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Exports, Quality, and Product Differentiation: Evidence from Argentine Manufacturing Firms

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"Exportaciones, Calidad, y Diferenciación de Producto: Evidencia de Firmas Manufactureras Argentinas"

Resumen: Este documento explora la relación entre la adopción de certificaciones internacionales de calidad, la diferenciación de producto y el desempeño exportador de firmas manufactureras argentinas. Utilizo datos de una encuesta de firmas manufactureras y registros administrativos de aduana que contienen información sobre el valor total de las exportaciones de cada empresa por tipo de producto y país de destino. Clasifico los productos en diferenciados y no diferenciados, y uso la certificación ISO 9001 como proxy de la capacidad de las firmas de producir productos de alta calidad. Por un lado, muestro que los valores unitarios de exportación a nivel empresa-producto-destino-año son más altos para las empresas con certificaciones de calidad, en promedio. Por otro lado, utilizando la devaluación del tipo de cambio argentino de 2002 como fuente de variación externa de la demanda de exportaciones, encuentro que inicialmente las empresas de alta calidad aumentaron las exportaciones de bienes diferenciados a destinos de altos ingresos más que empresas de baja calidad después de la devaluación. Estos resultados indican que las políticas que promueven la adopción de certificaciones de calidad pueden facilitar la inserción de firmas locales en el mercado exportador y promover el desarrollo de ventaja comparativas en productos diferenciados.

Palabras clave: Certificationes de calidad, diferenciation de productos, exportaciones, heterogeneidad de las firmas

"Exports, Quality, and Product Differentiation: Evidence from Argentine Manufacturing Firms"

Abstract: This paper explores the relationship between quality adoption, product differentiation, and export performance. Through tax identification numbers, I match firm-level survey data to administrative customs records containing information about each firm's total value of exports by product type and country of destination. I classify products into differentiated and non-differentiated, and I use ISO 9001 certification as a proxy for firms' ability to produce high-quality products. First, I show that firm-product-destination-year unit values are higher for high-quality firms, on average. Second, using the 2002 Argentine exchange rate devaluation as a source of variation in export demand, I find that initially high-quality firms increased total export value, export value of differentiated goods to high-income destinations, and investments in R&D more than low-quality firms after the devaluation. These results imply that policies promoting quality adoption may increase firms exports to high-income markets and help develop a comparative advantage in differentiated products.

Keywords: Quality upgrading, product differentiation, exports, firm heterogeneity

Códigos JEL: F10, F14, L10, L15, L60, O12, O14, O19

1 Introduction

Over the last several decades, developing countries have become largely integrated into the world economy while implementing large scale trade liberalizations. Some reforms have focused on the reduction in domestic import tariffs, which exposed domestic producers while reducing input costs; other reforms have lowered costs of accessing export markets (Pavcnik, 2017). Exporting gives firms larger access to markets, which in turn affects firms' decisions regarding technology adoption, innovation, and worker skill composition (Verhoogen, 2008; Bastos and Silva, 2010; Bustos, 2011). In particular, exporting to richer countries is associated with access to sophisticated consumers, encouraging quality-upgrading (Brambilla et al., 2012; Hallak and Sivadasan, 2013). Understanding the underlying factors that enable firms to succeed in the export market is challenging and essential for policy design.

In Argentina, economic instability has historically discouraged long-term investment, and a favorable exchange rate has been the main determinant of the manufacturing exports competitiveness. In the 1990s, the manufacturing industry was negatively affected during a period of trade opening and exchange rate appreciation. In the five years that followed a sharp exchange rate devaluation in 2002 (the peso depreciated 120 percent in real terms), the manufacturing sector growth rate was about 8 percent (Frenkel and Rapetti, 2010).

This macroeconomic volatility has hindered export-led growth of the manufacturing sector, making firms' entry and survival in export markets virtually impossible. For instance, high relative wages prevented the country from insertion into manufacturing global value chains (GVCs) cost-effective sources of unskilled labor, as many other developing countries did. In this context, some research focuses on an alternative insertion strategy in the GVCs that involves policies promoting production of high-quality consumer goods with non-standard attributes that are less sensitive to relative price changes (González et al., 2012; Artopoulos et al., 2013; Atkin et al., 2017).

This paper explores the relationship between quality adoption, product differentiation, and export performance, using a panel of Argentine manufacturing firms over 1994-2006.

My analysis has two main objectives. I provide empirical evidence on the differences in skill utilization, innovation, and product differentiation between domestic producers and exporters by destination. Moreover, I examine whether firms' investments in quality upgrading are associated with a better export performance in the event of a positive shock to export demand.

Through tax identification numbers, I match firm-level survey data to administrative customs records containing information about firms' total value of exports by product and country of destination. Combining these two sources of data, I construct a unique dataset that allows me to define measures of quality at product, destination, and firm level. First, using an 8-digit aggregation level in customs nomenclatures, I classify products into differentiated and non-differentiated. Second, I aggregate countries into two groups according to their income level to examine whether that high-income countries have a higher quality valuation. Third, I use ISO certification as a proxy for firms' ability to produce high-quality products combined with its ability to signal potential customers that the firm implements high-quality business practices (Bernini et al., 2017).

For each firm in the panel, I know whether the firm exported, how many and what type of products it exported (and at what price), and where it exported to. This data allows me to build on previous work claiming "what you export matters" (Hausmann et al., 2007) and "where you export matters" (Brambilla et al., 2012; Bastos and Silva, 2010). Using the information on whether firms have obtained quality international certifications, I explore "product productivity", or the ability to develop high-quality products, which provides an additional dimension of firm heterogeneity besides process productivity that is usually capture by firms' size (Hallak and Sivadasan, 2013; Atkin et al., 2017).

In the first part of the analysis, I show that firm-product-destination-year unit values are higher for high-quality firms, conditional on product and destination. In the second part of the analysis, I study firm-level responses an to economic shock, using the 2002 Argentine exchange rate devaluation as a source of variation in export demand. Using a difference-in-

difference empirical approach, I find that initially high-quality firms increased total export value, export value of differentiated goods, and investments in R&D more than low-quality firms after the devaluation.

In the intensive margin, I find that high-quality firms increased their total export value by 18 percent more than low-quality firms. Moreover, these firms increased their exports of differentiated goods by 20 percent, and their exports of differentiated goods to high-income destinations by 25 percent more than low-quality firms. In the extensive margin, I find that firms with ISO certification increased both the number of export destinations and the number of differentiated products compared to non-ISO certified firms. Finally, high-quality firms had significantly higher investment in R&D compared to low-quality firms. However, firms with ISO decreased the number of skilled workers compared to no-ISO firms after the shock.

