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EXPORTS, EXPORT DESTINATIONS, AND SKILLS

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ABSTRACT

This paper explores the links between exports, export destinations and skill utilization by firms. We identify two mechanisms behind these links, which we integrate into a unified theory of export destinations and skills. First, exporting to high-income countries requires quality upgrades that are skill-intensive (Verhoogen, 2008). Second, exporting in general, and exporting to high-income destinations in particular, requires services like distribution, transportation, and advertising, activities that are also intensive in skilled labor (Matsuyama, 2007). Both theories suggest a skill-bias in export destinations: firms that export to high-income destinations hire more skills and pay higher wages than firms that export to middle-income countries or that sell domestically. We test the theory using a panel of manufacturing Argentine firms. The data cover the period 1998-2000 and thus span the Brazilian currency devaluation of 1999. We use the exogenous changes in exports and export destinations brought about by this devaluation in a major export partner to identify the causal effect of exporting and of exporting to high-income countries on skill utilization. We find that Argentine firms exporting to high-income countries hired a higher proportion of skilled workers and paid higher average wages than other exporters (to non high-income countries) and domestic firms. Instead, we cannot identify any causal effect of exporting per se on either skill utilization or average wages.

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1 Introduction

This paper studies whether that act of exporting affects firm behavior and why this behavior is affected. Bernard and Jensen (1995, 1999) pioneered empirical work to characterize exporting firms and found that exporters outperform non-exporters: they pay higher wages, they are more productive, they are larger and so on. These findings were later confirmed by various authors.[1] In many cases, these correlations do not imply causality (and thus cannot be used to predict changes in firm behavior); in those cases where causality is established, the evidence tends to support a story of selection. This suggests that while exporting allows firms to take advantage of their inherent good attributes, such as productivity, the act of exporting itself does not necessarily affect firm behavior. In this paper, we instead identify one instance where exporting has behavioral responses in terms of skill utilization. Our work is thus in line with Verhoogen (2008), who shows that exporting induces firms to upgrade quality, and Bustos (2009), who finds that exporters adopt newer and better technologies than non-exporters.

Concretely, we elaborate upon a theory of how exports and export destinations affect the utilization of skilled labor, and we document those features using a panel of manufacturing firms in Argentina. Traditional theories of international trade often take a relatively simple view of the production process in which the production of "goods" is carried out by combining factors (labor, capital) and a technology. Recent trade models, including Feenstra and Hanson (1996), Matsuyama (2007), Verhoogen (2008), and Grossman and Rossi-Hansberg (2008, 2009), internalize some of the complexities of modern production processes by assuming that the production of goods comprises the combination of activities like various manufacturing tasks, marketing, distribution, foreign trade activities and exporting services. These tasks differ in their skill intensity so that the act of "exporting" becomes a skilled intensive activity, even when the act of "manufacturing" is unskilled-intensive. Moreover, we argue that the act of "exporting to high-income destinations" may require technologies and tasks that are yet more skill-intensive. In consequence, economies that trade with high-income countries will utilize relatively higher levels of skills than economies that are either closed or specialized in trade with middle- or low-income countries.

There are various reasons why the act of exporting by developing countries may demand skills,

[1]See Bernard and Jensen (2004), Bernard, Jensen, Redding and Schott (2007), De Loecker (2007), Schank, Schnabel and Wagner (2007), Clerides, Lach, and Tybout (1998), Pavcnik (2002), Park, Yang, Shi, and Jiang (2008), and many others. Bernard, Jensen, Redding and Schott (2007) also find that importers share many of the good attributes of exporters.

even when the production process is relatively intensive in the use of unskilled labor. A leading recent theory is provided by Verhoogen (2008), who developed a model where exports require quality upgrading—an activity that demands skilled labor. This idea can be extended to accommodate models where exporting requires "associated services" such as labeling or customer support and where the provision of these services is a skilled-intensive activity. Note that exporting per se does not necessarily require quality upgrading. A country like Argentina—the target country in the empirical work—may need to produce the same level of quality to sell internally than to sell to neighboring markets like Brazil. In contrast, exporting to high-income countries (e.g., the U.S.) does require higher quality and more skills. Our claim is that "where you export" matters.[2]

Matsuyama (2007) advances another reason why export destinations may require varying levels of skills. He developed a model of "skilled-bias globalization" in which international trade activities use resources and are relatively skilled-intensive. These activities include international marketing and commercialization, transportation and distribution, and perhaps also advertising (as in Arkolakis, 2009). These activities require expertise in international business, languages, foreign technologies, and social idiosyncrasies of foreign markets. In Matsuyama's model, the technologies to supply goods depend on whether firms sell domestically or abroad. In our setting, the technology to supply goods may also depend on the destination of exports. Once again for a country like Argentina, the activities needed to access high-income countries may require more skills than those activities needed to access neighboring markets.

We test our hypothesis using a panel of Argentine manufacturing firms, the Encuesta Nacional Industrial, ENI (National Industrial Survey). The surveys include information on sales, wage bill, employment of production and non-production workers, type of ownership, plant age, and other general characteristics of the firms (like industry affiliation). Using confidential information, we matched the firms in the ENI with administrative customs data available for 1998, 1999 and 2000. The result is a combination of typical information from industrial surveys with information on export volumes *and* export destinations at the firm level. In other words, we know, for each firm in the panel, whether the firm exported, how much it exported, and where it exported.

Our 1998-2000 data span the Brazilian devaluation of 1999, which provides a nice setting for identification. Brazil is a major trade partner of Argentina, and the 1999 devaluation had a large

[2]Our theory is thus related to the argument in Hausmann, Hwang and Rodrik (2007), who claim that "what you export" matters. If goods are differentiated by export destination, then "what you export" and "where you export" are clearly interrelated.

impact on Argentine exporters. The Brazilian devaluation generated exogenous variability in the export destinations of Argentine firms, out of Brazil and into high-income countries (and also into the domestic market). We use an instrumental variables strategy to exploit these exogenous changes to identify the role of exports and of the composition of exports in the determination of the skill composition of employment in Argentina. Moreover, since we work with a panel, we can match, for a given firm, the behavioral changes in terms of skill utilization with the exogenous changes in its export composition induced by the Brazilian devaluation.

We find that, for Argentine firms, exporting to high-income countries matters, but exporting per se does not. Firms that tend to export more to high-income countries use more skills and pay higher average wages than firms that do not export at all or export instead to middle-income countries. The reason is that the local markets in Argentina are similar to the export markets in middle-income countries and thus it is only possible to observe differences in firm's outcomes for firms specializing in exporting to high-income countries.

Our empirical test is related to Verhoogen's approach, but it is more general. While Matsuyama (2007) emphasizes the technological side of the link between export destinations and skills, Verhoogen (2008) theory has a demand component (high-income countries value quality more) and a technology component (more productive firms are more likely to produce higher quality goods). Verhoogen's empirical test, however, explicitly exploits only the technological component of the theory by linking changes in wages for firms with different initial levels of productivity. Our test is instead based on changes in skill utilization and exogenous changes in the destinations of exports. It thus exploits both the demand and technology features of the model and offers a more general and robust test of the theories.

The remainder of the paper is organized as follows. In Section 2, we integrate the various channels linking the choice of skilled labor utilization with the act of exporting and the act of exporting to high-income destinations. In Sections 3 and 4 we lay out our empirical model, we discuss the identification strategy, and we present the main results. We also discuss the main channels behind our findings. Section 5 concludes.

2 An Integrated Theory of Skills and Export Destinations

The trade literature has identified two broad mechanisms linking exports and skill composition at the firm-level: quality (Verhoogen, 2008) and exporting-related activities (Matsuyama, 2007).[3] In this section, we lay out a simple partial equilibrium model of trade that integrates both mechanisms and that incorporates differences among exporting markets. We first describe the demand side and the structure of production in a generic market. In turn, we discuss the role of different export destinations.

We let products be both horizontally and vertically differentiated and allow preferences to be non-homothetic in order to capture the notion that high income countries value high quality goods more than low income countries.[4] We adopt a multinomial logit utility specification as in Verhoogen (2008) where consumers in high income countries have a lower marginal utility of income and thus are willing to pay a "premium" for a good of a given quality. The utility that consumer i in country of destination c derives from purchasing product j depends on a vertical differentiation parameter, denoted by θ, its price, denoted by p, and a random deviation that follows a type-I extreme value distribution, denoted by ϵ. Utility is given by

$$(1) \quad U^c_{ij} = \theta^c_j - \alpha^c p^c_j + \epsilon^c_{ij}.$$

These assumptions yield the well–known multinomial–logit aggregate demand function

$$(2) \quad x^c_j(p^c_j, \theta^c_j) = \frac{M^c}{W^c} \exp(\theta^c_j - \alpha^c p^c_j),$$

where M^c is the number of consumers in country c, or market size, and W^c is an index that summarizes the characteristics of all available products in that market (i.e. $W^c = \sum_{z \in Z^c} \exp(\theta^c_z - \alpha^c p^c_z)$, where Z^c is the set of available products). The parameter α^c can be interpreted as the marginal utility of income, or the inverse valuation of quality; it dictates the relative importance of θ and p in the utility function. Thus, $1/\alpha^c$ captures quality valuation, as in Verhoogen (2008).

[3] The literature on the "quality of trade" is growing steadily. See Manasse and Turrini (2001), Hummels and Skiba (2004), Hummels and Klenow (2005), Hallak (2006), Verhoogen (2008), Hallak (2008), Hallak and Schott (2008), Hallak and Sivadasan (2009), Khandelwal (2009), Kugler and Vergoohen (2008), and Fajgelbaum, Grossman and Helpman (2009), among others. Our model combines elements from various papers in this literature. Matsuyama (2007) was the first to highlight the role of activities that are inherent to the act of exporting in the theory of trade and comparative advantage.

[4] For simplicity, we do not consider differences in preferences among consumers in a given country.

The production side of our model integrates two channels linking exports and skills. One channel illustrates the skill-intensive nature of quality production and the other illustrates the skill-intensive nature of foreign trade activities. For simplicity, we assume that there are J firms in the source country, each producing a differentiated product.[5] The only input is labor and there are two types of workers, skilled and unskilled. To streamline the exposition, we assume that there is a large homogeneous goods sector that employs skilled and unskilled workers in fixed proportions. This pins down wages, and thus simplifies the illustration of our main results. Without loss of generality we normalize the wage of unskilled workers to one and denote the wage of skilled workers by w.

The delivery of a final good to consumers combines two sets of tasks: the manufacturing of the product and various related services such as product design, packaging, transportation and distribution, marketing research, advertising, and customer support. These two tasks are different in their skill intensity. For simplicity, we assume that manufacturing employs only unskilled workers, while the provision of services employs only skilled workers.

We further distinguish between two types of services. Some services are "required services," in the sense that they are necessary to reach consumers, such as transportation and distribution, but do not affect the value that consumers attach to a firm's product. We denote the level of "required services" by a parameter τ^c. Differences in τ^c across countries capture Matsuyama's (2007) mechanisms. Note that in Matsuyama, τ is a variable cost, not a fixed cost.

The second type of services acts as a means of vertical differentiation and thus shift the aggregate demand function for the product. The level of these "vertical differentiation services" is chosen by the firm (via product design, packaging, advertising, customer support) and we assume they directly affect the parameter θ_j^c of the demand function (each firm j chooses θ_j^c for each country of destination c).

Providing a level of services—embodied in each unit of the final product—of θ_j^c and τ^c in destination c requires $b_j(\tau^c + (\theta_j^c)^\beta)$ units of skilled labor, with $\beta > 1$.[6] The manufacturing task

[5] We assume that the number of firms is fixed, as in Chaney (2008) and Arkolakis (2008). Arkolakis, Demidova, Klenow, and Rodriguez-Clare (2008) show that this assumption yields the same results as free entry in the model of Melitz (2003).

