, and the results show that beginning to export indeed has a causal impact on firm level employment and returns to skill. By increasing market size, exporters hire additional skilled workers, and due to the higher sophistication of export markets they pay higher skilled wages, a possible sign of an increase in the quality of their skilled workforce. As predicted by the theoretical model, I find that the responses are heterogeneous across destinations, with strong effects for new exporters to high income destinations, and relatively lower effects for firms that just begin serving a Latin American country. Additionally, I use an instrumental variable approach to estimate the causal effect on employment and wages for firms previously exporting to Latin America that are induced to begin exporting to high income countries as a consequence of the 2001-2002 Argentine peso devaluation, and results show an upgrading in the quality of their workforce even for these firms.

Even though a lot more work remains to be done in the area of the relationship between trade liberalization and wage inequality, I believe that this paper contributes to uncover an important way in which globalization can create winners and losers. While the Hecksher-Ohlin model predicts that unskilled labor, the relatively abundant factor of production, should be benefited by the reduction in trade barriers in developing countries, when we allow for firm heterogeneity I show that exporting, and especially exporting to high skill destinations, is *per se* a skilled activity, and it is skilled workers employed by exporting firms that gain when trade expands. In a developing country setting like Chile's, this clearly points to the pressing need to couple export promotion policies for small and medium firms with an education reform that could help create locally the skills that these firms will more and more require.

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2.a Appendix

2.a1 Derivation of the demand function facing each firm *i*.

Consumers maximize:

$$U = \left[\sum_{i=1}^{n} x_i^{\rho}\right]^{\frac{1}{\rho}}$$

subject to the constraint:

$$Y = \sum_{i=1}^{n} x_i p_i$$

Setting up the Lagrangian:

$$\mathcal{L} = \left[\sum_{i=1}^{n} x_i^{\rho}\right]^{\frac{1}{\rho}} + \lambda \left(Y - \sum_{i=1}^{n} x_i p_i\right)$$

The first order conditions are:

$$\frac{\partial \mathcal{L}}{\partial x_i} = \left[\sum_{i=1}^{n} x_i^{\rho}\right]^{\frac{1-\rho}{\rho}} x_i^{\rho-1} - \lambda p_i = 0 \;\; \forall\, i \in \{1, ..., n\}$$

Dividing between the first and the i-th equations yields:

$$\left(\frac{x_i}{x_1}\right)^{\rho-1} = \left(\frac{p_i}{p_1}\right)$$

Rearranging, I obtain:

$$p_i x_i = p_1 x_1 \left(\frac{p_i}{p_1}\right)^{\frac{\rho}{\rho-1}}$$

Summing over all $i \in \{1, ..., n\}$:

$$\sum_{i=1}^{n} p_i x_i = \sum_{i=1}^{n} p_1 x_1 \left(\frac{p_i}{p_1}\right)^{\frac{\rho}{\rho-1}}$$

By substituting this into the budget constraint and rearranging I get:

$$Y = \sum_{i=1}^{n} p_1 x_1 \left(\frac{p_i}{p_1}\right) = p_1^{-\frac{1}{\rho-1}} x_1 \sum_{i=1}^{n} p_i^{\frac{\rho}{\rho-1}}$$

By defining $P = \left[\sum_{i=1}^{n} p_i^{\frac{\rho}{\rho-1}}\right]^{\frac{\rho-1}{\rho}}$, the aggregate price of the differentiated good, I may write:

$$Y = p_1^{-\frac{1}{\rho-1}} x_1 P^{\frac{\rho}{\rho-1}}$$

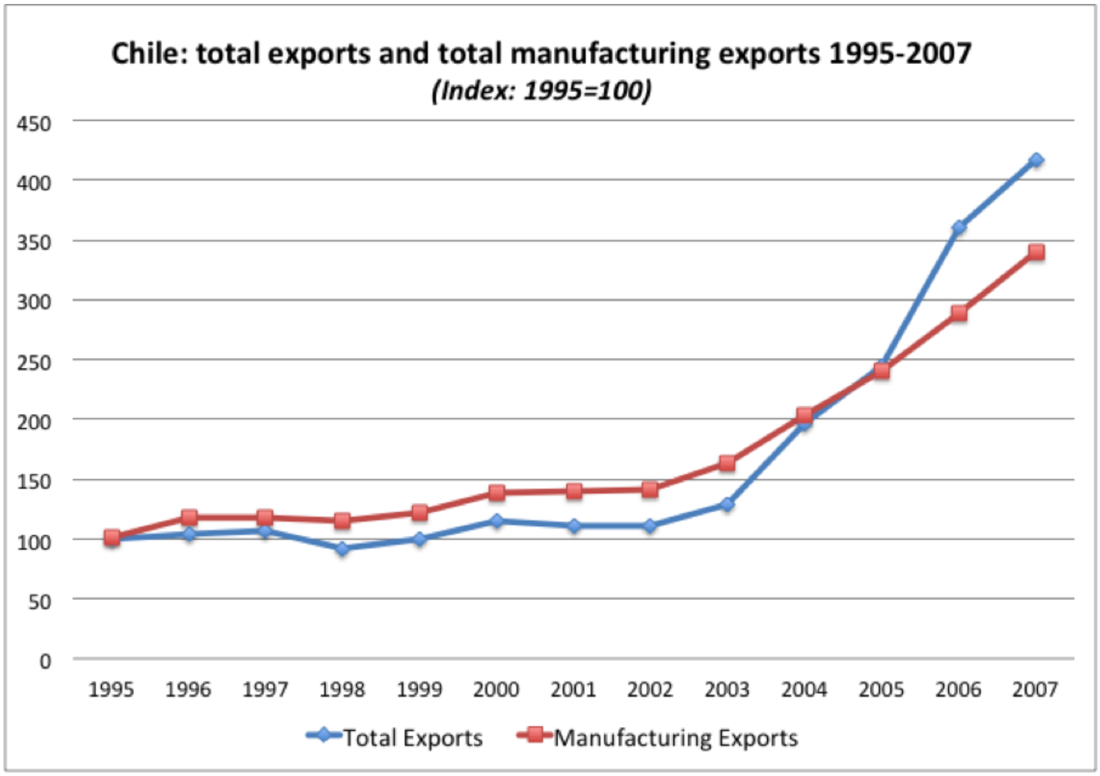
Solving for x_1 gives the demand function associated with this utility function:

$$x_1 = \left(\frac{Y p_1^{-\frac{1}{1-\rho}}}{P^{\frac{\rho}{\rho-1}}}\right) = \frac{Y}{P}\left(\frac{p_i}{P}\right)^{-\frac{1}{1-\rho}}$$

so that the demand for each variety x_i of the differentiated good is given by the real income $E = \frac{Y}{P}$ times a constant elasticity function of the relative price $\frac{p_i}{P}$ of each variety.

