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Input-trade liberalization and firm export decisions: Evidence from Argentina

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ABSTRACT

Trade openness contributes to the diffusion of the modern technologies embodied in imported intermediate goods, which play a central role in the economic growth of developing countries. This paper investigates the micro-economic effects of input-trade liberalization. Previous work has found positive effects of access to foreign inputs on firm performance. If the availability of imported intermediate goods yields firm productivity gains, we would also expect a positive effect of input-trade liberalization on firm export decisions. This paper contributes to this literature by looking at the relationship between changes in input tariffs and within-firm changes in export status. Using detailed firm-level data from Argentina, I demonstrate that the probability of entering the export market is higher for firms producing in industries that have experienced greater input tariff reductions. These empirical findings are robust to alternative specifications that control for other trade-policy reforms, and industry and firm characteristics.

1. Introduction

Globalization has been characterized by a significant increase in world imports. Falling tariff and non-tariff barriers, as well as lower transportation costs, have produced steady growth in the trade of intermediate goods. This has been especially the case in developing countries, which are very dependent on foreign technology. The endogenous-growth literature has provided theoretical arguments for the role of foreign inputs in producing efficiency gains and economic growth (Coe and Helpman, 1995; Ethier, 1979, 1982; Grossman and Helpman, 1991; Markusen, 1989; Rivera-Batiz and Romer, 1991). Given their predominant role in international trade, the analysis of the effects of access to foreign inputs on firm performance has become key to the understanding of the micro-determinants of economic growth in developing countries.

Recent empirical work has considered the relationship between imported intermediate goods and firm productivity gains (Amiti and Konings, 2007; Bas and Strauss-Kahn, 2011; Halpern et al., 2009; Kasahara and Rodrigue, 2008; Schor, 2004). This literature has highlighted three main channels through which input liberalization affects firm performance: (i) the reduction of production factor costs; (ii) access to new imported input varieties; and (iii) access to higher-quality inputs.

If access to foreign intermediate goods allows firms to reduce their marginal costs, we should also expect a positive effect on their export decisions. The export-selection effect of the most efficient firms into the export market has been well-documented in the empirical literature.[1] The goal of this paper is to look at the relationship between firms export decisions and the availability of imported intermediate goods through input-trade liberalization in a developing country. My empirical analysis is based on firm-level data from Argentina over the 1992–1996 period. I focus on the Argentine process of input-tariff liberalization over the 1990s. To the best of my knowledge, this is the first attempt to relate input-tariff reductions to the increased ability of firms to access export markets using detailed firm-level data.

One important concern that arises when addressing this question is how to deal with the potential reverse causality between the imports of intermediate goods and firms' export behavior. In general, firms which sell their goods in foreign markets benefit from direct links with foreign suppliers of intermediate goods. To establish the causal link between the availability of imported intermediate goods and export participation, I rely on the unilateral trade reform that took place in Argentina in 1991. At the beginning of the 1990s, import-

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[1] For empirical evidence, see Roberts and Tybout (1997), Clerides et al. (1998), Bernard and Jensen (1999), and Alvarez and Lopez (2005). Recent developments in the theoretical literature have suggested export xed costs and heterogeneous firm characteristics explain why only a subset of the most productive firms are able to export (Melitz (2003) and Bernard et al. (2003)).

substitution policies were at the core of the electoral campaign of the new government: tariff liberalization, which differed across sectors, was therefore unpredictable from the perspective of Argentinean firms. I moreover provide some additional evidence that input-tariff changes were not related to initial firm characteristics. I then exploit this exogenous variation in input tariffs across 4-digit-SIC industries to identify the effect of the changing availability of foreign intermediate goods on firms' export decisions.[2]

The results provide new evidence on the effects of input-tariff liberalization on firms export choices in developing countries. Our main findings are as follows. First, the firms producing in industries with the largest falls in input tariffs experienced the greatest increase in their probability of entering the export market. A 10 percentage-point fall in input tariffs is estimated to produce a 6% increase in the probability of exporting for the average firm, with an analogous figure of around 8% for the average importing firm. This finding is consistent with a second result: firms' export-sales shares are positively correlated with input-tariff liberalization. In our preferred specification, using a random-effects Tobit model to capture the censored nature of the dependent variable, a 10 percentage-point reduction in input tariffs induces a 3% expansion of export shares for the average firm, and a rise of 5% for the average initial non-exporting firm. Input-trade liberalization then seems to increase export profitability, allowing more firms to become exporters.

These findings are robust to specifications which control for industry characteristics that could be related to tariff changes and might change over time. I explicitly take into account the effect of other trade-policy reforms that occurred over this period such as the harmonization of tariffs within MERCOSUR countries, including the output-tariff changes in Brazil, Paraguay and Uruguay with respect to Argentina which also represented increased export opportunities for Argentinean firms. I also control for Argentina's tariffs on the goods of its MERCOSUR trading partners, and observable firm characteristics such as firm size, productivity and skill intensity.

As an extension, I investigate whether the effect of input-trade liberalization on export participation differs across firms according to initial firm size.[3] I find that medium-sized firms benefit the most from input-trade liberalization in terms of entry into the export market. This is in line with heterogeneous-firm trade models, and with the findings in Bustos (2011). Finally, I show that input-trade liberalization affects not only firms' decisions to use foreign intermediate goods, but also domestic sales, investment and technology spending.

This paper contributes to the recent growing empirical literature on the role of foreign intermediate goods in determining firm performance. The work of Goldberg et al. (2010) on India's trade liberalization finds that firms producing in industries with the greatest fall in input tariffs have a more significant increase in their ability to manufacture new domestic products. Recently, Bas and Strauss-Kahn (2011), using French firm-product level data, find that importing more varieties of foreign inputs increases firm TFP and also the number of exported varieties. Using firm-level data for different developing countries, a number of pieces of work find that the availability of foreign inputs improves firm productivity. Halpern et al. (2009) for Hungary and Kasahara and Rodrigue (2008) for Chile find that the use of foreign intermediate goods contributes to greater growth in firm productivity. Along the same lines, Schor (2004) for Brazil and Amiti and Konings (2007) for Indonesia show that lower input tariffs boost firm total factor productivity.

My findings also complement recent work on the effects of trade reform on firms' technology and quality-upgrading decisions. Using Mexican firm-level data, Verhoogen (2008) finds that firms upgrade the quality of their exports in response to more profitable export opportunities following an exchange-rate devaluation. Bustos (2011) shows that Brazil's tariff reductions induced Argentinean firms to enter the export market and upgrade their technology. Using plant-level data from Mexico, Teshima (2009) finds that trade liberalization via output tariff reductions induced firms to increase R&D. In this paper, I find robust evidence of a complementary channel through which trade reform affects firms' export patterns. My results confirm that input-tariff liberalization allows firms to access the foreign technology embodied in imported inputs, and thereby to increase their efficiency and competitiveness in participating in export markets.

The remainder of the paper is organized as follows. In Section 2, I discuss the main channels through which input-trade liberalization might affect firms' export patterns. Section 3 describes the data and Section 4 presents the trade-policy background and preliminary evidence on the import growth related to Argentina's trade liberalization. Section 5 describes the estimation strategy and the results of the baseline specifications, and Section 6 then explores the robustness of the main results as well as the relationship between input-tariff reductions and other firm outcomes. Lastly, Section 7 concludes.