This paper is related to the trade literature in three main ways. First, while it has already been established that when export opportunities arise, firms respond by adjusting their skill composition (Brambilla et al., 2012), investing in technology (Bustos, 2011), and/or upgrading their quality (Verhoogen, 2008; Medina, 2015), the effect of these adjustments on subsequent firm performance is less evident. This paper adds to this literature assessing whether firms' upgrading decisions actually pay off in the medium-term. In particular, it explores whether firms that adopted an internationally known quality certification in the years previous to a positive competitiveness shock were able to increase their exports in the intensive and extensive margin more, on average.

Second, it elaborates upon the theory of how export destinations affect firm behavior regarding quality adoption, skill utilization, and R&D investments (Bastos and Silva, 2010; Hummels and Skiba, 2004; Manova and Zhang, 2012). The evidence suggests that exporting to high-income countries affects firm behavior because those destinations have higher quality valuation (Hallak, 2006, 2010) and set strict quality standards (Maskus et al., 2005). To build on this, I use Rauch (1999) product classification into differentiated and non-differentiated

goods. Differentiated goods are those not traded on an organized exchange or listed in reference manuals. By classifying goods, I not only have information on export destinations, but also on the type of product each firm exports to these destinations. In this way, we can better assess if exporting to high-income destination is per se associated with firm behavior regarding quality, or if it actually depends on the type of product each firm is exporting to those destinations.

Third, it is also related to the literature that emphasizes the role of firm-level determinants of trade. While work in international trade has developed single-attribute models with productivity in its standard form as the main determinant of success (Bernard et al., 2003; Melitz, 2003; Chaney, 2008; Arkolakis, 2010), a growing recent literature has turned its focus to another dimension of productivity, the ability to produce quality with low variable costs (Kugler and Verhoogen, 2012; Hallak and Sivadasan, 2013). The latter dimension of productivity might be a relevant source of firm heterogeneity to introduce into trade models for developing countries for a number of reasons. For example, upgrading production processes to improve quality might lead to product differentiation, which potentially raises the non-price competitiveness of a country's exports. Artopoulos et al. (2010) find that differentiated goods exported by Argentina to OECD countries are less elastic to price changes compared to non-OECD countries. In order words, exports to developed countries tend to be more stable and less sensitive to macro policy.

The remainder of this paper is organized as follows. The next section describes the data. Section 3 presents empirical analysis. In Section 3.1, I present some descriptive statistics to characterize the firms in my sample. I compare exporters and non-exporters, and I also show mean differences between exporters to high- and low-income destinations. In Section 3.2, I show the relationship between quality upgrading and exported unit values. Section 3.3 explores the relationship between ISO certification and export performance, using the Argentine exchange rate devaluation of 2002 as source of plausibly exogenous variation in export demand. Section 4 concludes.

2 Data

In this section, I describe the two main sources of data that I use in this paper: a firm survey and administrative custom records.

2.1 Firm-level data

To obtain information about firm-level characteristics of Argentina's manufacturing sector, I use the "Encuesta Nacional de Innovación y Conducta Tecnológica de las Empresas Argentinas" (ENIT) or National Survey on Innovation and Technological Behavior of Argentinian Firms, conducted by the Instituto Nacional de Estadística y Censos (INDEC), the Argentinian government statistical agency.

I use two rounds of the ENIT that cover periods 1998-2001 and 2002-2004, and collect information on sales, exports, employment by level of education, spending on R&D and capital goods, patent acquisition, quality certifications, and industry affiliation at 5-digit level ISIC Revision 2 Classification. In each round, the ENIT surveyed approximately 1,600 manufacturing firms; however, the sample of firms changed from round to round (with no information on firm entry or exit). Because I am interested in analyzing, for a given firm, the production decisions and subsequent export performance, I keep firms that are present in both rounds of the survey and obtain a panel of 1,111 manufacturing firms.

The ENIT has information on employment by four levels of educational attainment: basic, technical, college, and college graduates in specific fields such as in engineering, chemistry, physics, math, etc.). I use this information to construct measures of skill intensity: unskilled are workers who have not graduated from high-school, while skilled workers are college graduates in any field plus tertiary and high school education graduates.[1] Table A.1 presents the share of skilled and unskilled workers by sector of activity.

[1]Unfortunately, the category of technical education does not distinguish between high school graduates with no further education and high school graduate who also completed some tertiary education. College graduates completed 5 to 6 years of education after high school, while tertiary graduates completed 3 years of education after high school.

I use initial firm size in terms of the logarithm of total number of workers, as a proxy of initial productivity. The survey lacks information on value added and capital stock, making it impossible to estimate a measure of productivity using the residual of the production function.[2]

2.2 Product-level data

Using the firms' tax identification number, I match the 1111 firms from the ENIT with Administrative Customs data for the period 1994-2006. Customs data contains annual records with a detailed 8-digit level product classification, sector, country of destination, total value of exports, and units. Table 1 presents the export value and share over total exports of the eight main countries of destination of the firms in my sample (i.e., Brazil, Chile, China, United States, Italy, Netherlands, Uruguay, Spain). These countries represent more than half of the exports during the period. It is worth noting that four out of these eight main destinations of Argentina's exports in this sample of manufacturing firms are high-income countries (United States, Italy, Netherlands, and Spain) and two are upper-middle-income countries (Chile and Uruguay). The remaining two countries (Brazil and China) belong to the low-middle-income category as classified by the World Bank at the time.

[2]The ENIT has two main caveats. First, survey questions are different between rounds, hence not all the same data is available in every round. For example, information on patents and quality certifications is only collected though 1998-2001.[3] Second, the survey contains annual information on some variables (i.e., for all the years covered within each round), while data on other variables is only available on the first and last year of each round. For example, information on sales and exports from the ENIT is available only for 1998, 2001, 2002, and 2004. I address the latter by using information on exports from the customs records, which are available at an yearly frequency. Since export data from customs records is available for every year and it comes from administrative data, as opposed to reported data in the ENIT, I chose to use only data on exports from the former data source. Then, I decided not to use data on sales to avoid any congruence problem with value of sales and value of exports since they come from different sources.