[6] To preserve Matsuyama's Ricardian features, we assume linearity in the provision of required services, such as transportation costs, while decreasing returns to scale in the provision of vertical differentiation, such as quality of service. This latter assumption reflects the fact that shifting the demand function becomes increasingly more difficult as quality increases. From a technical standpoint, this assumption is needed because θ_j^c is a choice variable. The skilled labor requirements could also be written as $b_j(\tau^c + \theta_j^c)^\beta$. This alternative assumption yields very similar predictions. At the same time, we assume that the cost of providing vertical differentiation in one market is independent of the level of vertical differentiation provided by the same firm in other markets. This assumption is in line with the constant marginal cost assumption in the manufacturing task and with independence of preferences across markets

requires a_j units of unskilled labor per unit of the final product. Thus, the total variable unit cost of providing the final product in country c is $a_j + b_j(\tau^c + (\theta_j^c)^\beta)w$. Additionally, there are fixed costs of production and of entering export markets given by F^c which we describe below. While these fixed costs are common to all firms, the labor requirements a_j and b_j vary at the firm level. The relative demand for skilled workers (number of skilled workers divided by the number of unskilled workers) is $S_j^c = \frac{b_j}{a_j}(\tau^c + (\theta_j^c)^\beta)$. It is increasing in τ^c and θ_j^c.

For each country of destination, firms choose p_j^c and θ_j^c to maximize profits given by $\pi_j^c = [p_j^c - a_j - b_j(\tau^c + (\theta_j^c)^\beta)w]x^c(p_j^c, \theta_j^c) - F^c$.[7] The solutions for prices (p_j^c) and the level of vertical differentiation (θ_j^c) are independent across destinations. They are given by

$$(3) \quad p_j^c = a_j + b_j\tau^c w + b_j w\left(\frac{1}{\alpha^c b_j \beta w}\right)^{\frac{\beta}{\beta-1}} + \frac{1}{\alpha^c},$$

$$(4) \quad \theta_j^c = \left(\frac{1}{\alpha^c b_j \beta w}\right)^{\frac{1}{\beta-1}}.$$

The vertical differentiation parameter θ_j^c is chosen so as to equalize its marginal cost with the inverse of the marginal utility of income, $\frac{1}{\alpha^c}$. It is decreasing in the marginal utility of income (α^c)—firms choose to provide a higher level of quality when it is valued more highly —and it is independent of τ_j^c. Price is increasing in τ^c, reflecting the higher unit cost implied by a higher τ^c, and decreasing in α^c, reflecting both the higher unit cost implied by the higher optimal quality and the fact that firms can extract more surplus from consumers when they are willing to pay more for their products.

Given the solutions for price and vertical differentiation, we write the relative demand for skilled workers employed in the production of goods that are shipped to country c (S_j^c) as

$$(5) \quad S_j^c = \frac{b_j}{a_j}\left[\tau^c + \left(\frac{1}{\alpha^c b_j \beta w}\right)^{\frac{\beta}{\beta-1}}\right].$$

Note that S_j^c is increasing in τ^c and decreasing in α^c. These features correspond to the two mechanisms outlined above. On the one hand, firms need to provide the required services τ^c because of technological requirements. On the other hand, firms will provide services to increase

(by which shifting the demand function in one country does not become increasingly more costly as demand is shifted in other markets).

[7] The monopolistic competition assumption implies that firms do not affect the index W^c.

quality when these services are more valuable to consumers. The provision of both types of services is intensive in skilled labor.

To study the role of export destinations, we assume that there are three markets: the domestic market (D), high income destinations (H), and low income destinations (L). We first study the mechanismsm proposed by Matsuyama (2007) and Verhoogen (2008) separately, and we later integrate them into a unified theory. To explore the "required services" mechanism of Matsuyama (2007), we let

$$(6) \quad \tau^H > \tau^L > \tau^D = 0; \alpha^H = \alpha^L = \alpha^D = \alpha.$$

These assumptions capture the idea that exporting requires skill-intensive services, relative to production for the domestic market, and that exporting to high-income countries requires even more skill-intensive technologies. Note that, in principle, the exporting services needed to access some low-income countries can be as skill-intensive as the exporting services needed to reach high-income destinations. Exporting to the U.S. requires an English speaking manager, as does exporting to China. However, the assumption that $\tau^H > \tau^L$ seems more plausible because doing business in high-income countries involves dealing with higher-educated consumers, more sophisticated rules of law, more stringent standards regulations and so on. Note, in addition, that our empirical analysis is a case study of Argentine firms, where exports of manufacturing products to countries like China or India are only a small share of total exports.

The comparative statics for p, θ and S are easy to derive from equations (3), (4) and (5). Since τ is higher in high income destination, firms need to employ a higher relative skill composition in order to reach these countries ($S_j^H > S_j^L > S_j^D$). Also, since costs are higher, prices are also higher in high-income destinations ($p_j^H > p_j^L > p_j^D$). This is a feature of technology, not of demand. This can also be seen by noting that firms choose the same θ for both destinations, since there are no differences in cross-country quality valuations ($\theta_j^H = \theta_j^L = \theta_j^D$).

To explore the role of the demand (quality valuation) mechanism, as in Verhoogen (2008), we let

$$(7) \quad \tau_H = \tau_L = \tau_D = 0; \alpha_H < \alpha_L = \alpha_D,$$

where we assume that quality valuation in domestic markets is similar to quality valuation in low-income countries. In equilibrium, firms choose a higher level of vertical differentiation in high income destinations, where quality is valued more highly (thus, $\theta_j^H > \theta_j^L = \theta_j^D$). Reaching high income countries requires a higher relative demand for skills than reaching both low-income and domestic consumers so that $S_j^H > S_j^L = S_j^D$. Price is higher in high-income countries due to two reasons: higher cost (due to higher quality) and price discrimination (thus, $p_j^H > p_j^L = p_j^D$).[8]

We can now combine the technology and demand mechanisms. Since both channels go in the same direction, they reinforce each other. There is skill-bias in the composition of employment for firms that target high-income countries. Relative demand for skilled workers at the firm level can be written as a weighted average of the relative demands for skilled workers employed in the production and delivery of goods that are shipped to each type of destination:

$$(8) \quad S_j = S_j^D \frac{x_j^D}{x_j} + S_j^L \frac{x_j^L}{x_j} + S_j^H \frac{x_j^H}{x_j}.$$

In this equation, $x = x^D + x^L + x^H$ are total firm sales (including domestic sales and exports to different destinations). Since $S^H > S^L > S^D$, it follows that the higher the share of exports that goes to high income countries, the higher the relative demand for skilled labor at the firm level. Note also that firms exporting to high income countries will incur a higher wage bill since skilled labor earns a higher wage than unskilled labor.[9]

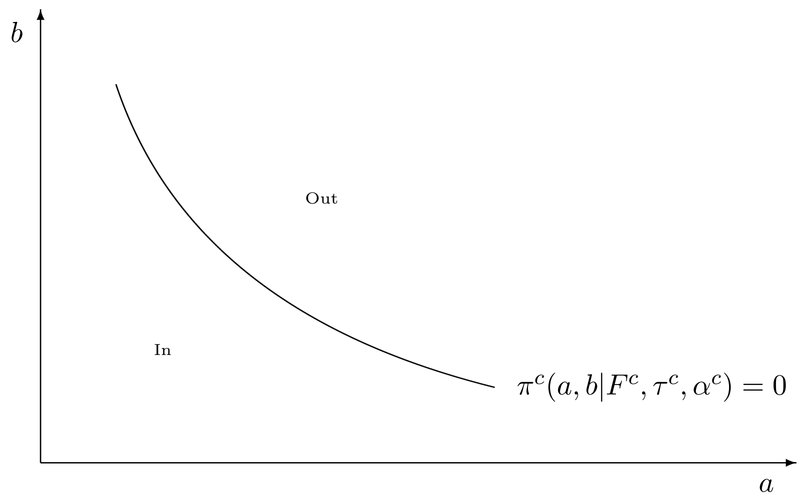
We now turn to market entry. Firms enter a market when variable profits given the optimal decision for θ_j^c and p_j^c are enough to cover the fixed cost F^c. In our model, there are two dimensions of firm heterogeneity. Firms differ in a, the efficiency in the use of unskilled labor, and in b, the efficiency in the use of skilled labor. Since we assume a fixed-proportion technology, both a and b (not just their ratio) matter in sorting out which firms have the necessary attributes to enter a market.[10] Firms with lower a and b are more efficient and are thus able to enter a market.

[8] Note that mark-ups are not constant in this model. However, the result of vertical differentiation could be achieved with constant mark-ups as well, with a CES utility specification as in Hallak (2006)

[9] There are other mechanisms that could in principle explain a positive link between exporting to high-income countries and wages in a country like Argentina. One explanation is "profit sharing" in a model of fair wages. Firms that export to high income countries are likely to make extra-profits, which are shared with workers. See Egger and Kreickemeier (2009) and Amity and Davis (2008). It is also possible that exporting to developed countries is associated with higher wages to reduce labor turnover. This is an efficiency wages story, but it could also be interpreted as a dimension of quality because the firm needs to reduce labor turnover to guarantee timely delivery of goods and maintain product standards. Another theory due to Yeaple (2005) argues for higher wages due to scale economies attached to exporting (to different destinations). In this model, the size of the market and the scale of the firm determine the choice of technology and larger firms choose more skill intensive technologies that pay higher average wages.

[10] This is a useful simplification that allow us to illustrate the role of multi-dimensional heterogeneity in models of trade. See Hallak and Sidivasan (2009) or Bernard, Redding and Schott (2009) for full general equilibrium models.

Figure 1
Entry into Export Markets
Multi-Dimensional Heterogeneity



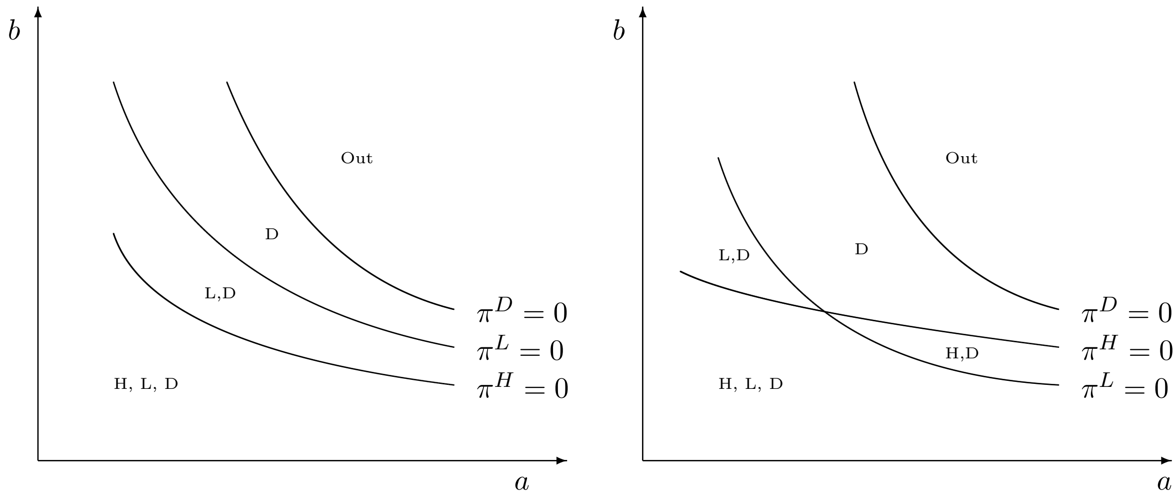
The zero-profit curve is the set of combinations of a and b the leave firms indifferent between staying in or out of market c.