2. Motivation: the channels via which imported inputs affect export decisions

One of the channels through which international trade encourages economic growth is the diffusion of the modern technologies embodied in imported intermediate inputs. The theoretical and empirical literature has underlined the considerable gains to trade from importing intermediate goods.[4] This is especially the case for developing countries, which benefit the most from the positive technological spillovers associated with imported intermediate goods. Empirical work on micro-level data has evidence that imported intermediate inputs increase firm productivity, which nonetheless depends on the country under consideration.[5]

As the greater availability of imported inputs should increase firm productivity, it should also encourage exports. In this case, the export-selection process determined by firm productivity will be reinforced by access to foreign intermediate inputs.

The literature proposes at least three explanations for a positive correlation between the availability of foreign intermediate goods and firm performance. I revisit these channels by emphasizing how they may also affect firms' decisions to participate in the export market. The first channel works via prices. Trade liberalization through lower input tariffs reduces the prices of foreign intermediate relative to domestic inputs. This fall in relative factor prices increases firm profitability and competitiveness. In this sense, lower input tariffs

[2] This empirical strategy is similar to those used in Goldberg et al. (2010) to analyze the effects of India's input-trade liberalization on the introduction of new domestic products, and Amiti and Konings (2007) to investigate the effects of Indonesia's trade reform on firm productivity.

[3] The initial size is measured by firms' employment in the first year of the sample 1992.

[4] Theoretical models (Ethier, 1979, 1982; Grossman and Helpman, 1991; Markusen, 1989; Rivera-Batiz and Romer, 1991;) and empirical work using aggregate cross-country data have emphasized a positive relationship between importing foreign intermediate goods and economic growth (Coe and Helpman, 1995; Coe et al., 1997; Keller, 2002).

[5] Using semi-parametric estimation of total factor productivity, Halpern et al. (2009) for Hungary, Kasahara and Rodrigue (2008) for Chile, Amiti and Konings (2007) for Indonesia and Van Biesebroeck (2008) for Zimbabwe, find large positive effects of importing intermediate inputs on firm productivity. On the other hand, Van Biesebroeck (2008) for textile plants in Colombia and Muendler (2004) for manufacturing plants in Brazil, they find no significant effect of imported inputs on firm productivity growth.

reduce the cost of production and allow firms that were previously unable to export to pay the fixed cost of exporting.

The second mechanism concerns variety. Klenow and Rodriguez-Clare (1997) show that trade liberalization increases access to new imported varieties that were previously unavailable. This greater availability of imported varieties allows firms to expand the set of inputs.[6] Along the same lines, Broda et al. (2006) consider how the availability of imported intermediate goods impacts on variety expansion. Goldberg et al. (2010) disentangle the price and variety channels. Using firm-level data for India, they find that new imported input varieties are more important than lower import prices. Halpern et al. (2009) distinguish between the variety and input-quality effects on firm productivity using firm-level data for Hungary. They show that most of the positive effect of importing intermediate goods on firm productivity comes from greater imported input variety. Recently, Smeets and Warzynski (2010), using firm-product level dataset from Denmark, show that imported inputs of different origins (OECD countries and low-wage countries) improve firm TFP. This increased imported variety may also have positive effects on firm's export decisions. The access to modern technology embodied in this new set of inputs allows firms to increase efficiency and the profitability of engaging in exports. Using firm-product level dataset for France, Bas and Strauss-Kahn (2011) test for the complementarity of inputs and technology transfer mechanisms by distinguishing the origin of imports (developing vs. developed countries). They find a significant impact of higher diversification and increased number of imported inputs varieties on both firm's TFP and export scope (the number of exported varieties).

The final mechanism is related to quality upgrading. Imported inputs which are higher quality than domestic intermediate inputs affect firm performance. Kugler and Verhoogen (2009) analyze the quality of foreign relative to domestic inputs using detailed firm-product level data from Colombia. They show that importers use more distinct categories of inputs and pay higher prices for imported inputs than for domestic inputs in the same product category. Lower input tariffs might provide access to high-quality imported inputs, which are particularly useful in the production of high-quality goods for export. Verhoogen (2008) shows that firms in developing countries tend to sell products of higher quality in export rather than in domestic markets.[7] As a result, imported inputs may be related to export participation: the availability of high-quality intermediate goods, which were not available prior to input liberalization, allows firms to produce sufficiently high-quality goods to enter the export market.

Keeping these alternative mechanisms in mind, I consider how lower input tariffs are related to firm export patterns using the unilateral Argentinean trade-liberalization process which took place at the beginning of the 1990s.

3. Data description

The Argentinean firm-level-data we use here come from the "Encuesta Nacional de Innovacion y Conducta Tecnologica (ENIT)" survey of the technological behavior of Argentine Industrial firms. This was conducted by the Argentinean government statistical agency (INDEC: "Instituto Nacional de Estadistica y Censos") in 1997. This database is available for 1992 and 1996. There are about 1640 firms, and the survey is representative of the Argentine manufacturing sector. The sample covers more than 50% of total industrial sales and employment and 55% of exports.[8]

The dataset provides, for each firm, detailed information on value-added, investment, export sales, imported inputs, and skilled and unskilled labor (both production and non-production workers). As capital stock is not available and I only have 2 years of data, I cannot calculate firm total factor productivity: as such I appeal to labor productivity, measured as value-added over total employment, as a proxy for firm efficiency. The survey also provides particular information on innovation activities and technology investment over all the years in the 1992–1996 period. The information on technology investment includes R&D investment, technology transfers, payments for patents, spending on computers and software, and spending on production factors related to innovation. Sector-specific deflators (Isic-3dig Rev2 1992) are applied to value-added, exports, technological measures, materials and investment to analyze the impact of MERCOSUR on firm technology upgrading.

The main empirical analysis is based on a balanced panel of 1403 firms present in both 1992 and 1996, belonging to 4-digit-SIC industries with information on Argentine most favored nation (MFN) import tariffs, and with non-missing information on export sales and employment. I drop firms that are present in 1992 but which subsequently exit, as I do not have 1996 information for them.

Table A in the Appendix summarizes the main firm variables used in the empirical analysis. We split firms in each year by their trade status: neither exporters nor importers, only exporters, only importers and exporter–importer. 30% of firms export and import in 1992, while in 1996 this percentage rises to 44%. The percentage of firms that neither export nor import falls from 38% in 1992 to 27% in 1996, indicating that 11% of firms switched from producing only for the domestic market in 1992 to trade activities in 1996. Similar to previous work, I find that exporters producing with imported products (exporter–importer) perform better than firms which only export or import[9]: the former are larger in terms of employment and domestic sales, are more skill intensive and invest more in technology.

The source of the MFN (Most Favored Nation) import tariffs is the MERCOSUR Agency ("Secretaria del MERCOSUR"). This agency reports the MFN tariffs at HS6 product level, as well as the correspondence to the 4-digit-SIC industry level for MERCOSUR country members in 1992. I use data on Argentina's MFN tariffs with respect to the World. I also use the tariffs in Brazil, Paraguay and Uruguay on Argentinean goods, as these could affect the market access and export decisions of Argentinean firms. Finally, I use data on Argentina's tariffs on the goods of its MERCOSUR partners to take into account explicitly other trade-policy reforms that occurred in the same period, such as the MERCOSUR regional trade-liberalization process.

4. Trade liberalization in Argentina

The main feature of trade reform in Argentina was the substantial trade-integration process of the early 1990s. In this section, I describe the different trade-policy instruments that were applied.

Argentina's trade policy during the 1980s was one of trade protection with an emphasis on import substitution. This trade regime was very restrictive, with high levels of nominal tariffs and import licenses in almost all sectors. A protectionist trade policy was part of the economic

[6] This effect is related to the form of the production technology. See Goldberg et al. (2010) for a general discussion of this effect.