2.3 Measures of Quality

2.3.1 Product differentiation

To divide products into differentiated and non-differentiated, I use Rauch (1999) 6-digit product-level classification scheme, which classifies products in three types: traded on an organized exchange (i.e., homogeneous goods), reference priced (i.e., not traded in organized exchanges but have reference prices in specialized publications), and differentiated products. I define non-differentiated products grouping goods traded in organized exchange and reference priced goods.

Prior work uses country of destination to establish which firms have a higher share of high-quality exports. By adding this standard product classification, I provide some more insight into the share of differentiated products exported to a high-income destinations.

2.3.2 Destinations - quality valuation

I use the World Bank's country classification to aggregate destinations into two groups according to their income level as in Brambilla et al. (2012). The high-income group definition includes high-income OECD countries, high-income non-OECD countries, and upper-middle-income countries.[4] Table A.3 shows Argentina's export shares to high-income destinations and Brazil by sector of activity for years 1998, 2001, and 2004.

Figure 1 shows total export value from a panel of 1,111 firms for the period 1994-2006 by destination income level group based on the World Bank country classification. Brazil is a major trade partner of Argentina. The country represents around 20 percent of export share on average from the sample of firms during that period, thus exported values to this destination are shown separately.[5] The figure shows how Argentine exports increased after 2002, especially to low-middle-income and upper-middle-income destinations. It is also possible to observe the drop in exports to Brazil and low-middle-income countries, while exports to

[4] See countries in each group in Table A.4.

[5] I use the World Bank's country classification in 2001; since then Brazil has change its income class from low-middle-income to upper-middle-income

OECD high-income countries kept an upward trend in 1999. The decrease in exports to low-middle-income countries might be explain by the fact that Brazil's devaluation in 1999 was a negative shock to Argentina's price competitiveness because Brazilian domestic products become relatively inexpensive. The upward trend in exports to high-income destinations is consistent with these countries having a higher quality valuation and their export demand is less elastic to price changes.

2.3.3 IS0 9001 - International quality certifications

The data collected in the firm-level survey does not have direct measures of product quality, thus I use ISO certification as a proxy of firms' quality standard to divide firms in high-quality and low-quality in 2001. As any proxy, ISO certification is an imperfect measure of firms' product quality. However, it serves two main purposes.

First, ISO certification serves as a signal to potential international clients that the firm is prepared to attain high-quality production standards. Verhoogen (2008) mentions that it was the common view among Mexican managers is that ISO 9000 was a signal of high product quality even though the certification focuses on the production process, but not the product itself. Moreover, the International Organization for Standardization (ISO) defines ISO 9001 as "a standard that sets out the requirement for a quality management system, helps business and organizations to be more efficient and improve customer satisfaction, and it is useful for organizations of all types, sizes and sectors".

Second, ISO is a measure of "product productivity", defined as the ability to develop high-quality products which provides an additional dimension of firm heterogeneity besides process productivity (Atkin et al., 2017; Verhoogen, 2008; Hallak and Sivadasan, 2013).

Table A.2 presents the share of firms with quality certifications by industry in year 2001.[6] The sectors with a higher share of firms with ISO certification (Column 1) are coke and refined petroleum products (.83), basic metals (.59), electrical machinery (.37), motor vehicles (.43),

[6] An important caveat in the data is not having information about ISO certification acquisition after 2001. Consequently, I am not able to analyze firms' quality upgrading response to the Argentine devaluation.

medical and optical instruments (.38). In Column 2 we can observe that these sectors also present higher shares of sector specific quality certifications (defined in section 2.1.). Finally, Column 3 shows that 0.59 percent of firms have some quality measure, including ISO, sector specific certifications and internal quality controls of their productive process.

3 Empirical Analysis

3.1 Descriptive statistics

In this section, I present some descriptive statistics to characterize the firms in my sample. Out of the 1111 firms and the 14,443 firm-year observations, 75 percent of the firms exported at least 1 of the 13 years, while in a given year, the average share of exporters is 53 percent. The proportion of exporters is higher than what the trade literature typically finds; partly explained by the fact that most of the firms in the survey are located in an export-oriented geographic area of Argentina (Brambilla et al., 2012).

Table 2 presents summary statistics from the combination of firm and customs data for the full sample 1994-2006. In Panel A, I focus on differences in outcomes (employment, skill utilization, quality certifications, and R&D) across firms; in Panel B, I describe the export intensity and export destinations of Argentine firms.

Exporters and non-exporters

Column 1 shows that for all the firms in the sample, the average firm size is 177 workers (the standard deviation is almost 400 implying the the firm size distribution is very spread out), the average share of skilled workers is 0.37, the average share of firms with ISO certification is 0.16, and average investment in R&D in half a million AR pesos. Column 2 presents the difference in means in log workers, share of skilled workers, ISO certification, log R&D investment between exporters and non-exporters, controlling for 4-digit industry and year. Relative to non-exporters, exporters are larger by 117%, have more skilled workers, are 14%

more likely to have ISO certification, and invest more in R&D. The average number of destinations is 7.91, while the average number of products (at 8-digit level of disaggregation) exported is 14.5. The average share of differentiated products exported is quite high (0.71), which might be explained by the fact that this is a sample of export oriented manufacturing firms. I only have product-level data on exporters; I cannot compare the difference in mean number of products and the share of differentiated products between exporters and non-exporters.

Exporters by destination and product type

In Columns 3-6, I show mean differences between different subgroups of exporters (by destination and type of product) conditional on exporting. Columns (3) presents the difference in means between firms that export to Brazil and other exporters (conditional on exporting), controlling for 4-digit industry and year. Firms that export to Brazil hire 54 percent more workers, have a higher share of skill, are 15 percent more likely to have ISO certification, invest more in R&D, and export more products to more destinations. However, their share of differentiated products over total goods is slightly lower, on average, relative to other exporters.

Column 4 shows the difference in means between firms that export to at least one high-income destination and other exporters (conditional on exporting), controlling for 4-digit industry and year. Exporters to high-income countries have a higher share of skill and export a higher share of differentiated products. However, they are not statistically different, on average, to the rest of exporters in other of firm-level characteristics. Column 5 presents the difference in means between firms that export at least one differentiated product and other exporters (conditional on exporting), controlling for 4-digit industry and year. Contrary to the subgroup of exporters to high-income destinations (presented in Column 4), mean differences are positive and significant in this case. Finally, Column 6 shows the difference in means between firms that export at least one differentiated product and other exporters

(conditional on exporting to a high income destination), controlling for 4-digit industry and year. All the mean differences are positive and statistically significant in this case.