More precisely, there is a trade-off between a and b, and firms with low a can compensate for a high b (but only to a limited extent). To see this, in Figure 1, we plot a zero-profit curve, a level curve for the function $\pi^c = 0$, where π^c are indirect profits in market c. The zero-profit curve is negatively-sloped (indicating the trade-off between a and b) and convex (indicating the increasing difficulties in trading-off one source of productivity with the other). Firms with parameters a and b below the zero-profit curve enter the market and the others stay out.

The position of the zero-profit curve for market c depends on F^c, τ^c and α^c. An increase in any of the three parameters implies a decrease in profits and thus shifts the zero-profit curve downwards. The downward shift is parallel for an increase in F, while an increase in τ or α cause the zero-profit curve to become less steep.

As these parameters differ across the three types of destinations, there are three zero-profit curves, one for the domestic market, one for low income export markets, and one for high income export markets. We assume that fixed costs are lowest in the domestic market and highest in the high income market, that is, $F^D < F^L < F^H$. This assumption, works in the direction of positioning the zero-profit curve for the domestic market above the zero-profit curve for the low-income export market, which in turn is above the zero-profit curve for the high-income export market, as depicted in the left panel of Figure 2. Firms with parameters a and b below the curve $\pi^H = 0$ enter the high

Figure 2
The Choice of Export Destinations



D=entry into the domestic market only; L,D=entry into the domestic and low-income markets; H,D=entry into the domestic and high-income markets; H,L,D=entry into all markets.

income market. They also sell their product in the low income market and the domestic market. Intermediate firms characterized by a combination of a and b between the level curves $\pi^H = 0$ and $\pi^L = 0$ enter the low income and domestic markets; while firms between $\pi^L = 0$ and $\pi^D = 0$ serve the domestic market only. The least productive firms stay out of all markets.

Export technology differences across markets ($\tau^H > \tau^L > \tau^D = 0$) work in the same direction, and they affect the relative slopes of the curves as well, so that the zero-profit curve for high-income markets is the least steep (as in Figure 2). The vertical differentiation channel ($\alpha^H < \alpha^L = \alpha^D$), on the other hand, pushes $\pi^H = 0$ upwards so that it is theoretically possible for $\pi^H = 0$ to intersect with $\pi^L = 0$ (the right panel in Figure 2) or with both $\pi^L = 0$ and $\pi^D = 0$. That is, firms that are sufficiently inefficient in the use of unskilled labor but relatively efficient in the use of skilled labor could find it profitable to export to high-income markets but not to low-income markets (or even domestic markets).[11] Thus, in our model, efficiency differences in the use of skilled labor are an important factor explaining the choice of export destinations (as are the country specific fixed costs of Chaney (2008) and the firm-country-product consumer tastes of Bernard, Redding, and

[11] Whether the zero-profit curves intersect or not depends on several parameters. Factors that work in the direction of curves crossing are large differences in α across destinations, small differences in F and τ, differences in number of consumers and firms, and low relative wages of skilled workers. In our data from manufacturing firms in Argentina, we find that, in 1998, 3 percent of exporting firms export only to high-income destinations and 11 percent of firms export only to upper-middle income destinations. As expected, all exporting firms sell in the domestic market as well.

Schott, 2009).

As we will shortly discuss, our empirical strategy exploits exogenous changes in exports and in export destinations of Argentine firms brought about by a Brazilian devaluation that took place in 1999. In the theoretical model, the Brazilian devaluation causes a downward shift in the level curve $\pi^L = 0$, without affecting $\pi^H = 0$. As a result, some exporters to low income foreign markets will exit (eventually retrenching into local markets) and exporters to high income markets will sell less in low income markets. This implies that the share of exports to high income destination will increase and so will the utilization of skills, as per equation (8). Note that, in this setting, this is a within-firm composition effect, where a weighted average (total skill utilization) changes due to changes in the participation of each destination in total sales. This corresponds to changes in the weights with constant S_j^c in equation (8). More generally, in a model with increasing marginal costs or capacity constraints, for instance, the devaluation of the low income country's currency could also boost exports into high income markets. In this case, the increase in the utilization of skills will be twofold, first because of export destination composition effects (changes in the weights in (8)) and second because of a higher demand of skills (changes in S_j^c in (8)).

3 Empirical Analysis

We now turn to our empirical analysis. We describe the data, introduce the regression model and the identification strategy, and present the main findings on exports, export destinations and skill utilization in Argentina.

3.1 The Data

We use two main sources of data in our analysis: a firm survey and administrative customs information. The firm survey is the "Encuesta Nacional Industrial" (ENI) or National Industrial Survey. The ENI is a panel of manufacturing plants and collects information on sales, value added, input use, employment of production workers, employment of non-production workers, total wage bill, and industry affiliation at the 3-digit ISIC level Revision 2. We have access to the module of the survey that corresponds to the province of Buenos Aires for the years 1998, 1999 and 2000.[12]

The second source of data for our analysis is administrative customs records. From the customs

[12] Being the most highly industrialized and developed area of the country, the province of Buenos Aires accounts for 40 percent of the population and more than half of the manufacturing activity in terms of employment and output.

records we extracted the total value of exports by country of destination at the firm level.[13] We then matched this information to the firm survey using tax identification numbers. The result is a rare panel of employment, wages, exports, and export destinations by firm.

When matching the two data sources, one issue to consider was that the firm survey was collected at the plant level while the customs information was recorded at the firm level. Since all plants owned by a same firm share the same identification number, we aggregated information across plants owned by a given firm and created a dataset at the firm level that we then matched with the customs records. In our survey, only 14 percent of firms own more than one plant. We later show that regression results are very similar whether we use the full sample of firms or only one-plant firms.

Table 1 presents summary statistics from the combination of firm and customs data for the full sample 1998-2000. In Panel A, we describe the export intensity and export destinations of Argentine firms; in Panel B, we focus on differences in outcomes (employment, wages, and skill utilization) across those firms. Out of 901 firms and 2544 firm-year observations, 68 percent of firms exported in at least one of the three years of data, while in a given year, the average share of exporters is 59 percent (Panel A). The proportion of exporters is higher than what the literature typically finds. This can be partly explained by the fact that our firm survey corresponds to an export-oriented geographic area of Argentina.[14] The share of exports in total sales is, in contrast, small: exports account for only 8 percent of sales across all firms (column 1) and 13 percent among exporters (column 2). The average number of destinations (including the domestic market) is 3.3 in the sample of all firms and 4.9 among exporters.

In columns 3 and 4, we describe the characteristics of firms that export to at least one high income destination, the "high-income exporters." We work with two definitions of "high-income" destinations based on the World Bank country classification. In the first definition (Definition I), we include countries classified as high-income OECD, high-income non-OECD and upper-middle income. The countries in each group are listed in the appendix. On average, each year 51 percent of firms export to at least one high-income destination (1307 out of 2544 firms). For the "high-income" exporters, total exports (to all destinations) account for 15 percent of total sales and the average number of destinations, including domestic sales, is 5.4.

[13] We do not have access to quantities or unit values.

[14] At the same time, the high share of exporting firms is not explained by biases in firm size, as the ENI covers firms of all sizes (provided they are in the formal sector), based on censuses sampling weights. While tax evasion and worker informality are prevalent among manufacturing firms in Argentina, firm informality is not.

In the second definition (Definition II), we classify as high-income destinations only countries in the World Bank's high-income OECD and non-OECD groups, while upper-middle income economies are excluded. In this grouping, the number of firms that export to high-income countries drops to 27 percent (680 out of 2544 firms). These firms show a higher export intensity (exports account for 22 percent of total sales) and a higher number of destinations (7.8 per firm). In our regression analysis, we choose the first classification as our main specification to show that even under a conservative definition there are significant differences between high- and low-income exporters. As we will show below, these differences are exacerbated when we apply the more liberal definition that excludes upper-middle income economies from the high-income destinations set.

In Panel B of Table 1, we begin exploring the relationship between skill utilization, exports and export destinations by comparing some differences between exporters and non-exporters. From the ENI panel survey, we report in column 1 average employment, sales and measures of skill utilization. We consider three measures of skill utilization: average wage—defined as the total wage bill divided by total employment,—the share of non-production workers in total employment, and the share of hours worked by non-production workers in the total number of hours worked by all employees.[15] In our sample, firms employ an average of 89.7 workers and pay average annual wages of 12,154 USD. Non-production workers account for 26 percent of total employment, whether measured in number of workers or hours worked. In column 2, we report differences between exporters and non-exporters by running an OLS regression of each firm attribute on a dummy of whether the firm exports or not (which we build using the matched customs data), controlling for industry and year effects. Our data confirm the stylized fact of this literature: Exporters are larger by around 122 percent (173 percent in terms of sales); they pay higher wages by about 48 percent; and they hire 5 percentage points more non-production workers than non-exporters.

In column 3, we compare high-income exporters to low-income exporters. Conditional on exporting, we run OLS regressions of the various outcomes on a dummy for high-income exporters (controlling for industry and year effects). Using Definition I, the results show that firms that export to at least one high-income destination are 39 percent larger in terms of employment and 54 percent larger in terms of sales than exporters that only export to low income countries; they pay higher wages by about 12 percent; and they hire a larger fraction of non-production workers

[15]Note that we do not have information on the educational level of the workers. In the surveys, firms report the total wage bill, which includes the total payment to workers of all types, production and non-production. However, firms do separately report the total number of employees in each of those two categories. The average wage is a proxy for skill utilization inasmuch as firms with a higher skill composition pay higher wages.

by about 3 more percentage points. In short, our data reveal that while exporters have good attributes, high-income exporters have yet better attributes.

In column 4, we compare high-income exporters in Definition I with those in Definition II. We keep firms that export to high income countries according to the first definition and show the premium for firms that specialize in exports to only high-income OECD and non-OECD destinations (compared to upper-middle income destinations). The data show that firm differences persist among high-income exporters. For instance, Definition II high-income exporters are larger (by 43 percent in terms of employment and by 54 percent in terms of sales) than Definition I high-income exporters. They also pay higher average wages (by 15 percent) and seem to employ a higher share of non-production workers (by 2 percentage points).

3.2 Skills and Export Destinations: The Model

The statistics reported in Table 1 uncover the basic relationship between exports, export destinations and skills. We now study this relationship in more detail with the following regression model:

$$s_{it} = \delta_1 EXP_{it} + \delta_2 HI_{it} + \mathbf{x}'_{it}\beta_1 + \phi_t + \phi_i + \epsilon_{it}. \qquad (9)$$

The variable s_{it} is a measure of the utilization of skills in the labor force employed by firm i at time t. As explained above, we use the average wage and the share of non-production workers in total employment as proxies for skill utilization.

The right-hand side variables of interest are EXP and HI. Let E_{it} be total exports of firm i, let Y_{it} be total sales (including domestic sales and exports) and let EH_{it} be exports to High-income destinations.[16] We define $EXP_{it} = E_{it}/Y_{it}$ as the ratio of total firm exports to total firm sales. This variable is a better measure of export exposure than an exporter dummy, since it captures the intensity of the exporting status. Furthermore, from a practical point of view, a continuous variable has much more variability within firms in a 3 year panel such as ours. $HI_{it} = EH_{it}/E_{it}$ is defined as the share of firm exports to high-income destinations on total firm exports. This variable is a measure of the composition of exports across destinations and captures the impact of exporting to

[16] In most of this section, we use the conservative definition (Definition I) where high income destinations are countries in the high-income OECD, high-income non-OECD and upper-middle income groups of the World Bank classification. We later show robustness results dropping the group of upper-middle income countries from high-income destinations.

high-income developed countries once export intensity has been accounted for.[17]

The vector of firm characteristics, $\mathbf{x}$, includes industry dummies (when firm fixed effects are not included), firm size measured by the log of total sales, and differential trends across time at the firm level. The differential trends are constructed by interacting sales in the first year of data (1998) with year effects (and exchange rates). The error term includes a firm fixed effect ϕ_i, a year fixed-effect ϕ_t, and a random component ϵ_{it}.