[7] In Mexican firm-level data,he finds that firms upgrade quality for exporting due to greater export opportunities after an exchange-rate devaluation.

[8] We should keep in mind that the Argentinean survey collected retrospective information. This may introduce bias as I rely on information reported by firms in 1997, regarding the 1992–1996 period. It is worth noting that the information provided in the survey was double-checked using previous years' accounts.

[9] See Bernard et al. (2005), Kasahara and Lapham (2007) and Muuls and Pisu (2009) for similar findings.

program aimed at the development of the domestic market and industrialization.

The unilateral trade-liberalization process which started in 1991 was highly unpredictable, since the new government had won the elections on the basis of policies of national self-sufficiency and regulation of the economy. However, in the context of the hyperinflations of 1989 and 1990, the government shifted to market-oriented policies and launched a vast unilateral trade-liberalization process at the end of 1991 as a part of an IMF program. Due to this unexpected shift in the economic policy of the new government, tariff cuts can be considered as an unanticipated trade-policy reform from the perspective of Argentinean firms.

In this context, the tariff reductions were mainly implemented in October 1991. Argentina's average import tariff fell from 12% in 1992 to 9% in 1996, with a wide variation in tariff changes across 4-digit industries. During this period most import licenses were also removed in the manufacturing sector.[10]

At the beginning of the 1990s Argentina also engaged in multilateral trade negotiations that resulted in the regional trade-liberalization process of the MERCOSUR with Brazil, Paraguay and Uruguay. This regional agreement consisted in a gradual process of tariff harmonization between these countries with the goal of establishing an external common tariff rate with third countries. The customs union was finally achieved in 1995 with the adoption of an external common tariff rate. I focus on the variation in Argentina's MFN tariff rates with respect to the Rest of The World from 1992 to 1996, which represents an unpredictable unilateral trade liberalization event, as subsequent changes in tariff rates were dictated by movements in common external MERCOSUR tariffs.

Fig A1 in the Appendix shows the simple (unweighted) average of Argentina's MFN tariffs and tariffs on the goods of its MERCOSUR partners at the 2-digit industry level.[11] As can be seen, Argentina's tariffs on MERCOSUR goods were already much lower in 1992 than those with respect to the world. Crucially, the change across sectors in Argentina's MFN tariffs was not the same as that in its MERCOSUR tariffs. Greater MFN tariff cuts were found in the electronic devices, equipment, TV, computers and plastic industries. For the MERCOSUR partners the largest Argentine tariff reductions were in the textile, transport and machinery industries. Fig A1 underlines the only weak correlation between the changes in Argentina's MFN and MERCOSUR tariffs.

To identify the impact of input-trade liberalization on firms' export decisions, I use input tariffs at the 4-digit-SIC industry level. Input tariffs are computed following the methodology in Goldberg et al. (2010). For each 4-digit industry, s, I generate an input tariff as the weighted average of tariffs on the intermediate goods used in the production of the final goods of that 4-digit industry, where the weights reflect the input industry's share of the output industry's total output share using Argentina's input–output matrix.[12]

I compute input tariffs as $\tau_{st} = \sum_z \alpha_{zs}\tau_{zt}$, where α_{zs} is the value share of input z in the production of output in the 4-digit industry s. Take for example an industry that uses three different intermediate goods in the production of a final good. Suppose that the intermediate goods face a tariff of 5, 10 and 15%, and value shares of 0.10, 0.30 and 0.60, respectively. Using this methodology, the input tariff for this industry is 12.5% ($5\times0.10 + 10\times0.30 + 15\times0.60$).

There is a significant variation in movements of input tariffs by industry over the 1992–1996 period. At the 2-digit industry level, industries that experienced the greatest input tariff cuts are electronic devices, equipment, TV, computers, plastic and non-metallic products. Not surprisingly, at the aggregated 2-digit industry level the change in input tariffs is similar that in output tariffs since industries use intermediate inputs of similar sectors to produce their final goods. However, at the more disaggregated 4-digit industry level there is more variation in input tariffs. The 4-digit industries with the largest fall in input tariff are knitted fabrics, electronic valves and tubes, measuring appliances, and aircraft, amongst others. Input tariffs fell by 4.5% on average. This considerable variation in tariff movements across industries was not only unpredictable but was also only weakly correlated with industry characteristics such as size or skill intensity.[13] I exploit this variation in input tariff cuts across industries below to consider the effect of input-trade liberalization on firm outcomes.

4.1. Tariff changes and import patterns

Before analyzing the relationship between input-trade liberalization and firm exports, I provide some evidence on the growth in imports related to Argentine trade liberalization. Since I expect cuts in input tariffs to affect firms' export decisions and their performance via the availability of foreign inputs, we should see an aggregate rise in the imports of intermediate goods after trade reforms.

A first glance at import data at the HS6 product level shows that imports expanded after the unilateral trade reform was implemented. Since I am interested in the effects of the unilateral liberalization process of October 1991, I focus on the 1992–1996 period. I use HS6 product level data from the BACI (CEPII) and COMTRADE (United Nations) databases. HS6 products are classified into intermediate and final products using the United Nations BEC (Broad Economic Categories) classification to measure import growth by product category.[14] The yearly growth in imports was on average 7% in the post-reform period: between 1992 and 1996, imports rose by 31%. Imports of foreign intermediate goods increased by 32% between 1992 and 1996, while those of final consumption products increased by 21% in the same period.

I now ask whether this import growth was related to the tariff cuts associated with Argentina's trade reform. I adopt a first-difference approach, and regress the change in the log of import values at the HS6 product level on the change in the HS6-level tariff, including year fixed effects. Column 1 of Table 1 shows the results across all products. Tariff reductions led to an overall increase in imports. As can be seen, tariff cuts are mainly associated with greater imports of intermediate inputs (column 2), while the effect on final goods is negative but insignificant (column 3).

Overall then, tariff reductions led to not only an overall increase in imports, but also an increase in imports of intermediate products. I now explore whether Argentinean firms benefited from the availability of foreign inputs by increasing their export participation.

4.2. Exogenous input tariff changes

One of the challenges in the investigation of the relationship between input-tariff reductions and firm export decisions is potential

[10] It is worth noting the two main exceptions which the government decided to maintain import licenses with high tariff rates. In the manufacturing sector, the main exception was the automobile industry, while in the primary sector it was sugar production.

[11] Argentina's tariffs on the goods of its MERCOSUR partners were set to zero in 1995 when they adopted the external common tariff rate. Fig A1 excludes the Tobacco and Oil production industries since there were just two firms producing in the former and 15 firms in the latter. The transport industry does not include automobiles due to the special trade regime which applied to this industry.

[12] Argentina's input–output table is available for the year 1976 and 1997. I use the latest one since it is the closest to our dataset.

[13] Section 4.2 discusses the correlation between input-tariff changes and industry characteristics.

[14] The correspondence tables between hs6 product codes and BEC classification are downloadable from the website of the United Nations Statistics: http://unstats.un.org/unsd/cr/registry/regso.asp?Ci=11&Lg=1.

Table 1
Tariff changes and import patterns at the HS6 product level.