Columns 4-6 provide some suggestive evidence that, conditional on exporting, distinguishing between product quality (i.e., differentiated versus non-differentiated) is relevant to analyze firms' decisions regarding quality upgrading, skill utilization, and R&D. Moreover, it might also shed light on a dimension of firm productivity not directly associated with size, but with the ability to produce high-quality products (Hallak and Sivadasan, 2013).

3.2 Quality-upgrading and product prices

Firms in the sample are multi-product firms; hence, firms could vary output quality across their products, conditional on ISO certification, using different inputs. The ENIT does not have data on inputs, so I cannot disentangle the different quality across products within a firm in a direct way. Following Manova and Yu (2017), I infer unobserved product quality from observed price and quantity data using customs data. Using the disaggregated product-level data within firms, I show the correlation between firm-product-destination-year exported unit values and different measures of quality available in the firm-survey: ISO certification, sector specific norms, and product differentiation.[7] I estimate the following equation:

$$log(UnitValue_{jidt}) = \alpha + \beta QualityProxy_{it} + \gamma_t + \epsilon_i + \sigma_d + \mu_{ijdt} \quad (1)$$

where j, i, d and t index product, firms, destination and years, respectively. $QualityProxy_{it}$ is a dummy variable that indicates whether the firm has ISO certification, a sector specific norm, or exports differentiated products. The regression includes firm, destination and year fixed effects. Firm fixed effects, ϵ_i, capture unobserved differences across firms. Destination fixed effects, σ_d, account for unobserved price differences depending on destination. Year

[7]Sector-specific quality measures: QS9000, a quality standard for automotive sector valid until 2006, that included ISO 9001 certification; HACCP (Hazard Analysis and Critical Control Points) and GMP (Good Manufacturing Practice) for the food and beverage, and pharmaceutical sectors; and TL9000 a Quality Management System (QMS) for the information and communications technology sector (includes the same principles as ISO 9001).

fixed effects, γ_t, capture time trends in the data. Standard errors are clustered at firm level to allow for correlated shocks within firms over time.

Table 3 presents the estimation results. The three quality measures are positively correlated with firm-product-destination-year log prices (fob export revenue). I only observe product-level data for exporting firms. Therefore, I am not able to compute the unit value of products sold in the domestic market. The coefficient on ISO certification, in Column 1, shows that the price of product j is 6.8 percent higher for firms with ISO relative to the rest of the firms. Column 2 shows that products exported by firms with some sector-specific quality norm are 12.7 percent more expensive on average. Finally, the coefficient in column 3 shows that differentiated products have unit values 73 percent higher than non-differentiated products.

3.3 Quality-upgrading and Export Performance

The statistics reported in Table 2 uncover the basic relationship between exports, export destinations, and product quality. In this section, I study this relationship in more detail using Argentina's exchange rate devaluation from 2002 as a source of plausibly exogenous variation in export demand.

In July 2002, the currency board nominal exchange rate skyrocketed, reaching a peak closed to AR Peso/4 USD. By July 2003, the real exchange rate was 93 percent higher than during the convertibility regime present in the previous decade (Damill et al., 2015). This plausibly exogenous variation in export demand provides an interesting setting for my empirical analysis. Following difference-in-difference approach similar to Verhoogen (2008), I compare high-quality and low-quality firms' export performance before and after the Argentine peso crisis.[8]

[8] Verhoogen (2008) finds that after the Mexican currency devaluation in 1995, initially more-productive plants increased the export share of sales, wages, and ISO 9000 certification more than initially less-productive plants.

I estimate the following equation:

$$Y_{it} = \alpha + \phi ISO_i * Post_t + \gamma_t + \epsilon_i + \mu_{it} \tag{2}$$

where Y_{it} is and outcome variable for firm i at time t. ISO_i is a dummy variable that takes value 1 for a firm that has obtained ISO certification by year 2001 (i.e., predetermined at the time of the currency devaluation). $Post_t$ is a dummy variable that takes value 1 for years 2002-2006. The regression includes year fixed effects, γ_t, and firm fixed effects, ϵ_i. μ_{it} is a mean zero disturbance.

There are unobservable factors that may affect both the decision to upgrade quality and other firm-level outcomes; hence, I do not attach a causal interpretation to the coefficient ϕ. The decision of a firm to obtain ISO certification on its export performance might be intimately related in exporters' profit maximization problem in a framework with endogenous quality choice (Manova and Yu, 2017). Until 2001, other export demand shocks might have influenced firms' decisions to obtain ISO certifications. For example, the Brazilian devaluation in year 1999 might have affected Argentine firms' decision to invest in quality.

Equation 2 allows me to explore whether high-quality firms have a different performance compared to low-quality firms after the exchange rate devaluation, which made Argentine exports more competitive in the export market. In the next subsections, I explore three dimensions of firm performance: the intensive margin (i.e., export value by destination and product type), the extensive margin (i.e., number of products and destinations), and firm behavior regarding investment and labor skill composition.[9]

I interpret the coefficient of interest, ϕ, as a conditional correlation. Each cell in Tables 4, 5, and 6 presents a coefficient that results from estimating Equation 2 separately for each outcome. Column 1 presents the results for every exporting firm, whereas Columns 2-5 disaggregate exporters in non-exclusive subgroups of exporters: firms that export to high-income destinations, to low-income destinations, firms that export differentiated products,

[9]Results show the value of exports at constant prices from year 2000, before the devaluation.

and firms that export differentiated products to high-income destinations.

3.3.1 Intensive margin: Export Performance

Table 4 presents the regression results for the logarithm of total exports, exports of differentiated products, and exports to different destination income groups, as defined above. Column 1 results correspond to all the exporting firms. On average, high-quality firms (i.e., firms that had obtained ISO certification by 2001, before the Argentine devaluation) increased their total export value by 18 percent more than the rest of the firms. Also, these firms increased their exports of differentiated goods by 20 percent more, and their exports of differentiated goods to high-income destinations by 25 percent more than low-quality firms. However, I do not find any significant correlation between high-quality and exports to low- and high-income countries. I take this result as suggestive evidence supporting that destination matters only depending on the type of product exported.