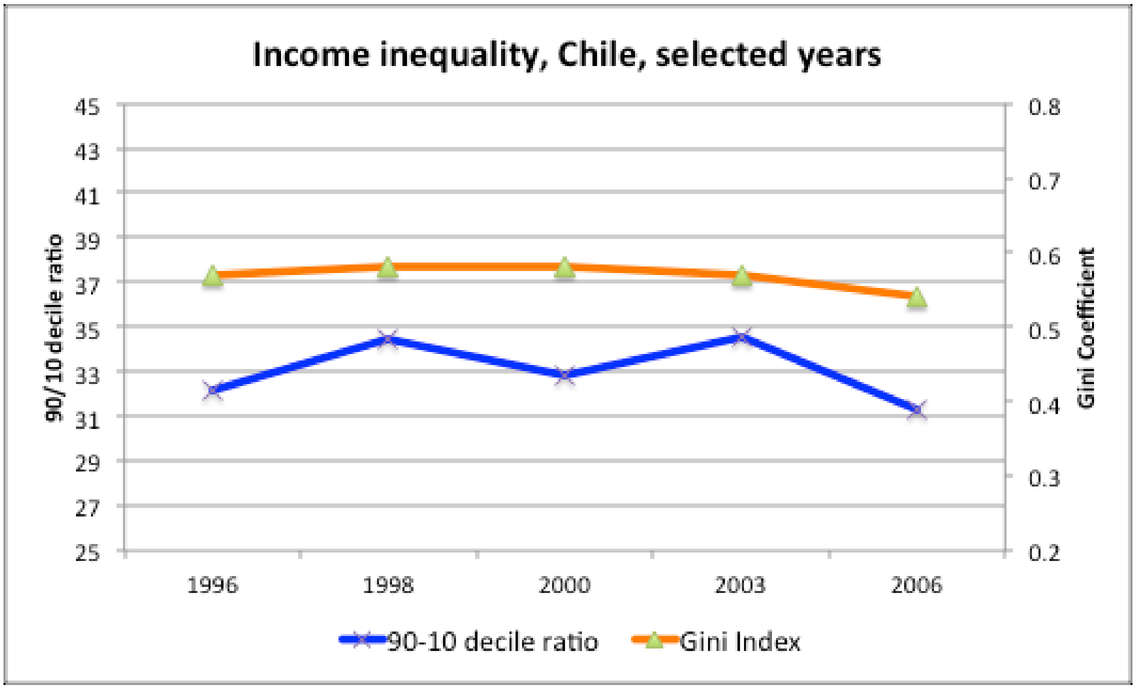
2.a.2 Tables and figures

Figure 1: Chile: total exports and total manufacturing exports 1996-2007



Source: Chilean Government, General Direction of International Economic Relations (DIRECON)

Figure 2: Income inequality in Chile, 1996-2006



Source: Chilean Department of Planning (MIDEPLAN)

Figure 3: Export cutoff functions, Latin American and high income destinations

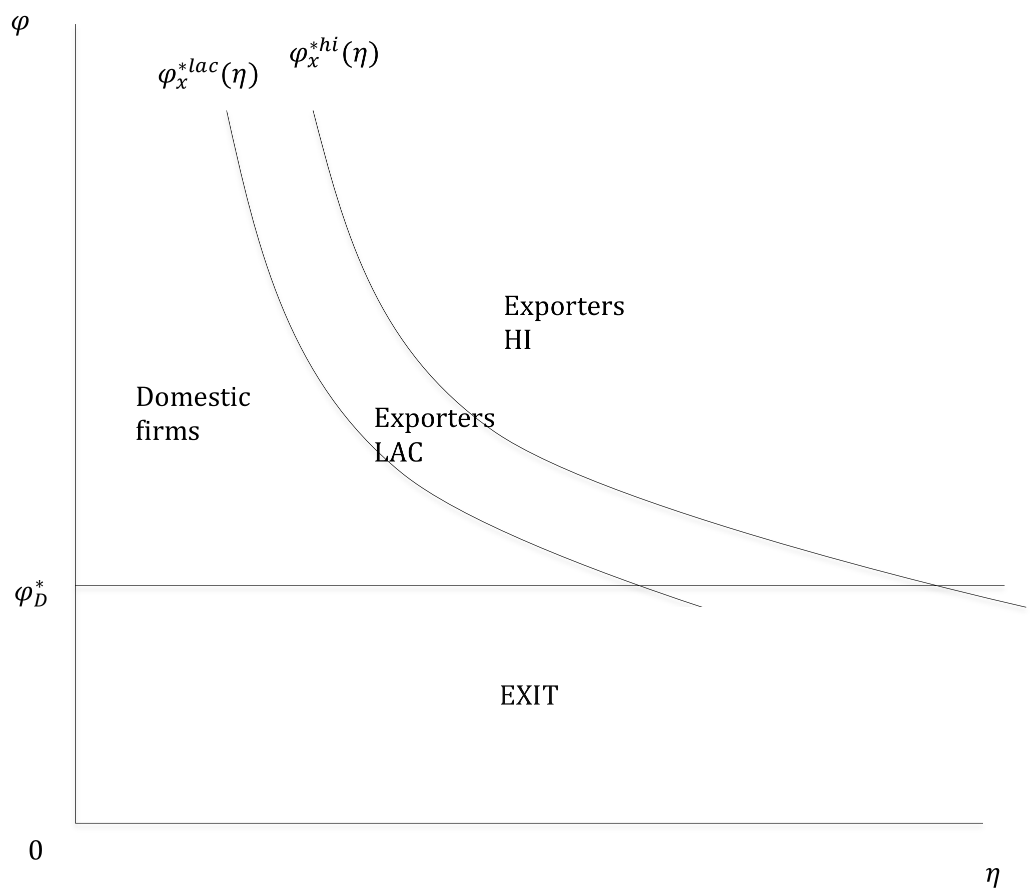


Figure 4: Export cutoff functions after trade liberalization, Latin American and high income destinations