Dependent variable	ΔLog of imports of product p at time t		
	(1)	(2)	(3)
	Full sample	Intermediate goods	Final goods
Δ Output tariffs	−0.763***	−1.157**	−0.352
	(0.283)	(0.474)	(0.594)
Year fixed effects	Yes	Yes	Yes
Observations	17,496	9605	2372
R-squared	0.062	0.044	0.112

Notes: The dependent variable is the change in the log of import values of product p at time t. The table shows the coefficients on tariff changes from product-level regressions in first-differences of the change in the log of import values on the change in output tariffs at the HS6 product level over the period 1992–1996. Δ stands for first differences. Column (1) pools across all products, and columns (2) and (3) report coefficients for the intermediate product and final good subsamples. HS6 products are classified into intermediate and final products using the BEC classification from the United Nations (Broad Economic Categories). Heteroskedasticity-robust standards errors appear in parentheses. Errors are corrected for clustering at the HS6 product level. ***, and ** indicate significance at the 1, and 5% levels respectively.

reverse causality between tariff changes and firms' export patterns which would bias our estimates. The question here is whether industries that increased their exports were also able to lobby for lower import tariffs. In this case, changes in input tariffs could reflect some omitted industry characteristics.

There are two main arguments against this reading of Argentina's trade reforms. First, as noted above, the tariff reductions implemented in October 1991 were very unpredictable from the perspective of Argentinean firms, since the new government won the 1991 elections on a platform of protectionist trade policies. Second, the ensuing tariff changes were only weakly correlated with industry characteristics. The correlation between the tariff cuts and industry size at the 4-digit industry level is 0.18, while that with skill intensity is −0.12. As such, it seems unlikely that firms producing in industries with greater input-tariff cuts were able to lobby for these lower tariffs.

An additional step towards addressing this issue, which makes economic sense, is to see whether tariff changes are exogenous to initial firm characteristics. I provide some evidence that input tariff changes between 1992 and 1996 were uncorrelated with initial firm-level outcomes in 1992, such as export status, export sales, labor productivity, skill intensity, investment and domestic sales. Had the government targeted specific firms or industries via its trade policies, we would expect tariff changes to be correlated with initial firm performance. A similar approach is taken by Goldberg et al. (2010) and Teshima (2009) to test whether tariff changes are exogenous to initial firm characteristics.

Table 2 shows the coefficients on the change in input tariffs (1992–1996) from firm-level regressions of initial firm characteristics on these tariff changes and 2-digit industry fixed effects. There is no statistically significant correlation between firm initial characteristics and the tariff cuts.[15]

5. Estimation strategy

5.1. Input tariff cuts and firm export decisions

Using input-tariff cuts to identify changes in access to foreign intermediate goods across industries, I now investigate the relationship between the availability of imported intermediate goods and firms' decision to enter the export market. I estimate the probability that firm i exports in year t using the following linear probability model:

$$Exporter_{iskt} = \gamma_1 Input\ \tau_{st} + \gamma_2\ Output\ \tau_{st} + \upsilon_{kt} + \mu_i + \epsilon_{iskt} \quad (I)$$

This specification does not explicitly deal with unobserved constant firm and industry heterogeneity. Taking first differences of Eq. (I) eliminates any time-invariant firm and industry unobserved heterogeneity:

$$\Delta\ Exporter_{isk(96-92)} = \gamma_1 \Delta Input\ \tau_{s(96-92)} + \gamma_2 \Delta Output\ \tau_{s(96-92)} + \gamma_3 \Delta Mercosur\ Output\ \tau_{s(96-92)} + \gamma_4 S_s + \Delta\upsilon_k + \Delta\epsilon_{isk} \quad (II)$$

Here $Exporter_{iskt}$ is a dummy variable for firm i producing in 4-digit industry s having positive export sales in year t (1992 or 1996). Δ stands for the first differences between 1992 and 1996, and $\Delta Input\ \tau_{s(96-92)}$ represents the changes in Argentina's MFN input tariffs with respect to the Rest of The World of 4-digit SIC industry s between 1992 and 1996.

As discussed above, input-tariff changes are not correlated with either initial firm characteristics or industry characteristics. To deal with additional concerns of reverse causality and omitted variables, I introduce a number of different control variables at the industry level which may affect firms' export decisions and could reflect the effects of input-tariff changes. I first include the change in Argentina's import tariffs for final goods at the 4-digit-SIC level between 1992 and 1996 ($\Delta Output\ \tau_{s(96-92)}$). I also add the change in Argentinean tariffs on the goods of its MERCOSUR partners (Brazil, Paraguay and Uruguay), as well as the tariffs set by its MERCOSUR partners on Argentinean goods, which could affect the export decisions of Argentinean firms over this period (Δ $Mercosur\ Output\ \tau_{s(96-92)}$).[16] All of the changes-in-tariffs variables measure the difference in tariffs between 1992 and 1996.

Second, since the variable of interest varies at the 4-digit industry level, I control for observable industry characteristics that might be correlated with input tariffs. The vector S_s is a set of 4-digit SIC industry level-s control variables such as size and imported input intensity.[17] This set of industry control variables (S_s) captures different time trends at the 4-digit industry level, as the dependent variable is in differences. However, as the variables of interest (the tariff measures) only vary at the 4-digit industry level, it is not possible to control completely for differential industry trends at this level. Third, all specifications include 3-digit SIC industry level fixed effects, υ_k. Tariffs vary at the 4-digit industry level, so the errors are corrected for clustering across 4-digit industries.

Table 3 shows the estimation results for Eq. (II) by Ordinary Least Squares (OLS). These estimations show the impact of lower input tariffs on the export decisions (1992–1996). In column (1) the coefficient on the input tariff change is negative and significant at the 5% confidence level, indicating that the drop in input tariffs between 1992 and 1996 increased the probability of entry into the export market.

I next include additional 4-digit-SIC industry level variables to control for industry characteristics that vary over time and which could be related to input tariffs. The estimated input tariff coefficient

[15] Similar results hold when I include the change in the output tariff as an explanatory variable in this specification, which does not attract a significant coefficient.

[16] Bustos (2011) shows that Brazil's tariff reductions had a positive effect on Argentinean firms' decisions to enter the export market over the 1992–1996 period.

[17] I use the firm-level data to calculate the 4-digit industry level variables. The median total employment and imported input intensity firm-level measures are calculated for each of the 4-digit industries in our sample in the initial year 1992.

Table 2
Initial firm characteristics in 1992 and tariff changes between 1992 and 1996.

	(1)	(2)	(3)	(4)	(5)	(6)
	Export status$_{i(92)}$	Export sales$_{i(92)}$	Labor productivity$_{i(92)}$	Skill intensity$_{i(92)}$	Investment$_{i(92)}$	Domestic sales$_{i(92)}$
Δ Input $\tau_{s(96-92)}$	−0.039	−3.194	0.114	0.069	−0.578	−0.084
	(0.334)	(2.633)	(0.634)	(0.219)	(1.365)	(0.940)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1403	569	1402	1399	1033	1400
R^2	0.093	0.270	0.203	0.251	0.084	0.178

Notes: The dependent variables in each column are the initial firm-level outcomes in 1992. The table shows the coefficients on changes in input tariffs between 1992 and 1996 from firm-level regressions of initial firm characteristics on tariff changes and industry fixed effects. Firm-level variables are expressed in logarithms. Heteroskedasticity-robust standards errors are reported in parentheses. Errors are corrected for clustering at the 4-digit industry level.

is robust to the inclusion of MFN tariffs for final goods set by Argentina (column 2). This implies that input tariff changes are not picking up the effect of changes in output tariffs. Moreover, I propose a simple way of testing whether the observed effects of Argentinean input-tariff reductions on export participation are instead driven by the regional trade negotiations over tariff harmonization within MERCOSUR. In column (3), I introduce the change in tariffs set by MERCOSUR partners on Argentinean goods. Our result is robust to the inclusion of MERCOSUR trade-policy variables which also represented greater export opportunities for Argentinean firms.