In Columns 2-5, I present the results from the same regression for non-exclusive subgroups of exporters: firms that export to at least one high-income destination, firms that export to at least one low-income destination, firms that export at least one differentiated product, and firms that export at least one differentiated product to at least one high-income destination. Although firms can belong to all of these categories, the aim of this subgroup distinction is to explore whether quality matters more in terms of destination of exports or type of product. The coefficients on the interaction between ISO and the Argentine devaluation dummy for the subgroups of exporters show that, after the shock, quality matters only for low-income exporters and exporters of differentiated products. In particular, these two groups of exporters increased their total exports and exports of differentiated products by 20-22 percent more than the rest of the firms.

This result is consistent with Manova and Yu (2017) characterization of multi-product firms, which organize their production processes reallocating across products might improve firm's productivity and their performance in response to trade reforms or exchange rate move-

ments. Thus, one of the mechanisms that could explain the results above is that low-income exporters were able to signal a "high quality" type to export markets and thus increased their exports. In particular, low-income exporters and exporters of differentiated products to any destination increased their exports of differentiated products by 25-27 percent more than firms with no ISO certification. This mechanism could have relevant policy implications. For example, in the event of a positive competitive shock, firms originally focused on low-income destinations might be able to entry high-income markets either by improving the quality of their production process (which enables them to allocate resources more efficiently to meet new export demand) or by signaling that they can meet the required product quality standards to meet export demand with higher quality valuation.

3.3.2 Extensive margin: Destinations and Products

Table 5 shows the results in levels for number of destinations by income level (top panel) and products by type (bottom panel). I find that firms with ISO had a larger expansion in both the number of export destinations and the number of differentiated products exported, compared to low-quality firms. With respect to the former, high-quality firms expanded to one or two new destinations more than low-quality firms, on average. With respect to products, on average, high-quality firms exported between 2 or 3 products more than low-quality firms after 2002.[10]

The type of product that firms with ISO exported more relative to the rest of the firms are differentiated goods. The coefficients on reference priced goods are never significant and the coefficients on goods traded in an organized exchange are significant and negative. This result is relevant if we think that having ISO certification either enables firms to enter new markets with taste for quality in the broad sense, or if multi-product firms that obtain ISO can shift their production line from non-differentiated to differentiated goods more rapidly and efficiently when new export opportunities arise. If these mechanisms are behind the

[10]Mean number of destinations (depending on the exporter subgroup): All (5-6), high-income (4-5), low-income (2). Mean number of products: total (7-9), differentiated (5-6), non-differentiated (1-3).

patterns observed in the data, providing incentives to firms to improve the quality of their production process could potentially prepare these firms to promptly respond to new export market demands when a positive macro shock occurs.

3.3.3 Firms' investment and skill composition

Table 6 shows that high-quality firms had significantly higher investment in R&D compared to low-quality firms after the devaluation. I find no significant correlation with investment in capital goods and unskilled workers hiring. The most puzzling result is the negative and statistically significant correlation between skilled work utilization and having ISO after the shock. However, this result must be taken with caution because the number of observations available reduces dramatically due to the fact that employment questions were only asked in years 1998, 2001 and 2004, thus decreasing the precision of the estimation.

4 Conclusion

This paper explores the link between quality adoption, product differentiation, and export destinations. Through tax identification numbers, I match firm-level survey data to administrative customs records and construct an unique dataset with information product-firm-destination-year level in Argentina. I classify products into differentiated and non-differentiated, and I use ISO 9001 certification as a proxy for firms' ability to produce high-quality products. First, I show that firm-product-destination-year unit values are higher for high-quality firms on average. Second, using the 2002 Argentine exchange rate devaluation as a source of variation in export demand, I find that initially high-quality firms increased total export value, export value of differentiated goods, and investments in R&D more than low-quality firms after the devaluation.

This paper contributes to the trade literature in three main ways. First, the Argentine devaluation episode provides plausibly exogenous variation to export demand, which allows

me to empirically explore the relationship between firms' decisions to upgrade quality on their subsequent export market performance. Second, it builds on the literature studying differences in quality valuation across destinations further exploring the link between export destination, product differentiation and quality adoption. I find that quality is not positively correlated with export destination per se, but with the type of product firms export to high-income destinations. Third, it provides further empirical evidence on a dimension of firms' productivity that is not fully captured by firm size, that is, the ability to produce high-quality products. The results presented in this paper are relevant because they add empirical evidence to the literature that deals with firm heterogeneity. Measuring either firms' quality or productivity is an important challenge in the trade literature. Therefore, the positive and significant correlation between having ISO quality certification and product unit values is a reasonable starting point to address this difficulty.

Policies focused on helping firms establish and sustain their presence in foreign markets seem to be key to foster export growth and economic development. The main takeaway of my analysis is that policies promoting quality adoption may make firms more competitive in the export market and help develop a comparative advantage in differentiated products that are less sensitive to relative price changes. Moreover, international certifications may reduce information asymmetries in the export market acting as a signal of good business practices.