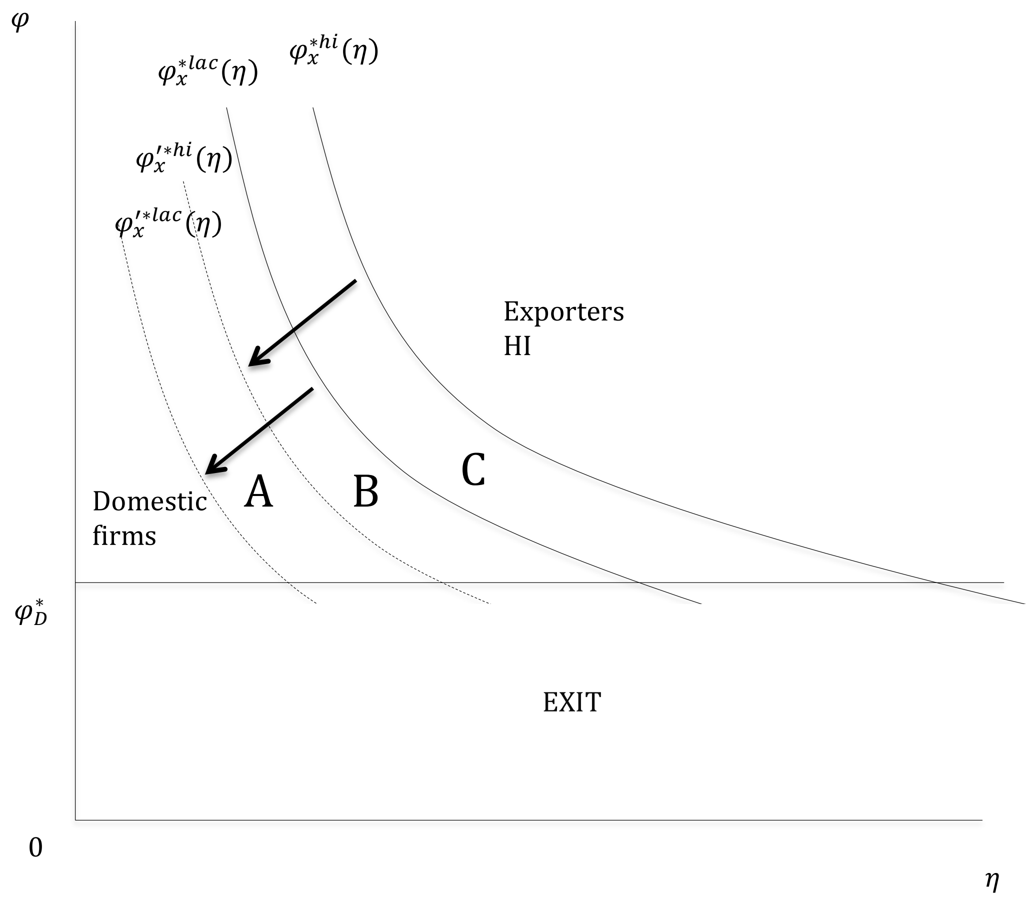
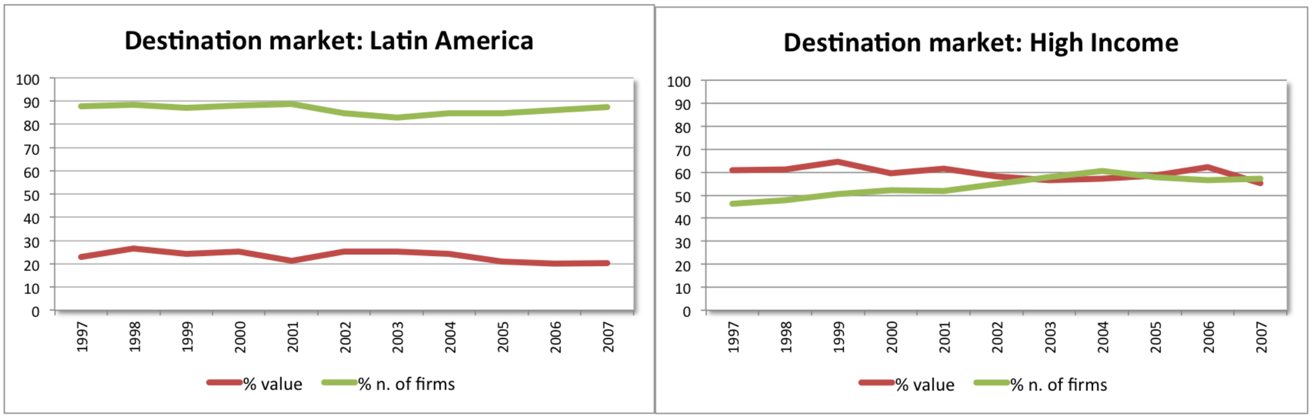


Figure 5: Model predictions of sign effect of exporting on labor outcomes, by destination

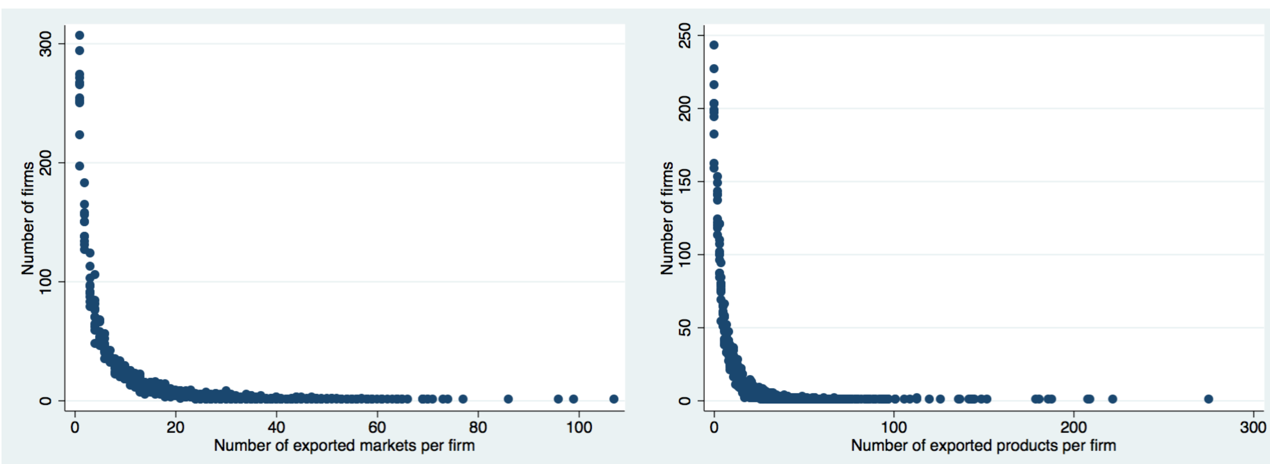
Export type	Area in graph	Employment		Wages	
		Unskilled	Skilled	Unskilled	Skilled
Enter LAC (new)	A	+	+	0	+
Enter HI (new)	B	+++	+++	0	+++
LAC to HI	C	++	++	0	++

Figure 6: Percent total value exported and percent number of firms, by major destination