I also include Argentina's tariffs on the goods of its MERCOSUR partners (column 4). As can be seen, accounting for the MERCOSUR regional trade-liberalization process within the does not affect the sign or significance of the coefficient on Argentinean input-tariff changes in the determination of the export entry decision. Last, our results are also robust to the inclusion of industry-level controls such as imported input intensity (column 5). The estimated coefficients imply that a 10 percentage point fall in input tariffs leads to 6.5% to 6.6% increase in the probability of exporting. Between 1992 and 1996, tariffs declined on average by 4.5 percentage points, with an associated implied increase in export probability of about 3%.

Table 3
Input-tariff liberalization and the change in export status, 1992–1996.

Dependent variable:	Δ *Exporter*$_{is(92-96)}$				
	(1)	(2)	(3)	(4)	(5)
Δ Input $\tau_{s(96-92)}$	−0.650**	−0.650**	−0.665**	−0.666**	−0.647**
	(0.256)	(0.325)	(0.263)	(0.277)	(0.282)
Δ Output $\tau_{s(96-92)}$		1.133	0.841	0.935	0.991
		(0.731)	(0.754)	(0.788)	(0.797)
Δ Brazil's $\tau_{s(96-92)}$ w.r.t Argentina			−0.486	−0.339	−0.302
			(0.763)	(0.810)	(0.824)
Δ Paraguay's $\tau_{s(96-92)}$ w.r.t Argentina			−0.628**	−0.480	−0.444
			(0.246)	(0.315)	(0.317)
Δ Uruguay's $\tau_{s(96-92)}$ w.r.t Argentina			−0.611*	−1.167**	−1.147**
			(0.316)	(0.530)	(0.533)
Δ Argentina's $\tau_{s(96-92)}$ w.r.t Brazil				−0.641	−0.568
				(2.371)	(2.281)
Δ Argentina's $\tau_{s(96-92)}$ w.r.t Paraguay				3.237	3.375
				(2.507)	(2.552)
Δ Argentina's $\tau_{s(96-92)}$ w.r.t Uruguay				−3.785	−3.920
				(2.485)	(2.457)
Observations	1403	1403	1403	1403	1403
R^2	0.041	0.041	0.052	0.055	0.055

Notes: The dependent variable is the change in the export status of firm *i* producing in 4-digit industry s between 1992 and 1996. Tariff variables are defined at the 4-digit industry level corresponding to the main industry in which firm *i* operates. The changes-in-tariffs are defined by the difference in tariffs between 1992 and 1996. Specifications include constant, industry dummies and the size at the industry-level measured as the median of total employment at the 4-digit industry level. Industry-level controls also include imported input intensity measured as imported inputs over total inputs at the 4-digit industry level in column (5). Heteroskedasticity-robust standards errors are shown in parentheses. Errors are corrected for clustering at the 4-digit industry level. **, and * indicate significance at the 5 and 10% levels respectively.

5.2. Input-tariff cuts and the intensive margin of exports

In this section, I explore whether the availability of foreign intermediate goods also has a positive effect on the volume of export sales. If firms increase efficiency via the use of foreign intermediate goods, and this allows them to enter the export market, we expect that they will also export larger volumes. One key concern in the estimation of the determinants of the intensive margin of trade is that the dependent variable, export sales, is observed only over some interval of its support. In this case, the sample is a mixture of observations with zero and positive values. In our sample, more than half of firms were non-exporters in 1992 (See Appendix Table A). An OLS regression of the logarithm of export sales will exclude the zero export values leading to sample-selection bias and inconsistent parameter estimates as the censored sample is not representative of the entire sample of Argentinean firms. In this case, the OLS model produces a downwardly-biased coefficient on input tariffs.

I address this issue in two different ways. I first carry out an OLS regression on the change in export shares (export sales over total sales) on changes in tariffs between 1992 and 1996. This new dependent variable retains the observations on non-exporting firms in either year, and is a similar strategy to that in Eq. (II). Estimating the model in first differences removes time-invariant firm and industry unobserved heterogeneity. However, the drawback is that it does not address the censored nature of the data. The distribution of export shares is indeed left-censored, and as such produces inconsistent estimates under linear models as the expected value of a censored variable is a non-linear function of the covariates. In addition, OLS estimation yields predicted values of the dependent variable outside of the valid range as it ignores the censored nature of the dependent variable.

In this case Tobit estimation is more suitable than OLS. I thus also present Tobit estimates with export shares on the left-hand side explicitly taking censoring into account by considering the zero export shares as a left-censored variable which equals zero when export sales are below a certain threshold. The predicted values from Tobit estimations account for the lower limit of the censored data.[18] As the Tobit model is non-linear, it is not possible to simply difference

[18] We should keep in mind that Tobit estimation relies on the assumption of homoskedastic normally-distributed errors for consistency.

Table 4
Input-tariff liberalization and the intensive margin of exports.

Dependent variable	Δ Export share$_{is(92-96)}$		Export share$_{ist}$			
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS		Pooled Tobit		Random effects Tobit	
Δ Input $\tau_{s(92-96)}$	−0.072**	−0.008				
	(0.036)	(0.087)				
Δ Output $\tau_{s(92-96)}$		−0.227				
		(0.188)				
Input τ_{st}			−0.617***	−0.840***	−0.157***	−0.314***
			(0.084)	(0.107)	(0.058)	(0.098)
Output τ_{st}				0.824***		0.421**
				(0.262)		(0.211)
Δ Brazil's $\tau_{s(92-96)}$ w.r.t. Argentina		−0.213				
		(0.170)				
Δ Paraguay's $\tau_{s(92-96)}$ w.r.t. Argentina		−0.115				
		(0.082)				
Δ Uruguay's $\tau_{s(92-96)}$ w.r.t. Argentina		−0.018				
		(0.120)				
Δ Argentina's $\tau_{s(92-96)}$ w.r.t. Brazil		0.918				
		(0.646)				
Δ Argentina's $\tau_{s(92-96)}$ w.r.t. Paraguay		−0.233				
		(0.535)				
Δ Argentina's $\tau_{s(92-96)}$ w.r.t. Uruguay		−0.454				
		(0.583)				
Brazil's τ_{st} w.r.t. Argentina				0.106		0.032
				(0.288)		(0.137)
Uruguay's τ_{st} w.r.t. Argentina				−0.420*		0.023
				(0.254)		(0.129)
Paraguay's τ_{st} w.r.t. Argentina				−0.393		−0.334**
				(0.255)		(0.141)
Argentina's τ_{st} w.r.t. Brazil				−1.147		−1.182*
				(1.301)		(0.661)
Argentina's τ_{st} w.r.t. Paraguay				0.655		−0.452
				(1.319)		(0.667)
Argentina's τ_{st} w.r.t. Uruguay				0.203		1.236
				(1.412)		(0.760)
Observations	1401	1401	2802	2802	2802	2802
R^2/Pseudo-R^2	0.059	0.067	0.299	0.319		
Log likelihood	1101	1107	−800	−777	−271	−252
Sigma$_e$			0.247	0.245	0.098	0.098
			(0.005)	(0.005)	(0.003)	(0.003)
Sigma$_u$					0.230	0.228
					(0.007)	(0.007)