We start by estimating (9) by OLS, pooling all years of data but including industry and year fixed effects. Results are in Table 2. In Columns 1 to 3, we work with our first proxy for skill utilization, average wages. In column 1, where we include EXP but exclude HI, we confirm the cross-section result: firms with higher ratios of exports to sales pay higher wages. In column 2, where we include HI, high-income destination exports, but we exclude EXP, we find a positive and significant coefficient as well. In column 3, we include both the exports to sales ratio (EXP) and the ratio of exports to high income (HI) in the same regression. Both coefficients are positive and statistically significant. Overall, thus, we observe that skill utilization is positively correlated not only with export intensity but also with the destination of a firm's exports. This means that, conditional on the same export intensity, firms that ship a larger share of their exports to high-income markets utilize, on average, more skills.

In columns 4 to 6, we work with our second proxy for s, the share of non-production workers in total firm employment. When we only include EXP (Column 4), we find a positive correlation, albeit not statistically significant, between export intensity and skills. When we only include HI, we find a strong positive correlation between exporting to high-income countries and skill composition. Finally, when both EXP and HI are included (column 6), we find that while exporting to high-income countries is positively correlated with a higher utilization of skills, export intensity is not.

Both the simple correlations in Table 1 and the OLS estimates in Table 2 are consistent with the claim that exporters utilize relatively more skilled labor and that high-income exporters even more than exporters. In the light of our model in Section 2, there are two ways to interpret these findings with different implications about the behavior of firms that are engaged in exports (to different destinations).

[17] An alternative specification that would also allow us to test our claim is to include exports over sales as well as exports to high-income countries over sales as regressors. These variables are highly collinear, however, and the model in (9) is therefore preferred.

Our model proposed differences in the fixed costs of exporting to different destinations, multi-dimensional firm heterogeneity (the parameters a and b), and differences in both the marginal utility of income (α) and in the costs of exporting (τ) across destinations. Consider first a scenario where there are no differences in α and τ, so that we "shut down" both the quality (Verhoogen 2008) and exporting technology (Matsuyama 2007) mechanisms. We retain the differences in a and b and also in the fixed costs (with higher fixed costs in the high-income market, lower in the low-income market, and even lower domestically, $F^H > F^L > F^D$). In this scenario, since α and τ are the same across destinations, a *given* firm will choose the same level of skills for each country of destination that it exports to ($S_{it}^H = S_{it}^L = S_{it}^D$). However, this level of skill will vary *across* firms according to their efficiency in the utilization of skilled and unskilled labor (the parameters a and b). This is because more efficient firms will choose a higher level of vertical differentiation for their products, which provides higher profits. At the same time, the differences in fixed costs generate a sorting of firms as described in Figure 2, where firms with lower a and b will be more likely to find it profitable to export to high income destinations.

This scenario generates a positive association between the skill (s) and the export destination variables and it is thus consistent with the OLS results of Table 2. There is no causality, however. The correlation arises because of the selection of firms into the different export markets. In other words, there are productivity and cost shocks that allow firms to enter or expand their export operations and hire different skill levels at the same time.

Let us now add the quality and export technology channels. We showed that in a scenario with lower marginal utility of income in high-income destinations ($\alpha^H < \alpha^L = \alpha^D$) and with more costly technology to export to high-income markets ($\tau^H > \tau^L > \tau^D = 0$), firms will use a higher share of skilled workers in their exports to high-income markets ($S_{it}^H > S_{it}^L > S_{it}^D$). This result is not directly testable with our data, since we do not observe skill use by country of destination. Instead, we observe the total skill intensity, which is a weighted average of the skill use in each destination as given by equation (8). However, since $S_{it}^H > S_{it}^D > S_{it}^L$, we should observe that for a *given* firm, the average skill use increases with the share of high-income exports. This scenario is also consistent with the OLS results of Table 2 but the implications are different. The correlation between skill use and high-income exports is not merely due to selection across firms but also because of differences in firm behavior (i.e., the utilization of different skills in serving different markets) in response to differences in α and τ.

For our analysis, we want to be able to discern between the two scenarios because they carry implications regarding the relevance of the mechanisms outlined in our theory. Clearly, it matters if the correlations between the variables are only due to selection of more productive firms or also due to behavioral responses. OLS cannot distinguish between the two scenarios.[18] To differentiate them, we develop an empirical strategy where we look at changes within firms and use instruments that explain exogenous shifts in the export share of high-income destinations. Our strategy provides an answer to the following question: for a given firm, with given a and b (possibly changing over time), and thus given S_{it}^H, S_{it}^L and S_{it}^D, does the average skill use go up if there is an exogenous increase in the share of high income destinations?

3.3 Identification Strategy

There are two endogenous variables in our model: exporting to high-income destinations HI (the share of exports to high income countries on total firm exports), and export intensity EXP (the share of exports in sales). To achieve identification, we exploit the panel nature of our data and we use instrumental variables. The panel allows us to track firms across time. To build the instruments, we exploit the exogenous variation in HI and EXP created by the Brazilian devaluation of 1999, which induced Argentine firms to cut sales in Brazil and to expand sales both domestically and in high-income countries.[19] In the end, our strategy boils down to tracking changes in skill utilization for a given firm, given its exogenous responses in exports and export destinations following the exogenous Brazilian devaluation.

Argentina and Brazil are major trade partners and thus the Brazilian devaluation had an impact on Argentine exports that is large enough to achieve identification. Argentine export statistics by country of destination provide prima-facie evidence in support our strategy. In Table 3, we report that in the pre-devaluation year of 1998, Argentine exports were destined mostly to Brazil (36

[18] There are other sources of unobserved heterogeneity which are beyond the scope of the model but that could be affecting the correlation in skill utilization and high income exports in the data. One important unobserved factor is imports. Bernard, Jensen, Redding and Schott (2007) show that exporters are also importers and that they share many good attributes. Another scenario, where the OLS estimates are attenuated, is when firms are subject to policy shocks or domestic regulation shocks. For instance, firms that are more likely to be "captured" by unions could be less likely to export while at the same time be required to pay higher wages, on average (see Galiani and Porto, 2009). Finally, if firms that are more oriented to the domestic market must incur costs related to non-tradable operations (like distribution), then high local costs may cause some firms to face a higher wage bill and become even less competitive in international markets.

[19] There is a growing literature that looks at changes in major trade partners as a source of identification. Exchange rates of trade partners were used for instance by Revenga (1992) and Park et al. (2008). Changes in Brazilian tariffs due to Mercosur were used to identify impacts on Argentine firms in Bustos (2009). Verhoogen (2008) uses the own devaluation of Mexico to link exports to wage inequality.

percent), Europe (13 percent), the United States (10 percent) and neighbors like Chile (6 percent), Uruguay (4 percent) and Paraguay (3 percent). In 1999, when the crisis hit and Brazil devaluated, the share of exports to Brazil dropped to 28 percent. These shares partially recovered in 2000, reaching 31 percent. Consistent with our argument above, alternative markets for Argentine exports were found in the U.S. (with shares increasing to 13 percent in 1999 and 15 percent in 2000) and Europe (with shares increasing to 15 percent in 1999 and 14 percent in 2000). At the bottom of Table 3, we observe that the share of exports destined to High Income countries increased from 43 percent in 1998 to 50 percent in 1999 and 51 percent in 2000 (using Definition I) and from 28 percent to 34 percent (using Definition II).

In Table 3, we also report changes in export volumes. As expected, exports to Brazil declined, because Brazilian domestic products became relatively more inexpensive. At the bottom of the table, we show that exports to high income destination actually increased significantly, from 6.5 billion dollars in 1998 to 7.2 billion dollars in 2000. This expansion is largely accounted for by an increase in exports to the U.S., from 1.6 to 2.2 billion dollars. While it is interesting to confirm that exports to high income countries increased, this result is not necessary for identification. As we showed in the theoretical model (see the last paragraph of section 2), for our purposes it suffices to observe within-firm changes in the *share* of high income countries in total exports after the Brazilian devaluation (independently of the changes in export volumes). Clearly, the fact that exports to high income countries actually increase in the data only reinforces the mechanisms that we exploit in our empirical analysis.[20]

3.4 IV Results

We build separate instruments for HI and EXP. Our instrument for HI is defined as $I_{it}^{HI} = Post_t * \lambda_{i98}^{BRA}$, that is, it is the interaction of a $Post$ devaluation variable with the pre-devaluation share of the firm's exports that were destined to Brazil, λ_{i98}^{BRA}. Since the 1998 shares λ_{i98}^{BRA} precede the devaluation, they measure exogenous exposure to the devaluation. The rationale for this instrument is that, as documented in Table 3, following the devaluation, firms that were mostly exposed to the Brazilian devaluation adjusted by moving away from this market and by exploring new markets in high income countries. We expect a positive correlation between the "scope to divert exports" and

[20]Incidentally, note our model assumes constant returns to scale and independent demands across destinations, and thus firms solve their optimization problems independently for each market. Since we observe changes in export volumes across destinations, we infer that there are factors linking firm decisions across markets, such as increasing marginal costs or capacity constraints. This observation does not affect the validity of our empirical strategy.

exports to high-income countries.

We adopt two specifications for $Post$. In the relatively more non-parametric model we interact the level of exposure to Brazil before the devaluation, λ_{i98}^{BRA}, with 1999 and 2000 year dummy variables, so that the instrumental variables are

$$(10) \quad I_{it}^{HI_1} = \phi_t * \lambda_{i98}^{BRA},$$

where ϕ_t denotes the 1999 and 2000 year dummies. This specification allows the impacts of the devaluation to vary from one year to the other as firms adjust to the exchange rate shock. In the second specification, we interact λ_{i98}^{BRA} with the exchange rate of the Brazilian to the Argentine currency in 1999 and 2000, $erate_t^{BRA}$:

$$(11) \quad I_{it}^{HI_2} = erate_t^{BRA} * \lambda_{i98}^{BRA}.$$

To deal with the endogeneity of the ratio of exports over sales (EXP), we construct a measure of the average exchange rate faced by a given firm in international markets:

$$(12) \quad I_{it}^{EXP} = \sum_c erate_t^c * \psi_{i98}^c,$$

where ψ_{i98}^c is the share of exports of firm i to country c on total *sales* in 1998 (which is predetermined) and $erate_t^c$ is the exchange rate of country c (to the Argentine Peso) at time t. Instruments such as (12) have been used before by, for example, Revenga (1992) and Park et al. (2008). Given the shares of export sales to market c in 1998, a higher exchange rate would induce firm i to export more to this market, thus increasing EXP_{it}. In consequence, we expect EXP to be positively correlated with I^{EXP} in the first stage regressions.[21] In the Appendix, we explore robustness results using a different instrument for EXP.

Good instruments have to be exogenous, help to explain the endogenous variables, and satisfy the exclusion restrictions. Our instruments satisfy all these conditions. First, the Brazilian devaluation generated exogenous variation in export intensity (EXP) and in export destinations (HI). These changes in exports are exogenous to the pre-devaluation shares of exports to Brazil.

[21] Note that while λ_{98}^{BRA} in equations (10) and (11) is the share of exports to Brazil in *total exports*, ψ_{98}^c in equation (12) is the share of exports to country c on total *sales*. As a consequence, the instruments are not perfectly correlated and in fact convey different useful information for identification purposes.