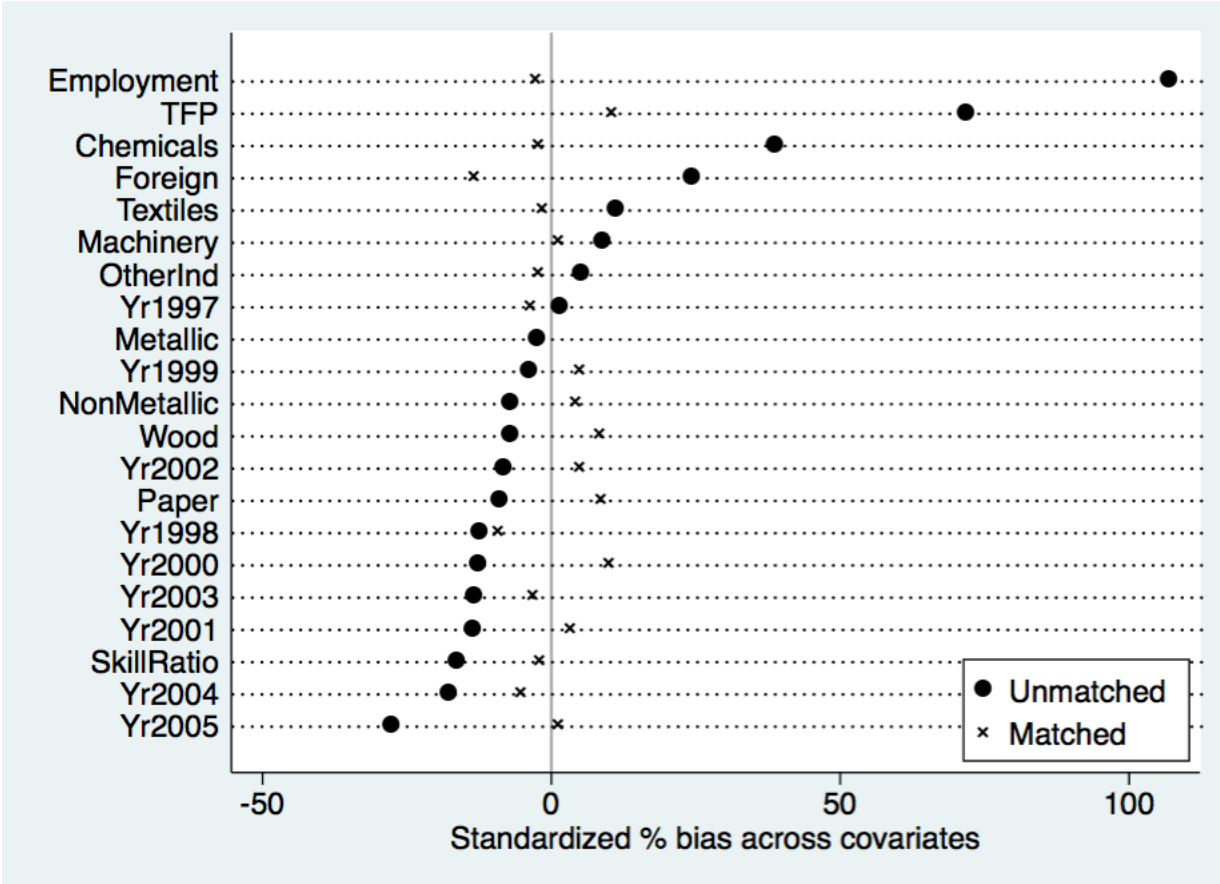
Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Figure 7: Number of export markets/6-digit HS products exported by individual firms



Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Figure 8: Covariate imbalance between treated and control observations, before and after matching



Note: the figure shows the standardized percentage bias for each covariate for the unmatched and matched samples, respectively.

Figure 9: Summary results of effects of exporting, by destination

Export type	Area in graph	Employment		Wages	
		Unskilled	Skilled	Unskilled	Skilled
Enter LAC (new)	A	0	4.6%	0	9.1% (***)
Enter HI (new)	B	9.3%	10.5% (*)	0	10.5% (**)
LAC to HI	C	0	0	0	4.8% (*)

Table 1: Chile's trade agreements entered into force in the 1995-2007 period.

Partner	Entry into force	Type (*)	% export
MERCOSUR (Argentina, Brazil, Paraguay, Uruguay)	October 1996	FTA	10.9
Canada	July 1997	FTA	0.8
Peru	July 1998	PPA	2.4
Mexico	August 1999	FTA	3.9
Costa Rica	February 2002	FTA	0.4
El Salvador	June 2002	FTA	0.1
European Union	February 2003	EAA	24.7
U.S.A	January 2004	FTA	15.4
Rep. Of Korea	April 2004	FTA	5.8
EFTA (Iceland, Liechtenstein, Norway, Switzerland)	December 2004	FTA	0.6
P4 (Brunei, New Zealand, Singapore)	May 2006	EAA	0.1
China	October 2006	FTA	8.8
India	August 2007	PPA	3.4
Japan	September 2007	FTA	10.8
Guatemala	December 2007	FTA	0.4

Source: Organization of American States (OAS) Note: (*) FTA = Free Trade Agreement, EAA = Economic Association Agreement (Trade Provisions), PPA = Partial Preferential Agreement

Table 2: Average sample statistics

	Non Exporters	Exporters	Exporters LAC	Exporters HI
Sales (thousands of pesos)	1,341,449	20,885,968	6,559,429	34,061,014
Log TFP	8.805	9.498	9.398	9.625
Unskilled Employment	24	114	61	157
Skilled Employment	16	81	49	109
Unskilled yearly wage (pesos)	2,858,717	4,600,931	4,033,824	4,263,361
Skilled yearly wage (pesos)	4,080,987	9,230,772	8,576,883	10,072,876
Observations (firm/year)	30,714	11.533	4,810	5,718

Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Table 3: Percentage firm size, by export category

	All firms	Non Exporters	Exporters LAC	Exporters HI	Export. OTHER
Small (>50)	67.0	81.3	41.2	20.3	53.8
Medium (50-200)	24.4	16.8	46.2	42.7	41.3
Large (>200)	8.5	2.0	12.6	37.1	5.0
Total	100.0	100.0	100.0	100.0	100.0

Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Table 4: Percentage export category, by firm size

	Non Exporters	Exporters LAC	Exporters HI	Exporters OTHER	Total
Small (>50)	87.6	7.7	4.5	0.2	100.0
Medium (50-200)	49.7	23.8	26.2	0.4	100.0
Large (>200)	16.5	18.6	64.8	0.1	100.0
Total	72.3	12.6	15.0	0.2	100.0

Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Table 5: Descriptive statistics: avg. yearly unskilled wage, by firm size

	Non Exporters	Exporters	Exporters LAC	Exporters HI
Small (>50)	2,749,564	3,631,867	3,723,364	3,642,748
Medium (50-200)	3,210,317	4,055,737	4,204,270	4,065,180
Large (>200)	3,553,614	4,598,080	4,345,715	4,807,784

Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Table 6: Descriptive statistics: avg. yearly skilled wage, by firm size

	Non Exporters	Exporters	Exporters LAC	Exporters HI
Small (>50)	4,088,760	7,637,467	7,381,425	8,554,452
Medium (50-200)	6,568,643	9,547,047	9,196,477	10,189,062
Large (>200)	7,918,778	10,632,239	10,187,488	10,759,679

Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Table 7: Exporting firms as % of total firms

sector	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Food & Beverages	23.3	24.4	24.6	23.5	23.4	22.9	24.1	25.1	26.6	26.9	26.2	26.1
Textiles	21.2	27.7	29.4	28.2	24.4	27.3	25.2	26.2	23.8	26.9	27.3	25.7
Wood	20.9	22.1	22.7	25.4	25.3	24.8	25.2	26.7	25.5	23.7	23.0	24.2
Pulp & Paper	20.8	24.0	24.6	20.5	23.7	26.3	22.6	20.2	21.0	20.5	21.4	22.5
Chemicals	36.6	49.3	47.8	48.0	46.8	47.0	45.0	44.0	43.4	43.8	43.1	44.1
Non Metallic	18.8	22.3	25.6	24.2	24.0	24.6	23.4	24.4	26.6	24.6	25.0	27.9
Metallic	47.2	57.7	51.0	48.3	42.6	39.8	30.7	34.5	40.6	39.1	39.0	39.8
Machinery	17.3	24.6	23.3	23.7	22.3	23.5	22.9	25.2	20.8	24.0	24.0	24.0
Other Industries	16.9	30.5	37.0	32.7	29.8	29.1	27.1	24.6	26.4	28.6	35.7	26.2
Total	23.1	28.3	28.4	27.9	27.1	27.8	26.9	27.7	27.0	28.1	27.9	28.0

Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Table 8: Average export intensity, by sector (mean export receipts over total firm sales)

sector	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Food & beverages	11.0	10.1	10.4	12.3	13.1	23.6	12.3	12.2	12.1	11.7	11.9	13.5
Textiles	2.4	2.3	2.3	2.3	2.6	2.9	2.6	2.6	2.8	2.8	3.2	2.4
Wood	8.5	7.6	7.4	9.1	8.7	8.6	8.4	9.9	8.7	8.8	9.2	8.0
Pulp & Paper	3.1	2.3	2.0	2.2	2.6	4.0	2.6	2.2	2.2	2.6	2.5	2.6
Chemicals	4.1	4.7	5.3	5.0	4.6	5.2	5.4	5.1	5.0	5.2	5.2	4.6
Non Metallic	1.8	2.0	2.4	2.4	2.8	2.6	2.4	2.5	2.7	2.5	2.4	2.3
Metallic	17.9	20.6	20.8	18.5	15.2	27.7	14.2	13.7	14.9	15.3	15.6	14.7
Machinery	1.9	1.9	2.2	2.2	2.1	3.0	2.2	2.6	2.4	2.5	2.8	2.7
Other Industries	2.5	2.5	3.8	3.6	3.4	4.1	4.3	2.7	3.3	2.8	2.1	2.2
Total	5.6	5.4	5.6	6.3	6.4	10.1	6.4	6.4	6.3	6.3	6.6	6.7

Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Table 9: Number of exporting firms by export destination

Country	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Argentina	544	499	485	468	411	321	356	371	360	339	329
Peru	430	441	388	395	393	421	421	426	430	363	365
U.S.A.	327	322	326	315	344	381	399	428	384	338	332
Bolivia	407	400	353	338	310	318	279	281	262	238	215
Ecuador	232	252	199	198	229	271	299	279	277	279	247
Mexico	163	188	204	203	229	274	290	313	288	304	276
Brazil	276	247	226	223	231	221	224	262	259	231	236
Colombia	184	204	194	189	187	219	238	249	241	237	240
Uruguay	264	244	237	219	205	178	170	178	196	179	189
Venezuela	161	175	190	193	190	196	169	192	203	198	196
Japan	188	181	159	159	139	152	150	163	155	144	133
Paraguay	256	245	186	171	155	128	118	109	114	101	98
Germany	133	132	129	110	112	129	148	171	166	164	163
Canada	111	128	93	106	111	124	148	165	173	157	134
Costarica	82	84	100	101	107	139	153	161	150	151	159
Spain	109	106	113	101	95	130	148	160	162	136	126
Panama	93	94	114	105	107	125	136	122	127	113	112
U.K.	100	101	99	94	96	108	103	134	129	124	112
Italy	91	88	96	89	94	107	124	131	123	120	116
China	65	78	68	60	77	99	96	126	133	121	140
Guatemala	65	76	82	80	76	93	120	107	115	116	106
France	72	84	71	76	85	93	111	126	113	98	98
Netherlands	77	75	86	78	79	75	91	111	111	108	99
South Korea	83	45	58	69	68	81	75	109	106	104	93

Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Table 10: Number of export markets served by individual firms

No. of markets	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	307	294	274	250	252	271	265	254	267	223	197
2	183	156	150	134	138	150	165	158	131	138	127
3	91	97	96	91	90	103	113	124	87	79	83
4	106	84	62	64	76	59	77	70	81	70	48
5	68	53	53	58	50	67	53	52	66	46	50
6	56	56	52	46	35	46	40	47	42	42	47
7	32	35	37	32	33	35	36	33	42	36	35
8	34	31	34	24	31	30	28	35	30	27	22
9	24	33	24	27	27	21	29	28	20	22	22
10	25	29	18	21	24	18	20	26	18	19	29
10<n<20	107	109	116	108	102	119	123	124	116	117	103
>20	47	44	42	50	52	54	63	76	85	78	78

Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Table 11: Number of 6-digit HS products exported by individual firms

No. of products	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	243	227	216	203	197	194	203	182	199	159	162
2	153	141	141	122	137	118	143	149	120	124	113
3	121	121	107	100	87	96	102	100	110	87	84
4	80	80	76	75	94	84	69	80	74	78	54
5	65	60	54	61	54	55	51	64	51	54	59
6	66	58	42	42	47	57	57	48	40	38	38
7	44	42	38	33	43	38	39	48	52	37	33
8	38	34	41	35	27	47	31	41	33	40	37
9	23	26	26	24	25	28	38	29	26	29	21
10	28	22	34	27	24	30	30	36	26	26	21
10<n<20	130	132	118	120	117	131	153	157	168	151	145
>20	89	78	65	63	58	95	96	93	86	74	74

Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Table 12: Percent distribution of exporting firms by number of export destination markets and 6-digit HS exported products

	No. of products						
N. of Markets	1	2	3	3<n<10	10<n<20	>20	Total
1	14.8	5.0	2.2	3.8	0.7	0.4	26.9
2	2.6	4.0	2.8	4.8	0.9	0.4	15.4
3	1.0	1.6	1.8	4.2	1.0	0.4	9.9
3<n<10	1.9	2.6	2.9	14.1	5.9	2.4	29.8
10<n<20	0.2	0.5	0.5	4.2	3.6	2.7	11.7
>20	0.0	0.2	0.3	1.5	2.4	1.9	6.3
Total	20.6	13.8	10.5	32.6	14.3	8.2	100.0

Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Table 13: Percentage firms exporting to major destinations

Year	LAC only	HI only	LAC & HI	Other only	Total
1997	53.0	11.4	34.9	0.7	100.0
1998	51.9	11.5	36.4	0.2	100.0
1999	49.1	12.5	38.1	0.3	100.0
2000	47.5	11.6	40.4	0.4	100.0
2001	47.5	10.7	41.3	0.6	100.0
2002	44.3	14.3	40.4	0.9	100.0
2003	40.8	15.9	42.1	1.2	100.0
2004	38.2	14.1	46.5	1.2	100.0
2005	40.9	14.2	43.8	1.1	100.0
2006	42.8	13.3	43.3	0.7	100.0
2007	42.0	11.7	45.4	1.0	100.0
Total	45.3	12.9	41.0	0.8	100.0

Source: Author's calculations based on Chile's annual manufacturing survey (ENIA) and official customs records.