Notes: Columns (1) and (2) report the first-difference estimations of the change in tariffs on the change in export shares (export sales over total sales) of firm *i* producing in 4-digit industry s between1992 and 1996. Columns (3) and (4) report results from a pooled Tobit estimation of the level of tariffs on levels of export shares for the years 1992 and 1996. Columns (5) and (6) provide the results from Tobit estimations including random effects. Tobit estimations include a dummy variable for 1992. Tariff variables are defined at the 4-digit industry level corresponding to the main industry in which firm *i* operates. Specifications include constant, industry dummies and industry-level controls. Heteroskedasticity-robust standards errors are shown in parentheses. ***, **, and * indicate significance at the 1, 5 and 10% levels respectively.

out time-invariant firm heterogeneity as in first-difference OLS. Tobit models with fixed effects have an incidental parameters problem, and are generally biased (Greene, 2003). I thus report results from both pooled Tobit, without unobserved effects (either fixed or random), and random effects Tobit. In the latter, firm unobserved heterogeneity, μ_i, is assumed to be part of the composite error: $\omega_{iskt} = \mu_i + \epsilon_{iskt}$. Random-effects Tobits are unbiased if firm characteristics are exogenous (uncorrelated with the regressors).[19]

Table 4 shows the results for the intensive margin of exports. Columns (1) and (2) present the first-difference estimate of the change in tariff on the change in export shares via OLS. The coefficient on input-tariff changes is negative and significant, implying that input-trade liberalization increases export shares (column 1). Once we control for the other tariff changes that took place at the same time, the coefficient on the change in input tariff becomes insignificant (column 2).[20] However, as previously noted, this specification ignores the censored nature of the data and yields inconsistent estimates. Columns (3) and (4) show the marginal effects at the sample mean from pooled Tobit estimation of tariffs on export shares in 1992 and 1996; columns (5) to (6) show the results from random-effects Tobits. The coefficient of interest on input tariffs is negative and significant in all of the specifications. As expected, the coefficients are higher than in the linear model. Controlling for unobserved firm heterogeneity via random effects yields lower coefficients on tariffs than

[19] Honore (1992) has developed a semiparametric method dealing with this issue which captures unobserved time-invariant individual heterogeneity. He proposes a trimmed least squares estimator of censored regression models. Nevertheless, this semiparametric estimator for fixed-effect Tobits is not suitable here due to the relatively small sample size.

[20] As a robustness check to see whether these results are related to the dispersion of export shares, I exclude the bottom deciles, which produces coefficients on input tariffs which are significant and robust to the introduction of controls. These results are available upon request.

Table 5
Intensive margin of exports: subsample of initial non-exporting firms.

Dependent variable	Δ Export share$_{is(92-96)}$			Export share$_{ist}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS			Pooled Tobit		Random effects Tobit	
Δ Input $\tau_{s(92-96)}$	−0.092***	−0.181**	−0.142*				
	(0.025)	(0.080)	(0.079)				
Δ Output $\tau_{s(92-96)}$		0.119	0.047				
		(0.283)	(0.309)				
Input τ_{st}				−0.368**	−0.528***	−0.368**	−0.528***
				(0.148)	(0.148)	(0.148)	(0.148)
Output τ_{st}					0.993**		0.993**
					(0.453)		(0.453)
Δ MERCOSUR tariffs			Yes				
Observations	833	833	833	1667	1667	1667	1667
R^2/Pseudo-R^2	0.076	0.079	0.081	0.527	0.537		
Log likelihood	873	874	875	−182	−179	−183	−179
Sigma$_e$				0.190	0.189	0.189	0.189
				(0.009)	(0.009)	(0.010)	(0.010)
Sigma$_u$						0.001	0.000
						(1.457)	(1.25)

Notes: The table reports estimates for the subsample of initial non-exporters. Columns (1) to (3) report the first-difference estimations of the change in tariffs on the change in export shares (export sales over total sales) of firm i producing in 4-digit industry s between 1992 and 1996. Columns (4) and (5) report results from a pooled Tobit estimation of the level of tariffs on levels of export shares for the years 1992 and 1996. Columns (6) and (7) provide the results from Tobit estimations including random effects. Tobit estimations include a dummy variable for 1992. Tariff variables are defined at the 4-digit industry level corresponding to the main industry in which firm i operates. Specifications include constant and industry dummies. Columns (2), (3), (5) and (7) include industry-level controls. Heteroskedasticity-robust standards errors are shown in parentheses.***, **, and * indicate significance at the 1, 5 and 10% levels respectively.

in the pooled Tobit specification, but still larger than in the first-difference OLS specification. In column (6), a 10 percentage point fall in input tariffs leads to a 3% rise in export shares for the average firm.

The main purpose of this paper is to see whether input liberalization affects firms' decisions to enter the export market. The previous section presented some evidence that input tariff cuts increase the export probability of Argentinean firms between 1992 and 1996. We expect the effect of input liberalization on the intensive margin to be present for initial non-exporting firms. Table 5 thus presents the results for the subsample of firms that were not exporters in 1992: here the OLS coefficients of the change in input tariffs are now significant in all specifications. The coefficient of input tariff changes in column (3) indicates that a 10 percentage point fall in input tariffs leads to an almost 1.5% increase in export shares for initial non-exporting firms. As expected, this coefficient is smaller than that from the Tobit specification. Note that the coefficients in the pooled Tobit, without unobserved effects, (columns 4 and 5) and the random-effects Tobit (columns 6 and 7) are almost identical, and the estimated standard deviation of the random effects ($sigma_u$) is not significant for the subsample of initial non-exporters.[21] The coefficient of interest in the Tobit estimations with industry-level controls implies that a 10 percentage point fall in input tariffs induces an expansion of 5% in the export share of the average initial non-exporting firm.[22]

6. Robustness checks

In this section, I present a series of robustness tests for the previous results. I first allow for the possibility that firm characteristics drive the results. Second, I investigate heterogeneity in the impact of input-tariff changes, depending on firms' initial size. I then provide evidence of a positive effect of input-tariff cuts on firms' decisions to use foreign intermediate goods. Finally, I explore how input-tariff reductions affect other firm performance measures.

6.1. Controlling for firm characteristics

I first explore whether these results are robust when I explicitly take into account changes in observable firm characteristics that could affect firms' export patterns.

Using micro-level data, a number of pieces of work have shown that export participation is positively correlated with firm size and productivity (Alvarez and Lopez, 2005; Aw et al., 2000; Bernard and Jensen, 1999; Clerides et al., 1998; Roberts and Tybout, 1997). Along the same lines, other work has found a positive correlation between skill intensity and export participation (Corseuil and Muendler, 2002; Verhoogen, 2008). I therefore expect that non-exporting Argentinean firms which experienced significant growth in labor productivity, size or skill intensity between 1992 and 1996 were more likely to enter the export market in 1996. The negative coefficient on the change in input tariffs might then simply be picking up the effects of changing firm performance over this period.

Table 6 introduces firm-level controls such as the change in firms' size (employment), skill intensity (production over non-production workers) and labor productivity (value added over employment) between 1992 and 1996 into the first-difference specification presented in Eq. (II). As expected, employment growth has a positive impact on the export decision (column 1). The coefficient on input-tariff changes remains negative, significant and stable, however. It is very similar in size to those in previous estimations with only industry-level controls shown in Table 3. I then introduce labor productivity (column 2) and skill intensity (column 3). In line with the literature, the growth in skill intensity has a positive impact on export participation, while the coefficient on labor productivity growth is positive but insignificant. The reason is that the growth rates of employment and productivity are highly correlated, and employment growth is picking up the effects of productivity growth.