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5 Figures

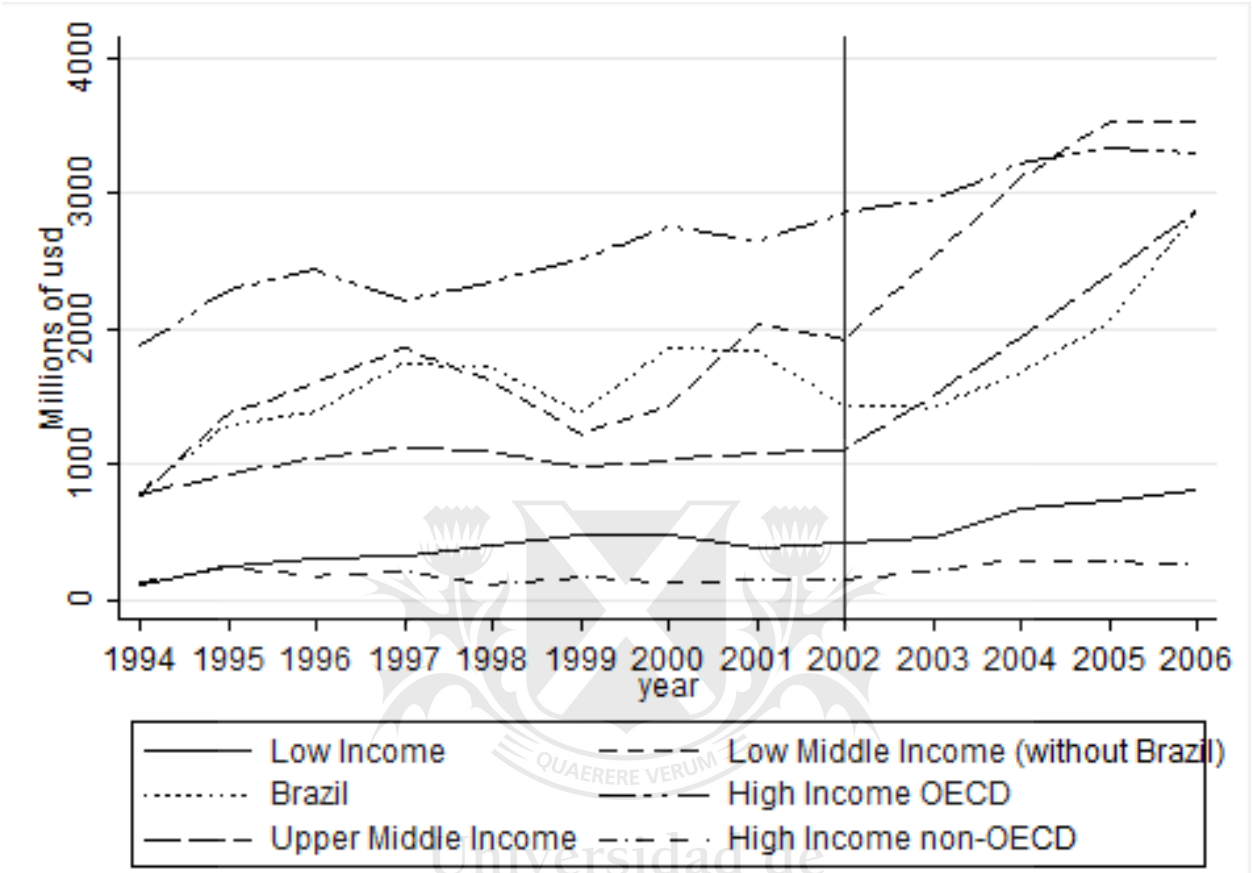

Figure 1: Total Exports by World Bank Income Class

6 Tables

Table 1: Main Destinations of ENIT Firms Exports: Values and Shares

	1994		1998		2002		2004		2006	
	Value	Share	Value	Share	Value	Share	Value	Share	Value	Share
Brazil	791.29	0.18	1712.65	0.23	1426.99	0.18	1678.61	0.15	2867.52	0.21
Chile	219.53	0.05	379.31	0.05	499.56	0.06	741.48	0.07	1084.15	0.08
China	91.18	0.02	255.53	0.03	516.53	0.07	1223.26	0.11	1051.01	0.08
United States	370.20	0.08	541.87	0.07	608.28	0.08	899.32	0.08	1008.54	0.07
Italy	162.53	0.04	269.02	0.04	381.67	0.05	429.12	0.04	295.31	0.02
Netherlands	360.61	0.08	414.36	0.06	453.05	0.06	400.00	0.04	464.24	0.03
Uruguay	179.45	0.04	242.48	0.03	138.22	0.02	224.69	0.02	285.84	0.02
Spain	149.70	0.03	228.17	0.03	427.97	0.05	463.09	0.04	454.01	0.03
Total main destinations	2324.49	0.52	4043.39	0.55	4452.28	0.56	6059.56	0.55	7510.62	0.55
Total all destinations	4479.49	1.00	7316.31	1.00	7886.06	1.00	10967.06	1.00	13729.15	1.00

Notes: Own calculations based on firm data from ENIT and customs records. Table shows export values (millions USD FOB) and share over total exports for selected years.

Table 2: Descriptive Statistics from Firm Survey (ENIT) and Customs Records (1994-2006)

	(1)	(2)	(3)	(4)	(5)	(6)
	All Firms	Exporters All	Exporter Brazil	Exporter High-income	Exporter Differentiated	Exporter Diff High-income
Panel A						
Workers	177.76	1.171***	0.532***	-0.0399	0.916***	0.924***
	(398.590)	(0.0523)	(0.0700)	(0.0651)	(0.134)	(0.232)
Skill Share	0.371	0.0970***	0.0480***	0.0287**	0.102***	0.106***
	(0.303)	(0.0109)	(0.0156)	(0.0142)	(0.0258)	(0.0395)
ISO 9001	0.158	0.141***	0.155***	-0.0101	0.143***	0.140***
	(0.361)	(0.00581)	(0.00907)	(0.00896)	(0.0143)	(0.0199)
R&D	0.51171	3.680***	1.981***	0.0510	2.449***	2.850***
	(2.536)	(0.139)	(0.204)	(0.197)	(0.355)	(0.496)
Panel B						
Destinations		7.91	0.952***	0.00421	0.578***	0.611***
		(9.342)	(0.0200)	(0.0214)	(0.0423)	(0.0559)
Products		14.51	0.800***	0.0154	1.194***	1.306***
		(22.832)	(0.0253)	(0.0252)	(0.0357)	(0.0492)
Share of Differentiated		0.710	-0.0197***	0.00947*	0.568***	0.563***
Products		(0.34984)	(0.00622)	(0.00568)	(0.00762)	(0.0106)
Observations	14,443	7,664	4,631	4,402	6,812	4,402

Notes: Own calculations based on firm data from ENIT and customs records. Differentiated products defined using Rauch's (1999) classification scheme. High income exporters (i.e. high income OECD, high income non-OECD and upper middle income) using World Bank classification. Column (1): All firms. Average number of workers, average share of skilled workers, average share of firms with ISO certification, average investment in R&D in million of Argentine pesos. Column (2): Difference in means in log workers, share of skilled workers, ISO certification, R&D investment between exporters and non-exporters, controlling for 4-digit industry and year. Average number of destinations, average number of products exported, average share of differentiated products exported over total products. Column (3): Difference in means between firms that export to Brazil and other exporters (conditional on exporting), controlling for 4-digit industry and year. Column (4): Difference in means between firms that export to at least one high income destination and other exporters (conditional on exporting), controlling for 4-digit industry and year. Column (5): Difference in means between firms that export at least one differentiated product and other exporters (conditional on exporting), controlling for 4-digit industry and year. Column (6): Difference in means between firms that export at least one differentiated product and other exporters (conditional on exporting to a high income destination), controlling for 4-digit industry and year.