Table 14: Production function estimation results

	Total	Food & Beverages	Textiles	Wood	Pulp & Paper	Chemical	Non Metallic	Metallic	Machinery	Other Industries
Skilled labor	0.47	0.34	0.54	0.46	0.42	0.60	0.50	0.51	0.50	0.51
	(47.07)***	(21.60)***	(34.90)***	(13.16)***	(11.75)***	(25.36)***	(11.00)***	(7.63)***	(24.56)***	(7.23)***
Unskilled labor	0.27	0.29	0.31	0.34316	0.23631	0.19082	0.24181	0.31412	0.30570	0.32556
	(40.43)***	(12.94)***	(16.01)***	(10.15)***	(10.11)***	(7.66)***	(4.81)***	(4.80)***	(19.56)***	(5.74)***
Capital	0.16	0.18	0.13	0.14	0.15	0.16	0.14	0.20	0.10	0.18
	(41.25)***	(11.75)***	(7.59)***	(4.66)***	(6.42)***	(7.25)***	(3.92)***	(2.22)**	(5.43)***	(4.06)***
N	38,691	10,594	5,530	3,680	2,725	5,529	1,455	765	7,853	560

Note; This table reports the estimated coefficients for value added Cobb-Douglas production function estimations with three factors (capital, skilled labor and unskilled labor) using the method proposed by Levinsohn and Petrin (2003) to correct for simultaneity and selection bias. t-statistics are in parenthesis.

Table 15: Percentage exporters, by decile of log TFP

Decile Log TFP Distr.	% of Exporters	% of LAC Exporters	% of HI Exporters
1	10.1%	7.5%	5.6%
2	11.8%	9.1%	6.0%
3	15.1%	11.5%	7.8%
4	21.7%	17.0%	10.8%
5	25.4%	21.2%	11.6%
6	29.6%	24.8%	14.2%
7	33.0%	28.5%	16.7%
8	39.3%	35.0%	19.0%
9	49.5%	45.5%	27.4%
10	67.3%	62.3%	45.2%

Note: This table reports the percentage of exporters, exporters to Latin American destinations, and exporters to High Income destinations over total firms by decile of logTFP distribution. TFP is calculated at the firm level as a residual of a Cobb-Douglas production function with three factors (capital, skilled labor and unskilled labor) using the method proposed by Levinsohn and Petrin (2003) to correct for simultaneity and selection bias.

Table 16: OLS regression results

VARIABLES	Log Unskilled Empl.		Log Skilled Empl.		Log Unskilled Wage		Log Skilled Wage	
Old exporters	1.411***	1.137***	1.406***	1.203***	0.315***	0.148***	0.604***	0.306***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.008)	(0.008)	(0.009)	(0.009)
New exporters	0.886***	0.696***	0.783***	0.663***	0.213***	0.0959***	0.457***	0.252***
	(0.024)	(0.0248)	(0.023)	(0.024)	(0.009)	(0.009)	(0.012)	(0.011)
TFP		0.424***		0.362***		0.260***		0.414***
		(0.009)		(0.008)		(0.004)		(0.005)
R-squared	0.265	0.325	0.236	0.313	0.242	0.387	0.310	0.469
Old exporters HI	1.494***	1.208***	1.497***	1.284***	0.332***	0.156***	0.628***	0.315***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.008)	(0.008)	(0.009)	(0.010)
Old exporters LAC	0.568***	0.460***	0.480***	0.430***	0.141***	0.072***	0.351***	0.212***
	(0.049)	(0.049)	(0.042)	(0.043)	(0.028)	(0.027)	(0.033)	(0.032)
New exporters HI	1.058***	0.840***	0.834***	0.724***	0.231***	0.098***	0.483***	0.251***
	(0.039)	(0.039)	(0.042)	(0.042)	(0.015)	(0.014)	(0.020)	(0.020)
New exporters LAC	0.780***	0.610***	0.753***	0.632***	0.205***	0.098***	0.438***	0.248***
	(0.030)	(0.030)	(0.026)	(0.028)	(0.012)	(0.011)	(0.014)	(0.013)
TFP		0.418***		0.356***		0.259***		0.414***
		(0.009)		(0.008)		(0.004)		(0.005)
R-squared	0.270	0.329	0.242	0.317	0.244	0.387	0.311	0.469
Observations	36,302	35,352	41,926	35,352	36,302	35,352	41,926	35,352

Note: The top portion of this table reports the results of a regression of the dependent variable listed in the column on four-digit ISIC sector fixed effects, year fixed effects, and two dummy variables indicating whether the firm is a new exporter or an old exporter. The right column of each outcome adds a control for TFP. An old exporter is defined as a firm that is observed exporting in the first year in the sample (1995) and continue to do so for at least ten years. A new exporter is a firm that begins to export at any point between 1996 and 2006 and sells in international markets for at least two consecutive years. The bottom portion of the table reports the results of a regression of the dependent variable listed in the column on four-digit ISIC sector fixed effects, year fixed effects, and four dummies indicating whether the firm is a new exporter LAC or HI, or an old exporter LAC or HI. Old exporters HI are defined as old exporters that export to a high income destination for at least one year during their exporting life. New exporters HI are defined as new exporters that export to at least one high income country in the year they begin to export. ** denotes significance at the 5% level. *** denotes significance at the 1% level.

Table 17: Probit estimates

Lag TFP	0.313	***	(0.040)
Lag skill ratio	-0.070		(0.107)
Lag employment	0.471	***	(0.031)
Lag foreign	0.695	***	(0.202)
Textiles	0.518	***	(0.086)
Wood	0.180	*	(0.100)
Pulp & paper	0.143		(0.118)
Chemicals	0.655	***	(0.085)
Non-metallic	-0.193		(0.153)
Metallic	0.058	***	(0.220)
Machinery	0.215	***	(0.079)
Other industries	0.574	***	(0.222)
Year 1998	-0.340	***	(0.086)
Year 1999	-0.553	***	(0.104)
Year 2000	-0.303	***	(0.097)
Year 2001	-0.439	***	(0.109)
Year 2002	-0.447	***	(0.108)
Year 2003	-0.348	***	(0.099)
Year 2004	-0.490	***	(0.106)
Year 2005	-0.602	***	(0.112)
Year 2006	-0.895	***	(0.142)

Note: This table reports the results of a probit regression of the determinants of starting to export for the total sample. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively. Standard errors are in parenthesis.