[21] The Tobit estimations do not include tariffs set by Argentina on its Mercosur partners or tariffs set by its partners on Argentinean goods. This is because these tariffs were zero in 1996, so that the Tobit estimation with 1429 left-censored observations over a total of 1667 observations for the subsample of initial non-exporting firms is not efficient and yields inconsistent estimates of MERCOSUR tariffs.

[22] The results are neither robust nor stable when we focus on the subsample of initial exporters. These findings indicate that input-trade liberalization allows initial non-exporting firms to increase their export revenues and thereby enter the export market, while it does not improve the export shares of firms that were already exporting in 1992.

Table 6
Robustness checks I: Firm-level controls. Input-tariff liberalization and change in export status between 1992 and 1996.

Dependent variable:	Δ *Exporter*$_{is(92-96)}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ Input $\tau_{s(92-96)}$	−0.698**	−0.655**	−0.665**	−0.281	−0.621**	−0.603**	−0.642**	−0.362
	(0.282)	(0.279)	(0.284)	(0.333)	(0.286)	(0.270)	(0.270)	(0.308)
Δ Input $\tau_{s(92-96)} \times$ Importer$_{i(96)}$				−0.872**				−0.764*
				(0.395)				(0.403)
Importer$_{i(96)}$				0.057				0.092**
				(0.043)				(0.045)
Δ Size$_{i(92-96)}$	0.125***	0.135***	0.142***	0.127***				
	(0.026)	(0.027)	(0.028)	(0.027)				
Δ Labor productivity$_{i(92-96)}$		0.029	0.022	0.005				
		(0.021)	(0.022)	(0.021)				
Δ Skill intensity$_{i(92-96)}$			0.104*	0.101*				
			(0.057)	(0.053)				
Size$_{i(1992)}$					0.012	0.010	0.013	−0.008
					(0.009)	(0.009)	(0.009)	(0.010)
Productivity$_{i(1992)}$						0.025*	0.031**	0.019
						(0.014)	(0.014)	(0.014)
Skill intensity$_{i(1992)}$							−0.012***	−0.011***
							(0.004)	(0.004)
Multinational$_{i(1992)}$							−0.072**	−0.083**
							(0.035)	(0.035)
Δ Output $\tau_{s(92-96)}$	1.007	0.954	1.101	0.293	0.938	0.924	1.025	0.361
	(0.798)	(0.798)	(0.818)	(0.817)	(0.810)	(0.772)	(0.804)	(0.779)
Δ Brazil's $\tau_{s(92-96)}$ w.r.t. Argentina	−0.459	−0.538	−0.559	−0.712	−0.306	−0.268	−0.191	−0.455
	(0.808)	(0.798)	(0.814)	(0.841)	(0.833)	(0.824)	(0.805)	(0.780)
Δ Paraguay's $\tau_{s(92-96)}$ w.r.t. Argentina	−0.387	−0.411	−0.442	0.264	−0.437	−0.362	−0.357	0.300
	(0.331)	(0.335)	(0.336)	(0.367)	(0.317)	(0.317)	(0.317)	(0.359)
Δ Uruguay's $\tau_{s(92-96)}$ w.r.t. Argentina	−1.134**	−1.121**	−1.052*	−1.009*	−1.165**	−1.246**	−1.272**	−1.275***
	(0.541)	(0.549)	(0.553)	(0.512)	(0.533)	(0.518)	(0.514)	(0.478)
Δ Argentina's $\tau_{s(92-96)}$ w.r.t. Brazil	−0.623	−0.553	−0.334	−1.006	−0.503	−0.579	−0.295	−0.831
	(2.378)	(2.407)	(2.409)	(2.466)	(2.298)	(2.271)	(2.225)	(2.387)
Δ Argentina's $\tau_{s(92-96)}$ w.r.t. Paraguay	3.592	3.365	2.942	3.446	3.324	3.545	3.447	3.720*
	(2.668)	(2.689)	(2.704)	(2.290)	(2.547)	(2.465)	(2.433)	(2.098)
Δ Argentina's $\tau_{s(92-96)}$ w.r.t. Uruguay	−4.014	−3.945	−3.685	−3.757*	−3.931	−4.041*	−4.225*	−4.318**
	(2.447)	(2.468)	(2.479)	(2.000)	(2.451)	(2.375)	(2.334)	(1.911)
Observations	1403	1402	1398	1398	1403	1402	1398	1398
R^2	0.076	0.078	0.083	0.109	0.057	0.059	0.063	0.091

Notes: The dependent variable is the change in export status of firm *i* producing in 4-digit industry s between 1992 and 1996. The changes-in-tariffs are defined by the difference in tariffs between 1992 and 1996. Firm-level controls include size (total employment), labor productivity (value added over total employment), skill intensity (production over non-production workers) and multinational firm status (over 50% of foreign capital in 1992). Firm-level variables are expressed in logarithms. Importer is a dummy variable for importing firms. Columns (4) and (8) include an interaction term between importer status and the change in input, output and MERCOSUR partners' tariffs. Specifications include a constant, industry dummies and industry-level controls. Heteroskedasticity-robust standards errors are reported in parentheses. Errors are corrected for clustering at the 4-digit industry level. ***, **, and * indicate significance at the 1, 5 and 10% levels respectively.

Our coefficient of interest on input-tariff changes is robust to these different specifications.

If the availability of foreign products causes export participation, we would expect the effect of lower input-tariffs to be greater for firms that actually import. Column (4) carries out this test, introducing an interaction between tariff changes and import status. The latter is a dummy for firms importing in 1996. The estimated coefficients show that the effect of input-tariff cuts is indeed stronger for importing firms. The estimated coefficients imply that a 10 percentage point fall in input tariffs leads to an 8.72% increase in the likelihood of exporting for firms which import over this period (column 4), while the analogous effect for the whole sample was 6.65% in column (3).

A reverse causality reading of these results is that firms may have improved their performance by investing in modern technologies between 1992 and 1996 in order to enter the export market in 1996. This is related to the conscious self-selection effect in Alvarez and Lopez (2005). In order to avoid any potential endogeneity issues between changing firm performance and export participation, columns (5) to (8) of Table 6 show the results including initial firm characteristics in 1992. This specification controls for differential exporting trends depending on the initial levels of firm characteristics. The results remain very similar to those in the previous specifications.

Column (7) then addresses the concern that multinational firms are globally engaged in foreign markets and are thus more likely to import inputs.[23] I here include a multinational dummy for firms that have more than 50% of foreign capital in 1992. The results are robust to the inclusion of this control. Surprisingly, multinational status is negatively correlated with the change in export status.[24]

6.2. The heterogeneous effect of input-tariff reductions depending on initial firm characteristics

Input-trade liberalization might affect firms differently according to their characteristics. Some firms may benefit more from the availability of intermediate goods than do others. I explore in this section whether the impact of input-tariff changes depends on firm initial characteristics.

To investigate this heterogeneity, I introduce interactions between input-tariff changes and firms' initial size (the log of employment in 1992). Firms are divided up into four initial size quartiles, with the first quartile representing the smallest firms. I then interact input-

[23] A number of pieces of empirical work highlight that multinational firms are more productive and have larger sales (Bernard et al., 2008, and Yeaple, 2008).