Likewise, our second instrument is based on arguably exogenous changes in the exchange rates of all trading partners and on each firm exposure to those changes given their pre-shock export/sales shares. In other words, while the pre-shock shares are a choice variable of the firm, once they are predetermined, the differential change in exports due to the devaluation of Brazil (or other countries) is exogenous. Second, as argued above, the instruments are correlated with the level of exports and its composition/destination. We test this below with results from the first-stage regressions. Finally, the exclusion restrictions require that our instruments do not have an effect on skill utilization beyond the indirect effect via exports and export destinations. One potential violation of the exclusion restrictions is given by the macroeconomic effects of the devaluation of a major trading partner. To account for this, we control for any direct effect of the devaluation with year effects.[22] Finally, note that our strategy can fail if there is serial correlation in the errors but we cannot do much about this with our short 3-year panel (Arellano, 2003).

We now turn to our IV estimates. We begin with Table 4, which shows results from the baseline model where our measure of skills is the average wage bill, the instrument for HI is the interaction between initial shares in 1998 with year dummies (equation (10)), and the instrument for EXP is the average weighted exchange rate (equation (12)). Panel A reports the IV estimates of δ_1 and δ_2 in (9); Panels B1 and B2 document the first stage regressions for HI and EXP, respectively.

In column 1, we run a simple model which omits the year effects, which are added in column 2. We find that exporting per se does not raise skill utilization, but exporting to high income countries does. Results are robust to the inclusion of the year effects in column 2. The purpose of this exercise is to informally test for the exclusion restriction. The year effects account for the macroeconomic impacts of the devaluation (and other time effects that affected all firms in the same fashion). If the devaluation is having a direct effect on the changes in export behavior of Argentine firms and this response depends on the initial shares in 1998, then the coefficients attached to the instruments in the first stage should change when we move from column 1 to column 2 (Panels B1 and B2). However, the results in both specifications are very similar and this lends support to our contention that the exclusion restriction is not violated by our estimation strategy. In all remaining specifications, we keep the year effects as they are crucial controls in our regressions.[23]

[22]It is important to emphasize that we are not interested in the impacts of the devaluation nor do we claim that we can identify those impacts. Instead, the argument is that identification relies on exogenous changes in export destinations (towards high-income countries and also towards domestic markets) caused by the Brazilian devaluation.

[23]Note that we cannot rule out a direct effect of the devaluation on export behavior. This is in fact captured by the year dummies. What matters for our strategy to work is that this is not confounding the changes in exports

We use results in Panels B1 and B2 to further diagnose the instruments. Overall, the instruments work very well: They have substantial explanatory power and are statistically significant. We also report very low p-values associated with the F-statistic of joint significance of the instruments, which consequently pass the Staiger and Stock (1997) test for weak instrumentation.

In columns 3-5 of Table 4, we report robustness results where we control for differences in initial conditions in order to rule out unobserved factors that could simultaneously determine the choice of export shares to Brazil in 1998 and the subsequent response to the shock. Pre-devaluation productivity shocks or cost shocks that persist in time are leading candidates. Those unobservables could invalidate our IV strategy because they imply that a firm's ability to change export destinations may depend on the initial share exported to Brazil (in 1998). In other words, our assumption that even though the choice of export markets is endogenous, the *change* caused by the Brazilian devaluation is not, could fail if firms more exposed to Brazil are somehow more (less) able to change destinations. While this is unlikely to be an issue in practice, we can address it directly by including controls for these unobserved pre-shock differences that may drive the potentially endogenous responses.

To control for initial conditions, we interact log sales in 1998 with year dummies (column 3) and with the Brazilian exchange rate (column 4). In these specifications, EXP is never statistically significant, while HI is always positive and highly statistically significant. In addition, the coefficients in columns 3 and 4 (0.321 and 0.338) are slightly larger, but comparable, to those in the simpler models of columns 1-2. In Panels B1 and B2, we find that the addition of controls for the firm's initial conditions does not affect the statistical properties of our instruments.

In column 5, we estimate the model with the log of sales as an additional control in the regression for time-varying heterogeneity such as current productivity or cost shocks. Note that we use sales as a proxy for unobserved characteristics in order to improve the estimation of δ_1 and δ_2; we consequently do not attach any causal interpretation to the coefficient of log sales. Our main results remain unchanged: EXP does not affect skill use, but HI does. The estimated coefficient of HI is 0.313, indicating that a firm with the average shares of exports to high-income countries (30 percent) pays around 9.4 percent higher wages than firms that do not export at all to developed countries. This is a sizeable difference, both statistically and economically.

As another robustness check, we run all the previous specifications using the alternative

conditional on the initial shares.

instrument for HI, equation (11) instead of (10). That is, the instrument is the interaction of the initial shares of exports to Brazil with the Brazilian exchange rate. Results are reported in Table 5. As before, Panel A shows the IV estimates of δ_1 and δ_2, and Panels B1 and B2 show the first-stage results for HI and EXP, respectively. All our findings remain unchanged. The ratio of exports to sales (EXP) is never significant and the ratio of export to high income on total exports (HI) is always significant. The estimated coefficients are also very similar. For instance, in our preferred specification with controls for log sales (column 5), our estimate of δ_2 is 0.314 (it was 0.313 in Table 4). In the first-stage results in Panels B1 and B2, the instruments show the expected sign, are jointly very significant, and there is no risk of weak instrumentation.

Before discussing our interpretation of these findings, we report the results from models where skill utilization is measured with the share of non-production workers on total employment. Results are in Tables 6 and 7. In Panel A, we use the ratio of the *number* of non-production workers to the total number of workers; In Panel B, we use the ratio of *hours* worked by non-production workers to the total number of hours worked by all employees. In Table 6, we report results using the instrument for HI built with year dummies (equation (10)) and in Table 7, we replace year dummies with exchange rates (equation (11)). In both cases, the instrument for EXP is given by (12). Our results suggest that, as before, the ratio of exports to sales does not seem to have an effect on the composition of skills at the firm level, whereas exporting to high income countries does matter. In our preferred specification, column 5, we find that a firm exporting to high-income destination at the average share of 0.30 utilizes 3.63 percentage points more skilled workers than non-high-income exporters. We find the same result when we use hours of skilled labor worked rather than physical units of skilled labor (see Panel B).

The reason why exporting to high-income countries (HI) is significant while simply exporting (EXP) is not can be found in Figure 2. If the domestic market in Argentina is similar to export markets in low- and middle-income economies (including any fixed costs), then the nature of domestic firms and of low-income exporters, in terms of their attributes a and b, will be similar and, consequently, differences in skill utilization will be small. In contrast, exporting to high-income countries does need quality upgrades and required services, which implies a significantly higher utilization of skills.

We can learn more about the structure of manufacturing exports in Argentina by looking at the estimates of EXP. In our model, the predicted sign of the impact of export intensity on skill utilization depends on the relative values of α and τ in Brazil vis-à-vis other trading partners (since the Brazilian devaluation is basically shifting exports out of Brazil and into both high-income countries and the domestic market). If Matsuyama's mechanism holds, then $\tau^{BRA} > \tau^{ARG}$ (and actually $\tau^{ARG} = 0$). Consequently, conditional of HI, export intensity should have a positive impact on skill utilization. On the other hand, if we plausibly assume that $\alpha^{ARG} < \alpha^{BRA}$, then (once again, conditional on the structure of exports to high-income countries), export density could negatively affect the utilization of skills (because firms choose a higher degree of product differentiation to sell in local markets). These are conflicting forces and it is thus not surprising that our estimates of EXP are not statistically significant. Note, however, that the estimates are negative and relatively large (but without enough precision) and this is (weakly) consistent with the quality mechanism.

Finally, we need to discuss the issue of timing and firm adjustments. Our data span the 1998-2000 period and hence the estimated impacts are based on changes in firm behavior taking place in the 2-year period following the Brazilian devaluation. A concern is whether it is plausible for firms to adjust the utilization of skills in such a short period of time. As explained above, for our test of relative skill utilization across destinations to work it is sufficient to observe compositional changes within firms (that is, changes in the export participation weights of the different S_j^c in equation (8)). Therefore, it is indeed possible to identify the mechanisms outlined in our theory in a short panel without necessarily relying on large firm adjustments.

3.5 A Validation Exercise

In this section, we perform a validation exercise where we explore results under the more stringent definition of "High-Income" destinations, which includes only High-Income OECD and High-Income non-OECD countries (Definition II, see section 3 and the Appendix). Table 8 reports IV results using both log average wages (columns 1-3) and the share of non-production workers (columns 4-6) as our measures of skill utilization. To streamline the exposition, we only report IV estimates from regressions models that include year effects and initial conditions, and that use the more non-parametric set of instruments (I^{HI_1}, the share of Brazil in exports in 1998 times year effects, and I^{EXP}, the weighted average exchange rate, defined in equations (10) and (12), respectively). In Table 8, we confirm our conclusion that exporting per se does not really matter but that exporting to high-income countries does. In fact, we find that under the more stringent definition of high-income destinations the impacts are close to three times larger than under Definition I. For instance, in the model of wages controlling for log sales, the coefficient on HI is 0.836 instead of 0.313. This result is consistent with our hypothesis since we expect larger differences in α and τ, and thus in skill utilization, the higher the income of the high-income destination group. Our conclusions are robust to results (not shown) using the alternative set of instruments given by (11), the share of Brazil in export in 1998 times the Brazilian exchange rate, and (12).

4 Channels

In this section, we set out to uncover some of the channels behind our "export destinations matter" result. We want to shed some light on the mechanisms by which Argentine firms that became more oriented towards high-income destinations utilized more skills.

4.1 Skill Upgrading Within Labor Categories

We begin with a simple extension of our baseline regression model. We re-estimate the wage specification with the addition of the share of non-production workers as a regressor. Our objective is to test whether HI remains statistically significant after controlling for the share of non-production workers. We include, as before, both HI and EXP as explanatory variables, and we instrument them with I^{HI_1} and I^{EXP}. Results are reported in Table 9 (similar results are obtained when we use I^{HI_2}, in place of I^{HI_1}, and I^{EXP} as instruments). We find that export intensity, EXP, is never significant, while HI, exports to high-income countries, always is. As expected, the share of non-production workers is positively associated with the average firm wage since on average non-production workers are more skilled than production workers. In addition, the coefficient of HI is smaller than in all previous regressions. Taken together, these results indicate that part of the impact of HI on average wages effectively work through increases in the share of non-production workers but that there are also other channels playing a role.

One plausible mechanism is skill upgrading within labor categories. With two labor categories, the average wage will ($\overline{w}$) can be written as

(13) $\overline{w} = w_{np}l_{np} + w_p l_p,$

where w_{np} and w_p are the average wages paid to non-production and production workers, and

l_{np} and l_p are their shares in total firm employment. In this formulation, our findings so far revealed that firms exporting to high-income countries pay higher wages $\overline{w}$, hire a higher share l_{np} of non-production workers, and pay higher wages $\overline{w}$ conditional on the shares l_{np}. This last result is consistent with a scenario where firms engage in skill upgrading within skill categories and possibly utilize better (that is, more skilled) non-production and production workers (in at least one of the two categories). To further clarify this idea, assume that there are two categories of workers, say semiskilled and skilled, within the non-production worker category, with the wages of the skilled workers being higher than the wages of the semiskilled workers. A higher l_{np} associated with high-income exports can take place because of higher levels of skilled workers or of higher levels of semiskilled workers. It follows that, if the mechanism operates via more skilled workers, then average wages will be even higher. This channel is consistent with the within-category skill upgrading uncovered by Verhoogen (2008).[24]

4.2 Quality

In our theory, the quality upgrading and the required services mechanisms played major roles. If these channels are valid, we argue that they should be much stronger in sectors with higher scope for quality/services upgrades. To test this, we estimate our IV regressions after splitting the sample according to the variance of the unit values in exports at the industry level (a measure of the degree of product differentiation in the sector). We calculated unit values using industry-level bilateral trade data from COMTRADE. First, we matched the COMTRADE trade data to the industrial classification system from the firm survey, the ISIC Revision 2 at the 3 digit level. Second, for each 3-digit industry, we computed the variance in export unit values from all pairwise combinations of countries of origin and destination that report to COMTRADE, after trimming outliers. Finally, we classified industries as "High Variance," if the variance of their unit values is above the 75th percentile, or as "Low Variance" otherwise.