Table 3: Correlation between Product's Price and Firms' Quality Measures

	Dependent Variable: $log(UnitValue)$		
	(1)	(2)	(3)
ISO Certification	0.0678***		
	(0.0114)		
Sector-specific Norm		0.127***	
		(0.0163)	
Differentiated Product			0.730***
			(0.00813)
Observations	243,166	243,166	239,800
Number of CUIT	866	866	866

Notes: This table shows Equation 1 estimation results. The sample includes all exporting firms in the firm-level survey that were match to customs records through tax identification numbers (i.e., CUIT). All regressions include firm, year, and destination fixed effects. Robust standard errors in parenthesis.

Table 4: Exports by Destination's Income and Product Type (1994-2006)

Subgroups of exporters by destination and product (columns)					
	All	High-income destinations	Low-income destinations	Differentiated products	Differentiated products to high-income destinations
	(1)	(2)	(3)	(4)	(5)
Dependent variable (rows): *Log(Exports$_{it}$ by product and destination)*					
Log(total exports)	0.178*	0.175	0.200**	0.227**	0.146
	(0.101)	(0.128)	(0.096)	(0.103)	(0.108)
Observations	7,664	4,402	6,410	6,812	5,833
Log(exports differentiated products)	0.201*	0.183	0.217*	0.201*	0.155
	(0.120)	(0.166)	(0.125)	(0.120)	(0.145)
Observations	6,812	3,982	5,747	6,812	4,981
Log(exports to low-income destinations)	0.161	0.161	0.161	0.183	0.149
	(0.127)	(0.167)	(0.127)	(0.133)	(0.143)
Observations	6,410	3,150	6,410	5,747	4,580
Log(exports to high-income destinations)	0.069	0.158	0.071	0.158	-0.029
	(0.124)	(0.133)	(0.130)	(0.118)	(0.130)
Observations	6,986	4,402	5,734	6,307	5,592
Log(exports differentiated products to high-income destinations)	0.248*	0.177	0.275*	0.248*	0.088
	(0.141)	(0.180)	(0.152)	(0.141)	(0.156)
Observations	5,914	3,908	4,850	5,914	4,728

Notes: All regressions include firm and year (1994-2006) fixed effects. Each coefficient results from estimating equation 2, i.e. regressing each dependent variable on the interaction term: ISO is a dummy = 1 if firm has ISO certification in year 2001. *Post_Arg* is a dummy = 1 in years 2002-2006. Dependent variables in rows 1-5: Row (1): Log total exports. Row (2): log exports of differentiated goods (as classified by Rauch(1999)). Row (3): log exports to low-income countries. Row (4): log exports to high-income countries. Row (5): log exports of differentiated goods to high-income countries. Columns are non-exclusive subgroups of exporters in a given year. Column 1: All exporter firms. Column 2: Firms that export to at least one high-income destination. Column 3: Firms that export to at least one low-income destination. Column 4: Firms that export at least one differentiated good. Column 5: Firms that export at least one differentiated product to a high-income destination. Standard errors clustered at firm-level in parentheses. Note: *** p<0.01, ** p<0.05, * p<0.1

Table 5: Number of products and destinations (1994-2006)

	Subgroups of exporters by destination and product (columns)				
	All	High-income destinations	Low-income destinations	Differentiated products	Differentiated products to high-income destinations
	(1)	(2)	(3)	(4)	(5)
Dependent variable (rows): Y_{it}					
Panel A: Destinations by income-class					
All	1.271**	1.927***	0.996	1.302**	1.534**
	(0.556)	(0.679)	(0.614)	(0.568)	(0.649)
Low-income	0.807***	1.159***	0.683**	0.809***	1.079***
	(0.306)	(0.380)	(0.336)	(0.312)	(0.358)
High-income	0.464	0.768**	0.313	0.492*	0.455
	(0.284)	(0.341)	(0.315)	(0.292)	(0.329)
Panel B: Products by level of differentiation					
All	2.335*	2.826*	2.575*	2.323*	3.518**
	(1.299)	(1.644)	(1.401)	(1.393)	(1.459)
Differentiated	2.445**	2.939**	2.695**	2.453**	3.477***
	(1.155)	(1.482)	(1.243)	(1.246)	(1.285)
Reference priced	0.051	0.036	0.056	0.032	0.207
	(0.247)	(0.286)	(0.276)	(0.260)	(0.300)
Organized exchange	-0.193**	-0.141	-0.218**	-0.187*	-0.203*
	(0.097)	(0.118)	(0.107)	(0.101)	(0.119)
Observations	7,664	4,402	6,410	6,812	5,833

Notes: All regressions are in levels and include firm and year (1994-2006) fixed effects. Each coefficient results from estimating equation 2, i.e. regressing each dependent variable on the interaction term: ISO is a dummy = 1 if firm has ISO certification in year 2001. *Post_Arg* is a dummy = 1 in years 2002-2006. Dependent variables in rows: Change in the number of destinations by income group. Number of products classified as Rauch (1999): Differentiated and non-differentiated (referenced priced and traded in organized exchange). Columns are non-exclusive subgroups of exporters in a given year. Column 1: All exporter firms. Column 2: Firms that export to at least one high-income destination. Column 3: Firms that export to at least one low-income destination. Column 4: Firms that export at least one differentiated good. Column 5: Firms that export at least one differentiated product to a high-income destination. Standard errors clustered at firm-level in parentheses. Note: *** p<0.01, ** p<0.05, * p<0.1

Table 6: Firm investments in R&D, Capital Goods, and Skilled Workers

	Subgroups of exporters by destination and product (columns)				
	All	High-income destinations	Low-income destinations	Differentiated products	Differentiated products to high-income destinations
	(1)	(2)	(3)	(4)	(5)
Dependent variable (rows): $Log(Y_{it})$					
Log(Investment in R&D)	0.777*	1.686***	0.666	0.632	1.335***
	(0.448)	(0.559)	(0.489)	(0.466)	(0.498)
Observations	4,160	2,449	3,442	3,733	3,175
Log(Investment in capital goods)	-0.621	-0.425	-0.584	-0.604	-0.277
	(0.494)	(0.655)	(0.534)	(0.518)	(0.571)
Observations	2,989	1,762	2,481	2,674	2,288
Log(Skilled workers)	-0.368***	-0.491**	-0.398***	-0.447***	-0.281
	(0.138)	(0.222)	(0.149)	(0.145)	(0.171)
Observations	1,614	936	1,350	1,452	1,235
Log(Unskilled workers)	0.077	-0.019	0.029	0.036	0.223
	(0.144)	(0.269)	(0.157)	(0.155)	(0.171)
Observations	1,596	919	1,328	1,433	1,217