Table 18: Impact of beginning to export on labor market outcomes: PS-DD nonparametric results

Treatment: Starting to export	Outcome: Employment					
	Unskilled			Skilled		
	All	LAC	HI	All	LAC	HI
Single Diff.: Treatment group	0.006	0.000	0.023	0.129	0.116	0.162
Single Diff.: Control group	-0.042	-0.030	-0.070	0.066	0.070	0.056
Double Difference (ATT)	0.048	-0.030	0.093	0.063**	0.046	0.105*
	(0.031)	(0.036)	(0.064)	(0.026)	(0.030)	(0.055)
Matched observations	354	253	97	370	266	100

Treatment: Starting to export	Outcome: Wages					
	Unskilled			Skilled		
	All	LAC	HI	All	LAC	HI
Single Diff.: Treatment Group	0.045	0.055	0.019	0.110	0.112	0.115
Single Diff.: Control Group	0.045	0.047	0.038	0.017	0.020	0.008
Double Difference (ATT)	-0.000	0.007	-0.019	0.093***	0.091***	0.107**
	(0.021)	(0.026)	(0.035)	(0.021)	(0.024)	(0.044)
Matched observations	354	253	97	370	266	100

Note: This table reports non-parametric double differences in outcome between first exporting year and pre-exporting year of matched treatment and control observations on common support. Treated firms are new exporting firms that keep exporting for at least two consecutive years; the first column of each outcome considers new exporters to all destinations in the treated group, the second column considers new exporters to Latin American destinations only, the third column considers new exporters to at least one high income destination. Control firms are firms that never export. *** denotes t-test significance at the 1% level, ** at the 5% level, * at the 10% level. Standard errors are in parenthesis.

Table 19: Impact of beginning to export on labor market outcomes: DD regression results

Treatment: Starting to export	Outcome: Employment					
	Unskilled			Skilled		
	All	LAC	HI	All	LAC	HI
Export treatment	0.041	0.035	0.054	0.066***	0.052*	0.099**
	(0.028)	(0.033)	(0.054)	(0.025)	(0.030)	(0.048)
R-squared	0.073	0.073	0.073	0.059	0.058	0.058
Observations	28,565	28,565	28,565	29,744	29,744	29,744

Treatment: Starting to export	Outcome: Wages					
	Unskilled			Skilled		
	All	LAC	HI	All	LAC	HI
Export treatment	0.007	0.015	-0.014	0.076***	0.077***	0.079*
	(0.020)	(0.023)	(0.037)	(0.022)	(0.026)	(0.042)
R-squared	0.012	0.012	0.012	0.013	0.013	0.013
Observations	28,565	28,565	28,565	29,744	29,744	29,744

Note: This table reports coefficient estimates of the export treatment dummy from differences-in-differences regressions of the outcome variable of interest on a dummy for the export treatment variable and a full set of controls (total employment, TFP, ratio of skilled workers to total employment, a foreign property dummy, and industry and year fixed effects). Treated firms are new exporting firms that keep exporting for at least two consecutive years; the first column of each outcome considers new exporters to all destinations in the treated group, the second column considers new exporters to Latin American destinations only, the third column considers new exporters to at least one high income destination. *** denotes t-test significance at the 1% level, ** at the 5% level, * at the 10% level. Standard errors are in parenthesis.

Table 20: Impact of beginning to export on labor market outcomes: Propensity score reweighed DD regression results

Treatment: Starting to export	Outcome: Employment					
	Unskilled			Skilled		
	All	LAC	HI	All	LAC	HI
Export treatment	0.047	0.042	0.067	0.052*	0.031	0.092
	(0.031)	(0.035)	(0.052)	(0.027)	(0.030)	(0.060)
R-squared	0.09	0.093	0.094	0.084	0.085	0.076
Observations	16,230	16,129	15,972	17,130	17,026	16,859

Treatment: Starting to export	Outcome: Wages					
	Unskilled			Skilled		
	All	LAC	HI	All	LAC	HI
Export treatment	-0.006	-0.000	-0.025	0.090***	0.087***	0.089**
	(0.021)	(0.026)	(0.033)	(0.022)	(0.024)	(0.043)
R-squared	0.04	0.035	0.044	0.052	0.05	0.036
Observations	16,230	16,129	15,972	17,130	17,026	16,859

Note: This table reports coefficient estimates of the export treatment dummy from differences-in-differences regressions of the outcome variable of interest on a dummy for the export treatment variable and a full set of controls (total employment, TFP, ratio of skilled workers to total employment, a foreign property dummy, and industry and year fixed effects). Regressions are weighted by the inverse of the propensity scores estimates. Treated firms are new exporting firms that keep exporting for at least two consecutive years; the first column of each outcome considers new exporters to all destinations in the treated group, the second column considers new exporters to Latin American destinations only, the third column considers new exporters to at least one high income destination. *** denotes t-test significance at the 1% level, ** at the 5% level, * at the 10% level. Standard errors are in parenthesis.

Table 21: Evolution of Chilean manufacturing exports, by destination, 2001-2003

	2001			2002			2003		
	Firms	Value	%	Firms	Value	%	Firms	Value	%
Argentina	411	542.8	3.9	321	190.9	1.5	356	318.0	2.0
Brazil	231	629.0	4.5	221	473.5	3.7	224	574.1	3.6
Peru	393	475.7	3.4	421	391.5	3.1	421	613.5	3.9
Mexico	229	769.5	5.6	274	743.8	5.8	290	746.4	4.7
United States	344	2699.1	19.5	381	2585.0	20.2	399	2591.4	16.5
European Union	272	3852.9	27.8	316	3356.5	26.2	369	3804.0	24.2
Japan	139	1286.1	9.3	152	1065.5	8.3	150	1174.5	7.5
China	77	746.0	5.4	99	958.7	7.5	96	1445.2	9.2
High income countries	473	3682.6	62.8	532	2876.8	62.9	587	4040.4	57.3

Note: Trade values in Millions of USD are from the UN COMTRADE Database.

Table 22: High income destination entry and firm level employment: Fixed effects IV regressions

	Unskilled		Skilled	
High income exp. dummy (HI)	-0.341	-0.074	0.094	0.120
	(0.358)	(0.377)	(0.279)	(0.298)
Export dummy (EXP)	0.099	0.025	-0.034	-0.041
	(0.101)	(0.106)	(0.078)	(0.084)
Log sales	0.423***	0.421***	0.365***	0.366***
	(0.027)	(0.027)	(0.021)	(0.021)
TFP	-0.124***	-0.125***	-0.233***	-0.233***
	(0.015)	(0.015)	(0.011)	(0.011)
Foreign	0.090	0.112	0.060	0.060
	(0.098)	(0.097)	(0.076)	(0.076)
First stage				
Share ARG exp. x *erate*	-0.149***	-0.145***	-0.149***	-0.145***
	(0.023)	(0.024)	(0.023)	(0.024)
F-test of excluded instrument	98.20	71.75	98.20	71.75
p-value	0.000	0.000	0.000	0.000
Firm fixed effects	yes	yes	yes	yes
Year fixed effects	no	yes	no	yes
Observations	8,717	8,717	8,717	8,717

Note: The table reports the results of IV-FE regressions of the listed dependent variable on a dummy taking the value of 1 if a firm exports to at least one high income destination in a given year, and a dummy taking the value of 1 if a firm exports to any destination in a given year, and a vector of control variables. All regressions include firm fixed effects. The second column of each outcome includes year effects to allow the intercept to vary over individual observations over time. The instrumented variable in the first stage is the export to high income countries (*HI*) dummy. The CHI/ARG pesos exchange rate interacted with 2001 export share to Argentina instrument is used in all regressions. * denotes significance at the 10% level. ** denotes significance at the 5% level. *** denotes significance at the 1% level.