Results are displayed in Table 10. We report the estimates of the IV models that use the more non-parametric instruments (year dummies times initial shares (equation 10) and the average exchange rate (equation 12)) and that control for year effects and firm initial conditions. The results are however robust to all other specifications presented above. In Panel A, we use log average wages as measures of skill utilization. We find that exporters to high-income countries pay higher wages

[24]Note that, as we discussed in the theoretical model, we cannot rule out other possible mechanisms like profit-sharing (fair wages), labor turnover, or scale economies.

in industries in which there is more vertical differentiation but not in industries in which products are vertically more homogeneous.[25] In Panel B, we use instead the share of non-production workers (number of employees). In this case, we find that HI impacts the share of non-production workers in both High-variance and Low-variance sectors.[26]

These findings provide support to both Matsuyama (2007) and Verhoogen (2008). On the one hand, the fact that high-income exporters pay higher wages only in sectors with a higher scope for quality differentiation is clearly consistent with Verhoogen's mechanism. On the other hand, the fact that high-income exporters hire a higher share of non-production workers is consistent with "required services" that are independent of the degree of vertical differentiation, as in Matsuyama (2007). Also, taken together, both results suggest that skill upgrading due to vertical differentiation is materialized via skill upgrading within categories (as found by Verhoogen (2008)), while Matsuyama's technical services require a higher share of non-production workers. In terms of equation 13, our findings can be interpreted as follows. Matsuyama implies higher l_{np} associated with high-income exports in all sectors. In turn, we only observe higher $\overline{w}$ in high-quality sectors. This means that the quality mechanism in high-quality sectors operates via skilled upgrading, that is via more skilled workers vis-'a-vis semiskilled workers among the non-production workers, l_{np}. The "required services" of Matsuyama, in contrast, are met with semiskilled workers, rather than skilled workers, within non-production workers.

5 Conclusions

In this paper, we elaborate upon a theory linking export destinations and skill utilization in developing countries. We provide a unified theoretical framework to study the behavior of firms that export to high-income countries in terms of the utilization of skilled labor. In our framework, exporters to high-income destinations hire a higher level of non-production workers for two reasons.

[25] We have experimented with several cutoffs for high and low variance industries. We do not find different impacts between high and low variance industries if we define high variance industries as those above the mean or the median.

[26] For robustness, we also split the sample using the length of the quality ladder introduced by Khandelwal (2009). He calculates an index based on the estimation of demand equations that incorporate a valuation for quality. We defined sectors with "long" quality ladders if his index is above the mean, and with "short" ladders in the opposite case. Overall, our results are similar to those in Table 10. When the dependent variable is log average wages, we find a strong, positive, and statistically significant impact of exporting to high-income export destinations (HI) in industries with long ladders. In industries with short ladders, the estimates of δ_2 are smaller and they are not statistically significant. When the dependent variable is the share of non-production workers, we find positive impacts of HI on the share of non-production workers in both long- and short-ladder industries. The point estimates are similar in both cases (and also comparable to those in Table 10), but they are only marginally significant. These results can be found in our online Appendix at `http://faculty.udesa.edu.ar/ibrambilla/papers/exportdestinations_appendix.pdf`.

First, exporting to high-income countries requires quality upgrades, which are skill-intensive. Second, there are required services associated with exporting to high-income countries, and these activities are also intensive in skills. Our model introduces multi-dimensional firm heterogeneity in order to explain both the decision to export as well as the decision to export to high-income countries. This heterogeneity is due to differences in the efficiency in the use of skilled and unskilled labor across firms.

We provide empirical evidence using a panel of Argentine manufacturing firms that we matched with customs information on exports and export destinations at the firm level. The available data cover the 1998-2000 period and thus span the Brazilian devaluation of 1999. This provides a useful source of identification because we can use the exogenous changes in exports and in export destinations brought about by the Brazilian devaluation to explore whether firms choose the skill composition of their workforce based on the destination of their exports.

The empirical models consistently find that exporting to high-income countries induces firms to hire more skilled workers, but exporting per se does not. The reason is that the domestic markets in Argentina are similar to export markets in middle-income countries and thus it is only possible to observe differences in firm's outcomes for firms specializing in exporting to high-income countries. We also provide evidence in support of the two mechanisms outlined in our model, namely quality upgrades and required services.

Our contribution lies in identifying, empirically and theoretically, mechanisms that explain how the "act of exporting" to different destinations affects the behavior of firms. Our results can shed light on the nature of this behavior and, in turn, this may prove useful in current research efforts to understand factors driving firm choices of exporting and of exporting to different markets.

Appendices

Appendix 1: Distribution of Firms by Industry

Table A1 reports the number of firms by 2-digit industry in 1998. This information gives a sense of the type of industries involved in our analysis. Among a total of 901 manufacturing firms, the largest number of units are in Food & Beverages (139), followed by Chemical Products (83), Textiles (68), Rubber & Plastic (67) and Metal Products (66). In contrast, there are very few firms in Coke & Refined Petroleum Products, Office, Accounting & Computing Machinery, or Radio, TV & Communication Equipment. The survey does not cover firms that produce primary products like agricultural commodities.

Appendix 2: Export Destinations Definitions

Table A2 lists the World Bank country classification.

Appendix 3: One Plant Firms

As we mentioned during the description of the data, the ENI firm survey collects data at the plant level while the Customs data collect export information at the firm level. We deal with this issue by aggregating the plant-level data. To see if this has any impact on our estimates, we re-did all the regressions reported in the text for the sample of one-plant firms. Since 86 percent of firms in the ENI survey are one-plant firms, we do not expect sizeable differences in our estimates. In Table A3, we report results for log average shares and for the share of non-production workers. None of our conclusions are affected.

Appendix 4: Alternative Set of Instruments

In this appendix, we test the robustness of our results by using an alternative set of instruments for export density, EXP, the share of exports on total sales. In Section 3, we built a measure of the average exchange rate faced by a firm by weighing the exchange rate of each country partner with the initial export share in sales in 1998. In what follows, we replace this instrument with a similar one that only exploits the exogenous variation caused by the Brazilian devaluation. Concretely, we define

$$(14) \quad I_{it}^{EXP_1} = \phi_t * \psi_{i98}^{BRA},$$

and

$$(15) \quad I_{it}^{EXP_2} = erate_{it} * \psi_{i98}^{BRA}.$$

The instrument $I_{it}^{EXP_1}$ is analogous to I^{HI_1}; we interact the year effects ϕ_t with the initial share of exports to Brazil on total sales, ψ_{98}^{BRA}. To construct I^{EXP_2}, we interact those shares with the Brazilian exchange rate so that this instrument works in the same way as I^{EXP} does (but only taking into account the Brazilian devaluation).[27] Note that I^{EXP_1} and I^{EXP_2} are a measure of the "scope for retrenchment into local markets." Firms with a larger pre-shock share of exports to Brazil on total *sales* had more possibilities to divert sales into the domestic markets (compared to other firms oriented towards non-Brazil markets). We expect a negative association between EXP and I^{EXP_1} or I^{EXP_2} in the first stage. In addition, we expect these instruments to be negatively correlated with HI because a higher scope for retrenchment into local markets limit the scope to divert exports to high income. In contrast, we expect I^{HI_1} and I^{HI_2} to be positively correlated with export intensity EXP because a higher scope for export switching to high-income countries allow firm exports to remain high relative to sales (conditional of the other controls and instruments).

In principle, we have four possible combinations of instruments. To simplify the exposition, we only consider two combinations, one where we use time dummies to build the instruments for both HI and EXP, and another where we use the Brazilian exchange rates. The results are reported in Tables A4 (for the case of instruments based on year dummy variables, equation (14)) and Table A5 (for the case of instruments based on exchange rates, equation (15)). In Panel A, we report IV

[27] Note the difference with λ_{i98}^{BRA} in (10) or (11), which is the share of exports to Brazil on total exports. That is, a_{i98}=exports to Brazil/total exports but b_{i98}=exports to Brazil/sales.

estimates using both log average wages and the share of non-production workers (in numbers) as measures of skill utilization. In all these regressions, our conclusions are unchanged: only exporting to high-income destinations matters. The point values of the estimates are very similar to those reported in the main text. For instance, in column 3 of Table A4, the IV coefficient of HI is 0.311 (vis-à-vis 0.313 in Table 4). In column 6 of Table A4, the IV coefficient of HI is the non-production workers share equation is 0.124 (vis-a-vis 0.121). In Panels B1 and B2 of Tables A4 and A5, we also report the first-stage results. Overall, the instruments work very well, have good explanatory power and are highly statistically significant. There is no apparent risk of weak instrumentation.

Appendix 5: Additional Results

In the paper, we only show a set of the most important results to illustrate the findings. We have prepared a note with a full set of results, which can be found at `http://faculty.udesa.edu.ar/ibrambilla/papers/exportdestinations_appendix.pdf`. This Note includes tables with results using instruments I^{HI_2} and I^{EXP} for the following models: i) wage regressions controlling for share of non-production workers; ii) High-variance / Low-Variance regressions; iii) Quality ladder regressions. We also include tables with results using the alternative instruments described in Appendix 4 for the following models: i) wage regressions conditional on share of non-production workers; ii) High-variance/Low-variance regressions; iii) Quality Ladders. Finally, we include a full set of results with various instruments using Definition II of high-income destinations.

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Table 1
Descriptive Statistics from Firm Survey (ENI) and Customs Records
Argentina 1998-2000

	All Firms	Exporters	High-income exporters I	High-income exporters II
	(1)	(2)	(3)	(4)
Panel A				
Exported in a given year	0.59			
Exported during sample period	0.68			
Exports/Sales	0.08	0.13	0.15	0.22
Number of destinations	3.3	4.9	5.4	7.8
Observations	2544	1499	1307	680
Panel B				
Number of workers	89.7	1.22***	0.39***	0.43***
		(0.04)	(0.07)	(0.05)
Annual sales in 100,000 USD	8.04	1.73***	0.54***	0.54***
		(0.05)	(0.09)	(0.06)
Average annual wage in USD	12,154	0.48***	0.12***	0.15***
		(0.02)	(0.03)	(0.03)
Share of non-production workers	0.26	0.05***	0.03***	0.014
(Number of workers)		(0.01)	(0.01)	(0.01)
Share of non-production workers	0.26	0.05***	0.03***	0.02**
(Hours worked)		(0.01)	(0.01)	(0.01)

Source: Own calculations based on firm data from the National Industrial Survey (ENI) and customs records.
(1): Average number of workers, average annual sales, average annual wage, average share of non-production workers (number of workers and hours worked).
(2): Difference in means in log workers, log sales, log wage and share of non-production workers between exporters and non-exporters, controlling for industry and year.
(3): Difference in means between firms that export to at least one high-income destination and other exporters (conditional on exporting), controlling for industry and year.
(4): Difference in means between firms that export to at least one high-income destination (definition II) and other exporters (conditional on exporting to high-income countries, definition I), controlling for industry and year. Definition I includes high-income and upper-middle-income countries. Definition II includes only high-income countries.