Notes: All regressions are in levels and include firm and year (1994-2006) fixed effects. Each coefficient results from estimating equation 2, i.e. regressing each dependent variable on the interaction term: ISO is a dummy = 1 if firm has ISO certification in year 2001. *Post_Arg* is a dummy = 1 in years 2002-2006. Dependent variables in rows: (1) Log investment in internal R&D; (2) Log investment in capital goods; (3) Log skilled workers; (4) Log unskilled workers. Columns are non-exclusive subgroups of exporters in a given year. Column 1: All exporter firms. Column 2: Firms that export to at least one high-income destination. Column 3: Firms that export to at least one low-income destination. Column 4: Firms that export at least one differentiated good. Column 5: Firms that export at least one differentiated product to a high-income destination.Standard errors clustered at firm-level in parentheses.

A Appendix

Table A.1: Share of Skilled and Unskilled Workers by Industry

	Skilled share	Unskilled share
Food and beverage	0.38	0.62
Tobacco	0.43	0.57
Textiles	0.33	0.67
Apparel	0.37	0.63
Leather and leather products	0.25	0.75
Wood, cork and paper products	0.28	0.72
Paper and paper products	0.44	0.56
Publishing, printing, media	0.68	0.32
Coke and refined petroleum products	0.81	0.19
Chemicals and chemical products	0.62	0.38
Rubber and plastic products	0.41	0.59
Other non-metallic mineral products	0.33	0.67
Basic metals	0.38	0.62
Metal products	0.36	0.64
Machinery and equipment n.e.c	0.44	0.56
Electrical Machinery	0.39	0.61
Radio, TV and communications equipment	0.65	0.35
Medical, precision and optical instruments	0.63	0.37
Motor vehicles	0.50	0.50
Other transport equipment	0.31	0.69
Furniture	0.37	0.63

Notes: Firm data from ENIT Survey. Table shows share of skilled and unskilled workers in each sector for the period (1994-2006). Skilled workers are college graduates in any field plus tertiary and high school graduates. Unskilled workers are those who have not graduated from high school.

Table A.2: Share of firms with Quality certifications in 2001

	ISO9001 Share	Sector-specific Share	Any norm Share	Number of firms
Food and beverage	0.15	0.20	0.64	209
Tobacco	0.60	0.00	0.80	5
Textiles	0.07	0.01	0.45	98
Apparel	0.03	0.00	0.24	37
Leather and leather products	0.12	0.03	0.53	34
Wood, cork and paper products	0.17	0.03	0.47	30
Paper and paper products	0.24	0.00	0.38	29
Publishing, printing, media	0.11	0.00	0.42	64
Coke and refined petroleum products	0.83	0.17	1.00	6
Chemicals and chemical products	0.28	0.20	0.76	101
Rubber and plastic products	0.28	0.07	0.67	57
Other non-metallic mineral products	0.22	0.05	0.67	63
Basic metals	0.59	0.13	0.78	32
Metal products	0.34	0.07	0.55	58
Machinery and equipment n.e.c	0.28	0.08	0.65	95
Electrical Machinery	0.37	0.11	0.78	46
Radio, TV and communications equipment	0.36	0.14	0.71	14
Medical, precision and optical instruments	0.38	0.06	0.56	16
Motor vehicles	0.43	0.28	0.74	47
Other transport equipment	0.07	0.03	0.38	29
Furniture	0.08	0.00	0.38	40
Total	0.22	0.10	0.59	1111

Notes: Firm data from ENIT Survey. Table shows share of firms with quality certifications in each sector in year 2001. Column (1): firms with ISO certification; Column (2): firms with sector specific quality certifications: QS900, HACCP, GMP, TL9000 (see Data section for specific definitions); Column (3): firms with any quality measure (includes firms in columns (1) and (2) plus firms that have interal quality controls of the productive process).

Table A.3: Export shares: to High-income destinations and Brazil

	High- income			Brazil		
	1998	2001	2004	1998	2001	2004
Food and beverage	0.51	0.52	0.48	0.14	0.10	0.06
Tobacco	0.62	0.66	0.61	0.04	0.19	0.06
Textiles	0.36	0.51	0.58	0.34	0.14	0.10
Apparel	0.80	0.67	0.60	0.10	0.01	0.28
Leather and leather products	0.65	0.73	0.59	0.20	0.10	0.11
Wood, cork and paper products	0.48	0.49	0.55	0.47	0.37	0.30
Paper and paper products	0.51	0.73	0.69	0.21	0.05	0.08
Publishing, printing, media	0.23	0.69	0.60	0.66	0.14	0.14
Coke and refined petroleum products	0.34	0.48	0.45	0.30	0.32	0.26
Chemicals and chemical products	0.44	0.46	0.35	0.32	0.30	0.33
Rubber and plastic products	0.38	0.50	0.53	0.48	0.37	0.32
Other non-metallic mineral products	0.48	0.57	0.62	0.18	0.07	0.08
Basic metals	0.75	0.73	0.80	0.10	0.10	0.09
Metal products	0.32	0.37	0.49	0.53	0.46	0.17
Machinery and equipment n.e.c	0.44	0.25	0.49	0.32	0.33	0.39
Electrical Machinery	0.32	0.47	0.55	0.52	0.40	0.23
Radio, TV and communications equipment	0.24	0.15	0.18	0.65	0.79	0.70
Medical, precision and optical instruments	0.64	0.45	0.54	0.28	0.26	0.22
Motor vehicles	0.15	0.25	0.38	0.84	0.73	0.53
Other transport equipment	0.77	0.84	0.58	0.20	0.14	0.32
Furniture	0.25	0.23	0.22	0.57	0.49	0.54

Notes: Own calculations based on firm data from ENIT and customs records. High income exporters (i.e. high income OECD, high income non-OECD and upper middle income) using World Bank classification. Table show participation of High income destinations (columns 1-3) and Brazil (columns 4-6) in total exports of each industry for years 1998, 2001, 2004.

Table A.4: World Bank Income-class 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'Ivoire, 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

Source: World Bank and Brambilla et al. (2012).