Table 23: High income destination entry and firm level wages: Fixed effects IV regressions

	Unskilled		Skilled	
High income exp. dummy (HI)	0.340	0.310	0.719***	0.476*
	(0.237)	(0.251)	(0.279)	(0.283)
Export dummy (EXP)	-0.084	-0.078	-0.200**	-0.134*
	(0.067)	(0.071)	(0.079)	(0.080)
Log sales	0.072***	0.071***	0.073***	0.072***
	(0.018)	(0.018)	(0.021)	(0.020)
TFP	0.044***	0.044***	0.073***	0.075***
	(0.009)	(0.009)	(0.011)	(0.011)
Foreign	-0.058	-0.059	0.061	0.049
	(0.065)	(0.065)	(0.076)	(0.073)
First stage				
Share ARG exp. x *erate*	-0.149***	-0.145***	-0.149***	-0.145***
	(0.023)	(0.024)	(0.023)	(0.024)
F-test of excluded instrument	98.20	71.75	98.20	71.75
p-value	0.000	0.000	0.000	0.000
Firm fixed effects	yes	yes	yes	yes
Year fixed effects	no	yes	no	yes
Observations	8,717	8,717	8,717	8,717

Note: The table reports the results of IV-FE regressions of the listed dependent variable on a dummy taking the value of 1 if a firm exports to at least one high income destination in a given year, and a dummy taking the value of 1 if a firm exports to any destination in a given year, and a vector of control variables. All regressions include firm fixed effects. The second column of each outcome includes year effects to allow the intercept to vary over individual observations over time. The instrumented variable in the first stage is the export to high income countries (*HI*) dummy. The CHI/ARG pesos exchange rate interacted with 2001 export share to Argentina instrument is used in all regressions. * denotes significance at the 10% level. ** denotes significance at the 5% level. *** denotes significance at the 1% level.

Table 24: High income destination percent increase and firm level employment: Fixed effects IV regressions

	Unskilled		Skilled	
High income exp./Total exp. (HI)	-0.468	-0.127	0.147	0.177
	(0.479)	(0.520)	(0.347)	(0.411)
Exports/Sales (EXP)	0.013	0.015	0.015	0.016
	(0.017)	(0.018)	(0.013)	(0.014)
Log sales	0.426***	0.424***	0.368***	0.369***
	(0.027)	(0.027)	(0.021)	(0.021)
TFP	-0.126***	-0.125***	-0.233***	-0.233***
	(0.015)	(0.015)	(0.011)	(0.012)
Foreign	0.103	0.114	0.056	0.056
	(0.095)	(0.094)	(0.074)	(0.074)
First stage (HI)				
Share ARG exp. x *erate*	-0.105***	-0.105***	-0.105***	-0.105***
	(0.016)	(0.016)	(0.016)	(0.016)
Average *erate*	-0.083***	-0.083***	-0.083***	-0.083***
	(0.030)	(0.030)	(0.030)	(0.030)
First stage (EXP)				
Share ARG exp. x *erate*	-0.346***	-0.346***	-0.346***	-0.346***
	(0.127)	(0.127)	(0.127)	(0.127)
Average *erate*	6.106***	6.106***	6.106***	6.106***
	(0.241)	(0.241)	(0.241)	(0.241)
F-test of excluded instrument	129.46	129.46	129.46	129.46
p-value	0.000	0.000	0.000	0.000
Firm fixed effects	yes	yes	yes	yes
Year fixed effects	no	yes	no	yes
Observations	8,717	8,717	8,717	8,717

Note: The table reports the results of IV-FE regressions of the listed dependent variable on a variable indicating the share of exports to high income destinations in total exports (HI), and a variable indicating total export value over total value of sales (EXP), and a vector of control variables. All regressions include firm fixed effects. The second column of each outcome includes year effects to allow the intercept to vary over individual observations over time. The instrumented variables in the first stage are the share of exports to high income destinations in total exports (HI), and the total export value over total value of sales (EXP) variables. The CHI/ARG pesos exchange rate interacted with 2001 export share to Argentina instrument and the weighted average exchange rate with all trading partners are used in all regressions. * significant at the 10% level. ** significant at the 5% level. *** significant at the 1% level.

Table 25: High income destination percent increase and firm level wages: Fixed effects IV regressions

	Unskilled		Skilled	
High income exp./Total exp. (HI)	0.430	0.409	0.965***	0.663*
	(0.315)	(0.345)	(0.367)	(0.388)
Exports/Sales (EXP)	0.005	0.005	0.010	0.007
	(0.315)	(0.011)	(0.014)	(0.013)
Log sales	0.073***	0.073***	0.076***	0.073***
	(0.018)	(0.018)	(0.021)	(0.020)
TFP	0.045***	0.045***	0.077***	0.077***
	(0.009)	(0.009)	(0.011)	(0.011)
Foreign	-0.072	-0.072	0.031	0.031
	(0.062)	(0.062)	(0.073)	(0.070)
First stage (HI)				
Share ARG exp. x *erate*	-0.105***	-0.105***	-0.105***	-0.105***
	(0.016)	(0.016)	(0.016)	(0.016)
Average *erate*	-0.083***	-0.083***	-0.083***	-0.083***
	(0.030)	(0.030)	(0.030)	(0.030)
First stage (EXP)				
Share ARG exp. x *erate*	-0.346***	-0.346***	-0.346***	-0.346***
	(0.127)	(0.127)	(0.127)	(0.127)
Average *erate*	6.106***	6.106***	6.106***	6.106***
	(0.241)	(0.241)	(0.241)	(0.241)
F-test of excluded instrument	129.46	129.46	129.46	129.46
p-value	0.000	0.000	0.000	0.000
Firm fixed effects	yes	yes	yes	yes
Year fixed effects	no	yes	no	yes
Observations	8,717	8,717	8,717	8,717

Note: The table reports the results of IV-FE regressions of the listed dependent variable on a variable indicating the share of exports to high income destinations in total exports (HI), and a variable indicating total export value over total value of sales (EXP), and a vector of control variables. All regressions include firm fixed effects. The second column of each outcome includes year effects to allow the intercept to vary over individual observations over time. The instrumented variables in the first stage are the share of exports to high income destinations in total exports (HI), and the total export value over total value of sales (EXP) variables. The CHI/ARG pesos exchange rate interacted with 2001 export share to Argentina instrument and the weighted average exchange rate with all trading partners are used in all regressions. * significant at the 10% level. ** significant at the 5% level. *** significant at the 1% level.