Table 2
Exports, Export Destinations and Skill Utilization in the Cross Section
OLS Estimates

	Log Average Wage			Share of non-production Workers		
	(1)	(2)	(3)	(4)	(5)	(6)
Exports/Sales (EXP)	0.692***	–	0.513***	0.0410	–	0.010
	(0.110)		(0.113)	(0.031)		(0.032)
High Income Exports (HI)	–	0.340***	0.291***	–	0.052***	0.051***
		(0.039)	(0.291)		(0.012)	(0.013)
Observations	2544	2544	2544	2544	2544	2544
R-squared	0.219	0.238	0.256	0.257	0.266	0.266

All regressions include year and industry effects. Standard errors are clustered at the firm level. Significance at the 1 percent, 5 percent and 10 percent level is denoted by ***, ** and *. The share of non-production workers is measured as the number of non-production workers relative to the total number of employees.

Table 3
Main Countries of Destination of Argentine Manufacturing Exports

	1998		1999		2000	
	Value	Share	Value	Share	Value	Share
Brazil	5568.5	0.36	3858.3	0.28	4363.6	0.31
United States	1550.9	0.10	1822.7	0.13	2187.1	0.15
Chile	959.8	0.06	950.4	0.07	1190.0	0.08
Uruguay	654.0	0.04	638.8	0.05	608.6	0.04
Paraguay	491.5	0.03	441.3	0.03	460.1	0.03
Europe	2025.3	0.13	2037.7	0.15	2014.8	0.14
TOTAL	15259.1	1	13716.0	1	14155.9	1
High Income I	6512.3	0.43	6840.5	0.50	7265.8	0.51
High Income II	4237.3	0.28	4624.7	0.34	4872.3	0.34

Source: UN COMTRADE. Manufacturing sector only. Values in constant 1998 millions of dollars.
High Income I: countries classified by the World Bank as high income (OECD and non-OECD) and upper middle income.
High Income II: countries classified by the World Bank as high income (OECD and non-OECD).

Table 4

Exports, Export Destinations, and Skills. Wage Regressions

Dummy Instruments

	(1)	(2)	(3)	(4)	(5)
Panel A: Second Stage					
Exports/Sales (EXP)	–0.186	–0.191	–0.324	–0.273	–0.235
	(0.475)	(0.518)	(0.556)	(0.527)	(0.544)
High Income Exports (HI)	0.277***	0.306***	0.321***	0.338***	0.313***
	(0.098)	(0.098)	(0.106)	(0.108)	(0.104)
Log Sales	–	–	–	–	0.058***
					(0.020)
Panel B1: First Stage (HI)					
Share BRA in exports * 1999 (I^{HI_1})	0.213***	0.230***	0.231***	0.229***	0.231***
	(0.035)	(0.039)	(0.041)	(0.040)	(0.041)
Share BRA in exports * 2000 (I^{HI_1})	0.241***	0.250***	0.245***	0.249***	0.245***
	(0.038)	(0.043)	(0.045)	(0.043)	(0.045)
Average Exchange Rate (I^{EXP})	0.986***	0.970***	0.980***	0.973***	0.992***
	(0.302)	(0.304)	(0.308)	(0.306)	(0.309)
Log Sales	–	–	–	–	0.010
					(0.017)
R-squared	0.034	0.035	0.035	0.035	0.035
p-value	0.000	0.000	0.000	0.000	0.000
Panel B2: First Stage (EXP)					
Share BRA in exports * 1999 (I^{HI_1})	0.012	0.013	0.011	0.010	0.011
	(0.011)	(0.011)	(0.012)	(0.012)	(0.012)
Share BRA in exports * 2000 (I^{HI_1})	0.037***	0.031**	0.029**	0.029**	0.029*
	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)
Average Exchange Rate (I^{EXP})	0.600***	0.612***	0.619***	0.618***	0.626***
	(0.229)	(0.231)	(0.232)	(0.232)	(0.232)
Log Sales	–	–	–	–	0.006
					(0.009)
R-squared	0.029	0.031	0.031	0.031	0.033
p-value	0.001	0.007	0.011	0.006	0.011
Year Effects	–	Yes	Yes	Yes	Yes
Initial Conditions * Year Effects	–	–	Yes	–	Yes
Initial Conditions * Exchange Rate	–	–	–	Yes	–
Number of firms	901	901	901	901	901
Observations	2544	2544	2544	2544	2544

Dependent variable in second stage: Log Average Wage (Panel A). Dependent variables in first stage: Exports to high income destinations over Total value of exports (HI), in Panel B1; and Total value of exports over Total value of sales (EXP) in Panel B2. All regressions include firm fixed effects. Dummy instruments are used in all regressions. Bootstrapped SE in parenthesis. Significance at the 1 percent, 5 percent and 10 percent level is denoted by ***, ** and *.

Table 5
Exports, Export Destinations, and Skills. Wage Regressions
Exchange Rate Instruments

	(1)	(2)	(3)	(4)	(5)
Panel A: Second Stage					
Exports/Sales (EXP)	–0.258	–0.370	–0.356	–0.442	–0.232
	(0.645)	(0.620)	(0.613)	(0.627)	(0.580)
High Income Exports (HI)	0.270***	0.282***	0.316***	0.311***	0.314***
	(0.109)	(0.105)	(0.109)	(0.111)	(0.106)
Log Sales	–	–	–	–	0.058***
					(0.020)
Panel B1: First Stage (HI)					
Share BRA in exports * erate (I^{HI_2})	0.364***	0.393***	0.395***	0.392***	0.395***
	(0.057)	(0.063)	(0.065)	(0.065)	(0.065)
Average Exchange Rate (I^{EXP})	0.814***	0.871***	0.905***	0.873***	0.919***
	(0.287)	(0.297)	(0.305)	(0.300)	(0.306)
Log Sales	–	–	–	–	0.012
					(0.017)
R-squared	0.310	0.032	0.033	0.032	0.33
p-value	0.000	0.000	0.000	0.000	0.000
Panel B2: First Stage (EXP)					
Share BRA in exports * erate (I^{HI_2})	0.028	0.029	0.025	0.025	0.026
	(0.019)	(0.020)	(0.021)	(0.020)	(0.020)
Average Exchange Rate (I^{EXP})	0.534**	0.580**	0.594**	0.587**	0.602***
	(0.225)	(0.230)	(0.232)	(0.230)	(0.231)
Log Sales	–	–	–	–	0.006
					(0.009)
R-squared	0.020	0.027	0.028	0.027	0.029
p-value	0.059	0.041	0.037	0.039	0.034
Year Effects	–	Yes	Yes	Yes	Yes
Initial Conditions * Year Effects	–	–	Yes	–	Yes
Initial Conditions * Exchange Rate	–	–	–	Yes	–
Number of firms	901	901	901	901	901
Observations	2544	2544	2544	2544	2544

Dependent variable in second stage: Log Average Wage (Panel A). Dependent variables in first stage: Exports to high income destinations over Total value of exports (HI), in Panel B1; and Total value of exports over Total value of sales (EXP) in Panel B2. All regressions include firm fixed effects. Exchange rate instruments are used in all regressions. Bootstrapped SE in parenthesis. Significance at the 1 percent, 5 percent and 10 percent level is denoted by ***, ** and *.

Table 6
Exports, Export Destinations, and Skills. Share of Non-Production Workers
Dummy Instruments

	(1)	(2)	(3)	(4)	(5)
Panel A: Workers					
Exports/Sales (EXP)	–0.109	–0.015	0.011	0.011	0.007
	(0.150)	(0.165)	(0.164)	(0.166)	(0.162)
High Income Exports (HI)	0.174***	0.130***	0.120***	0.120***	0.121***
	(0.042)	(0.041)	(0.041)	(0.041)	(0.042)
Log Sales	–	–	–	–	-0.003
					0.007
Panel B: Hours					
Exports/Sales (EXP)	–0.126	–0.001	0.026	0.030	0.022
	(0.162)	(0.169)	(0.175)	(0.175)	(0.171)
High Income Exports (HI)	0.171***	0.105***	0.092**	0.093**	0.093**
	(0.043)	(0.041)	(0.042)	(0.040)	(0.042)
Log Sales	–	–	–	–	–0.004
					(0.007)
Year Effects	–	Yes	Yes	Yes	Yes
Initial Conditions * Year Effects	–	–	Yes	–	Yes
Initial Conditions * Exchange Rate	–	–	–	Yes	–
Observations	2544	2544	2544	2544	2544
Number of Firms	901	901	901	901	901

Dependent variables: number of non-production workers over total number of workers (Panel A) and hours worked by non-production workers over total number of hours worked by all employees (Panel B). All regressions include firm fixed effects and year effects. Dummy instruments are used in all regressions. First stage regressions are the same as in Table 4. Bootstrapped SE in parenthesis. Significance at the 1 percent, 5 percent and 10 percent level is denoted by ***, ** and *.

Table 7
Exports, Export Destinations, and Skills. Share of Non-Production Workers
Exchange Rate Instruments

	(1)	(2)	(3)	(4)	(5)
Panel A: Workers					
Exports/Sales (EXP)	–0.078	0.018	0.042	0.041	0.035
	(0.190)	(0.180)	(0.179)	(0.179)	(0.177)
High Income Exports (HI)	0.177***	0.134***	0.125***	0.125***	0.125***
	(0.044)	(0.041)	(0.043)	(0.043)	(0.043)
Log Sales					–0.003
					(0.007)
Panel B: Hours					
Exports/Sales (EXP)	–0.086	0.071	0.108	0.099	0.098
	(0.199)	(0.196)	(0.197)	(0.198)	(0.194)
High Income Exports (HI)	0.175***	0.115***	0.104**	0.104**	0.104**
	(0.044)	(0.042)	(0.043)	(0.043)	(0.043)
Log Sales					–0.005
					(0.007)
Year Effects	–	Yes	Yes	Yes	Yes
Initial Conditions * Year Effects	–	–	Yes	–	Yes
Initial Conditions * Exchange Rate	–	–	–	Yes	–
Observations	2544	2544	2544	2544	2544
Number of Firms	901	901	901	901	901

Dependent variables: number of non-production workers over total number of workers (Panel A) and hours worked by non-production workers over total number of hours worked by all employees (Panel B). All regressions include firm fixed effects and year effects. Exchange rate instruments are used in all regressions. First stage regressions are the same as in Table 4. Bootstrapped SE in parenthesis. Significance at the 1 percent, 5 percent and 10 percent level is denoted by ***, ** and *.

Table 8
Alternative Definition of High Income Exports

	Log Average Wage			Share of non-prod Workers		
	(1)	(2)	(3)	(4)	(5)	(6)
Exports/Sales (EXP)	−0.339	−0.264	−0.239	0.010	0.013	0.008
	(0.553)	(0.532)	(0.542)	(0.169)	(0.163)	(0.165)
High Income Exports II (HI)	0.894***	0.968***	0.861***	0.324**	0.346***	0.325**
	(0.322)	(0.332)	(0.314)	(0.130)	(0.132)	(0.130)
Log Sales	–	–	0.061***	–	–	-0.002
			(0.022)			(0.008)
Initial Conditions * Year Effects	Yes	–	Yes	Yes	–	Yes
Initial Conditions * Exchange Rate	–	Yes	–	–	Yes	–
Observations	2544	2544	2544	2544	2544	2544
Firms	901	901	901	901	901	901

High Income Exports II are defined as the share of total value of exports that is shipped to countries classified by the World Bank as High Income OECD and non-OECD (it excludes upper-middle income countries). Dependent variables: Log average wage in columns (1), (2), (3); Number of non-production workers over total number of workers in columns (4), (5), (6). All regressions include firm fixed effects and year effects. Dummy instruments are used in all regressions. Bootstrapped SE in parenthesis. Significance at the 1 percent, 5 percent and 10 percent level is denoted by ***, ** and *.

Table 9
Exports, Export Destination and Skills
Wage Regressions Controlling for Share of Non-Production Workers.

	(1)	(2)	(3)
Exports/Sales (EXP)	–0.330	–0.278	–0.239
	(0.517)	(0.501)	(0.522)
High Income Exports (HI)	0.265***	0.281***	0.256***
	(0.101)	(0.103)	(0.098)
Share of non-prod workers	0.469***	0.471***	0.471***
	(0.088)	(0.089)	(0.088)
Log Sales	–	–	0.059***
			(0.019)
Initial Conditions * Year Effects	Yes	–	Yes
Initial Conditions * Exchange Rate	–	Yes	–
Observations	2544	2544	2544
Firms	901	901	901

Dependent variable: Log average wage. Share of non-production workers is measured as the number of non-production workers over the total number of workers. All regressions include firm fixed effects and year effects. Dummy instruments are used in all regressions. Bootstrapped SE in parenthesis. Significance at the 1 percent, 5 percent and 10 percent level is denoted by ***, ** and *.

Table 10
Scope for Vertical Differentiation. Variance in Unit Values

	High Variance Industries			Low Variance Industries		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Average Wages						
Exports/Sales (EXP)	–0.301	–0.301	–0.268	–0.296	–0.196	–0.138
	(0.908)	(0.921)	(0.887)	(0.459)	(0.451)	(0.439)
High Income Exports (HI)	0.461**	0.476**	0.435**	0.211	0.230	0.214
	(0.187)	(0.188)	(0.194)	(0.140)	(0.141)	(0.137)
Log Sales	–	–	0.050	–	–	0.062**
			(0.034)			(0.029)
Observations	973	973	973	1506	1506	1506
Firms	344	344	344	536	536	536
Panel B: Non-Production Workers						
Exports/Sales (EXP)	0.077	0.080	0.073	–0.026	–0.041	–0.028
	(0.234)	(0.247)	(0.237)	(0.216)	(0.211)	(0.203)
High Income Exports (HI)	0.121*	0.122*	0.124*	0.110**	0.107**	0.109**
	(0.072)	(0.072)	(0.072)	(0.054)	(0.055)	(0.055)
Log Sales	–	–	-0.005	–	–	–0.002
			(0.015)			(0.009)
Observations	973	973	973	1506	1506	1506
Firms	344	344	344	536	536	536
Initial Conditions * Year Effects	Yes	–	Yes	Yes	–	Yes
Initial Conditions * Exchange Rate	–	Yes	–	–	Yes	–

Dependent variable: Log average wage (Panel A) and Share of non-production workers (Panel B). High (Low) variance: 3-digit ISIC industries with variance in export unit values above (below) the 75th percentile. All regressions include firm fixed effects and year effects. Dummy instruments are used in all regressions. Bootstrapped SE in parenthesis. Significance at the 1 percent, 5 percent and 10 percent level is denoted by ***, ** and *.

Table A1
Distribution of Firms by Industry

	All firms	Exporters	Non-Exporters
Food and beverages	139	72	67
Textiles	68	38	30
Apparel	17	7	10
Leather and leather products	22	10	12
Wood, cork and straw products	20	5	15
Paper and paper products	31	20	11
Publishing, printing, media	27	10	17
Coke and refined petroleum products	4	4	
Chemicals and chemical products	83	73	10
Rubber and plastics products	67	42	25
Other non-metallic mineral products	61	29	32
Basic metals	34	20	14
Metal products	66	35	31
Machinery and equipment n.e.c.	82	62	20
Office, accounting and computing machinery	1	1	
Electrical machinery	56	37	19
Radio, TV and communication equipment	5	3	2
Medical, precision and optical instruments	13	11	2
Motor vehicles	44	30	14
Other transport equipment	14	7	7
Furniture; Other	47	27	20
Total	901	543	358

Source: Own calculations based on firm data from the Encuesta Nacional Industrial (ENI) or National Industrial Survey. Industries are classified according to ISIC Revision 2. In this table we aggregate industries at the 2-digit level.

Table A2
World Bank Country Classification

High income OECD: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Italy, Japan, Korea, Luxembourg, Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States
High income non-OECD: Bahrain, Bahamas, Barbados, Cyprus, Hong Kong, Israel, Kuwait, Malta, Puerto Rico, Qatar, Singapore, United Arab Emirates
Upper-middle income: Chile, Costa Rica, Croatia, Czech Republic, Dominica, Gabon, Grenada, Hungary, Lebanon, Lithuania, Mexico, Mauritius, Malaysia, Panama, Poland, Saudi Arabia, Seychelles, St. Lucia, Trinidad and Tobago, Uruguay, Venezuela
Low-middle income: Algeria, Bolivia, Brazil, Bulgaria, China, Colombia, Cuba, Dominican Republic, Ecuador, Egypt, El Salvador, Guatemala, Guyana, Honduras, Iran, Jamaica, Jordan, Morocco, Paraguay, Peru, Phillipines, Russia, Saint Vincent and the Grenadines, South Africa, Sri Lanka, Suriname, Syria, Thailand, Turkmenistan, Tunisia, Turkey, Ukraine
Low income: Angola, Benin, Bangladesh, Cote d'Ivorie, Comoros, Democratic People's Republic of Korea, Democratic Republic of Congo, Ethiopia, Haiti, India, Indonesia, Kenya, Myanmar, Mozambique, Nigeria, Nicaragua, Pakistan, Papua New Guinea, Tanzania, Uganda, Vietnam, Yemen, Zimbabwe

List includes countries with positive exports in the firm-level data.

Table A3
One Plant Firms Only

	Log Average Wage			Share non-prod Workers		
	(1)	(2)	(3)	(4)	(5)	(6)
Exports/Sales (EXP)	–0.391	–0.302	–0.339	–0.142	–0.146	–0.15
	(0.55)	(0.524)	(0.526)	(0.155)	(0.157)	(0.150)
High Income Exports (HI)	0.324**	0.333**	0.324**	0.097**	0.098**	0.097**
	(0.127)	(0.134)	(0.127)	(0.047)	(0.047)	(0.047)
Log Sales	–	–	0.045**	–	–	–0.005
			(0.021)			(0.009)
Initial Conditions * Year Effects	Yes	–	Yes	Yes	–	Yes
Initial Conditions * Exchange Rate	–	Yes	–	–	Yes	–
Observations	2117	2117	2117	2117	2117	2117
Number of Firms	750	750	750	750	750	750

Firms that report owning more than one plant are dropped from the sample. Dependent variables: Log average wage in columns (1)-(3); number of non-production workers over total number of workers in columns (4)-(6). All regressions include firm fixed effects and year effects. Dummy instruments are used in all regressions. Bootstrapped SE in parenthesis. Significance at the 1 percent, 5 percent and 10 percent level is denoted by ***, ** and *.

Table A4
Alternative Set of Instruments. Dummy Instruments.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Second Stage	Log Average Wage			Share non-prod Workers		
Exports/Sales (EXP)	–0.468	–0.379	–0.399	0.099	0.098	0.096
	(0.475)	(0.472)	(0.475)	(0.182)	(0.177)	(0.183)
High Income Exports (HI)	0.32***	0.34***	0.311***	0.123***	0.123***	0.124***
	(0.107)	(0.109)	(0.104)	(0.044)	(0.044)	(0.043)
Log Sales	–	–	0.059***	–	–	-0.003
			(0.019)			(0.007)
Panel B1: First Stage (HI)						
Share BRA exports * 1999	0.227***	0.225***	0.227***			
	(0.044)	(0.044)	(0.044)			
Share BRA exports * 2000	0.249***	0.252***	0.249***			
	(0.049)	(0.048)	(0.049)			
Share BRA sales * 1999	−0.276**	−0.277**	−0.278**			
	(0.122)	(0.122)	(0.122)			
Share BRA sales * 2000	−0.332**	−0.329**	−0.335***			
	(0.129)	(0.129)	(0.130)			
Log Sales	–	–	0.010			
			(0.017)			
R-squared	0.034	0.034	0.034			
p-value	0.000	0.000	0.000			
Panel B2: Second Stage (EXP)						
Share BRA exports * 1999	0.008	0.008	0.008			
	(0.012)	(0.012)	(0.012)			
Share BRA exports * 2000	0.035**	0.035**	0.035**			
	(0.016)	(0.016)	(0.016)			
Share BRA sales * 1999	−0.173**	−0.173**	−0.174**			
	(0.079)	(0.079)	(0.080)			
Share BRA sales * 2000	−0.235**	−0.235**	−0.237**			
	(0.096)	(0.096)	(0.096)			
Log Sales	–	–	0.006			
			(0.009)			
R-squared	0.028	0.028	0.029			
p-value	0.014	0.007	0.014			
Initial Conditions * Year Effects	Yes	–	Yes	Yes	–	Yes
Initial Conditions * Exchange Rate	–	Yes	–	–	Yes	–
Observations	2544	2544	2544	2544	2544	2544
Number of Firms	901	901	901	901	901	901

Dependent variable in second stage: Log Average Wage (columns 1-3) and Share of non-production workers (columns 4-6). Dependent variables in first stage: Exports to high income destinations over Total value of exports (HI), in Panel B1; and Total value of exports over Total value of sales (EXP) in Panel B2. Alternative instruments: Share of Brazil in Sales interacted with year effects is used instead of the average exchange rate of all trade partners weighted by share in sales. All regressions include firm and year fixed effects. Bootstrapped SE in parenthesis. Significance at the 1 percent, 5 percent and 10 percent level is denoted by ***, ** and *.

Table A5
Alternative Set of Instruments. Exchange Rate Instruments.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Second Stage	Log Average Wage			Share non-prod Workers		
Exports/Sales (EXP)	–0.234	–0.230	–0.141	0.107	0.107	0.101
	(0.471)	(0.477)	(0.468)	(0.204)	(0.204)	(0.203)
High Income Exports (HI)	0.323***	0.323***	0.318***	0.128***	0.128***	0.129***
	(0.113)	(0.113)	(0.110)	(0.044)	(0.044)	(0.045)
Log Sales	–	–	0.058***	–	–	–0.004
			(0.020)			(0.007)
Panel B1: First Stage (HI)						
Share BRA Exports * Exchange Rate	0.398***	0.398***	0.398***			
	(0.070)	(0.070)	(0.070)			
Share BRA Sales * Exchange Rate	−0.500***	−0.501***	−0.505***			
	(0.190)	(0.190)	(0.190)			
Log Sales	–	–	0.011			
			(0.017)			
R-squared	0.032	0.032	0.033			
p-value	0.000	0.000	0.000			
Panel B2: First Stage (EXP)						
Share BRA Exports * Exchange Rate	0.028	0.028	0.028			
	(0.021)	(0.021)	(0.021)			
Share BRA Sales * Exchange Rate	−0.330**	−0.330**	−0.333**			
	(0.140)	(0.140)	(0.141)			
Log Sales			0.006			
			(0.009)			
R-squared	0.022	0.022	0.024			
p-value	0.063	0.063	0.061			
Initial Conditions * Year Effects	Yes	–	Yes	Yes	–	Yes
Initial Conditions * Exchange Rate	–	Yes	–	–	Yes	–
Observations	2544	2544	2544	2544	2544	2544
Firms	901	901	901	901	901	901

Dependent variable in second stage: Log Average Wage (columns 1-3) and Share of non-production workers (columns 4-6). Dependent variables in first stage: Exports to high income destinations over Total value of exports (HI), in Panel B1; and Total value of exports over Total value of sales (EXP) in Panel B2. Alternative instruments: Share of Brazil in Sales interacted with the Brazilian exchange rate is used instead of the average exchange rate of all trade partners weighted by share in sales. All regressions include firm and year fixed effects. Bootstrapped SE in parenthesis. Significance at the 1 percent, 5 percent and 10 percent level is denoted by ***, ** and *.