[24] This could be related to a selection bias since there are a few multinational firms (8%) and most of them export in both years. Only 12% of multinational firms do not export in 1992 and start exporting in 1996.

tariff changes with the firm's initial size quartile. I estimate the following linear probability model for the export decision:

$$\Delta Exporter_{isk(92-96)} = \sum_{\rho=1}^{4} \chi^{\rho}\left(\Delta \text{Input}\,\tau_{s(92-96)} \times Q_{is}^{\rho}\right) + \sum_{\rho=2}^{4} \lambda^{\rho} Q_{is}^{\rho} + \gamma_2 \Delta \text{Output}\,\tau_{s(92-96)} + \gamma_3 \Delta \text{Mercosur Output}\,\tau_{s(92-96)} + \gamma_4 S_s + \Delta \upsilon_k + \Delta \varepsilon_{isk} \quad \text{(III)}$$

Here $Exporter_{iskt}$ is a dummy variable for firm i in 4-digit industry s having positive export sales in year t (1992 or 1996). Firms are classified into four quartiles (Q) of initial size by ρ: Q_{is}^{1} is a dummy variable for firm i belonging to the first size quartile and so on. $\Delta \text{Input}\,\tau_{s(92-96)} \times Q_{is}^{\rho}$ are the interaction terms between the quartiles of initial size and tariff changes.

The estimation results for Eq. (III) are presented in Table 7. After controlling for MERCOSUR tariff changes in column (2), the impact of input tariffs on export probability is greater in the second and third quartiles of the firm-size distribution. This result persists when other relevant industry and firm characteristics are introduced as controls (columns 3 to 6).

The effect of tariff cuts on firms in the first and fourth size quartiles is not always significant. Input tariffs have a greater effect on the export decisions of firms in the middle range of the size distribution. Input-tariff liberalization has no significant effect on larger firms (in the fourth quartile) as most of these were already exporters before the trade reforms. This result is in line with heterogeneous-firm trade models, and the results in Bustos (2011). The estimated interaction coefficients indicate that the average fall in input tariffs increases the probability of entering the export market by 4.5 percentage points for firms in the third size quartile, and 3.6 percentage points for firms in the second quartile.

Table 8
Input-tariff liberalization and the decision to use imported intermediate goods.

Dependent variable	Δ $Importer_{i(s)(92-96)}$			
	(1)	(2)	(3)	(4)
Δ Input$\tau_{s(92-96)}$	−0.371**	−0.378**	−0.388**	−0.397**
	(0.182)	(0.184)	(0.182)	(0.184)
Δ Employment$_{i(92-96)}$			0.057**	0.057**
			(0.022)	(0.022)
Δ Skill intensity$_{i(92-96)}$				−0.013
				(0.019)
Industry controls		Yes	Yes	Yes
Observations	1403	1403	1403	1399
R^2	0.003	0.003	0.009	0.009

Notes: The dependent variable is the change in import status of intermediate goods of firm i producing in 4-digit industry s between 1992 and 1996. Importer is a dummy = 1 for firm i importing intermediate goods in year t. Specifications include a constant and industry dummies. Columns (2) to (4) also include industry-level controls and the change in output tariffs. Heteroskedasticity-robust standards errors are reported in parentheses. Errors are corrected for clustering at the 4-digit industry level. **, indicates significance at the 5% level.

6.3. Input-tariff cuts and the use of foreign inputs

In Section 4.1 I showed that import tariff reductions induced an overall increase in the imports of intermediate products at the HS6 level. This import pattern should also be found at the firm level. In this section, I show that Argentinean firms increased their probability of using foreign intermediate goods as input tariffs fell. I do so using firm-level data, although we should keep in mind that this analysis will miss out the use of imported inputs that are not directly imported by firms.

The results from a linear-probability estimation of importing intermediate goods as a function of input tariff changes and the other industry- and firm-level controls are shown in Table 8.

The coefficient on input-tariff changes is negative and significant at the 5% level, so that lower input tariffs positively affect firms' decisions to use foreign inputs. Accounting for industry characteristics

Table 7
The heterogeneous impact of input-tariff reductions on export decisions.

Dependent variable	Δ $Exporter_{is(92-96)}$					
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Input τ × First Size Quartile	−0.360	−0.425	−0.455*	−0.477*	−0.393	−0.412
	(0.305)	(0.262)	(0.266)	(0.269)	(0.256)	(0.294)
Δ Input τ × Second Size Quartile	−0.737	−0.822**	−0.845**	−0.851**	−0.801**	−0.791**
	(0.452)	(0.341)	(0.339)	(0.338)	(0.340)	(0.388)
Δ Input τ × Third Size Quartile	−0.865**	−0.900***	−0.923***	−0.946***	−0.872***	−0.888**
	(0.393)	(0.323)	(0.321)	(0.319)	(0.319)	(0.363)
Δ Input τ × Fourth Size Quartile	−0.170	−0.213	−0.229	−0.230	−0.198	−0.240
	(0.352)	(0.335)	(0.333)	(0.337)	(0.329)	(0.336)
Δ Labor productivity			−0.018	−0.023		
			(0.021)	(0.021)		
Δ Skill intensity				0.076		
				(0.053)		
Productivity$_{i(1992)}$					0.017	0.020
					(0.013)	(0.013)
Skill intensity$_{i(1992)}$						−0.011***
						(0.004)
Multinational$_{i(1992)}$						−0.059*
						(0.035)
Δ Output $\tau_{s(92-96)}$	Yes	Yes	Yes	Yes	Yes	Yes
Δ MERCOSUR tariffs		Yes	Yes	Yes	Yes	Yes
Observations	1403	1403	1402	1398	1402	1398
R^2	0.071	0.080	0.080	0.083	0.081	0.077

Notes: The dependent variable is the change in export status of firm i producing in 4-digit industry s between 1992 and 1996. The changes-in-tariffs are defined by the difference in tariffs between 1992 and 1996. Firms are classified into four initial size quartiles measured by employment in 1992. The first size quartile represents the smallest firms. Δ Input τ × First Size Quartile is an interaction term between the change in input tariffs between 1992 and 1996 and the first size quartile. Specifications include a constant, the second to fourth size quartiles, industry dummies, industry-level controls (size, imported input intensity, the change in output tariffs and changes in MERCOSUR tariffs w.r.t. Argentina and Argentina's tariffs w.r.t MERCOSUR partners). Heteroskedasticity-robust standards errors are reported in parentheses. Errors are corrected for clustering at the 4-digit industry level. ***, **, and * indicate significance at the 1, 5 and 10% levels respectively.

Table 9
Input-tariff liberalization and other firm outcomes.

Dependent variable	Δ Domestic sales$_{is(92-96)}$			Δ Technology spending$_{is(92-96)}$			Δ Investment$_{is(92-96)}$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Input $\tau_{s(92-96)}$	−0.954*	−0.892**	−0.927**	−1.736**	−1.667**	−1.527*	−3.337*	−4.050**	−3.655**
	(0.494)	(0.449)	(0.448)	(0.703)	(0.761)	(0.889)	(1.888)	(1.907)	(1.708)
Δ Size$_{i(92-96)}$		0.660***	0.660***		0.696***	0.676***		0.723***	0.754***
		(0.046)	(0.046)		(0.095)	(0.095)		(0.149)	(0.164)
Δ Skill int.$_{i(92-96)}$		0.205***	0.204***		0.252***	0.279***		0.190	0.187
		(0.058)	(0.057)		(0.085)	(0.100)		(0.163)	(0.144)
Industry controls			Yes			Yes			Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1400	1396	1396	920	917	917	914	912	912
R^2	0.049	0.267	0.268	0.022	0.075	0.080	0.073	0.101	0.100

Notes: The dependent variable in columns (1) to (3) is the change in domestic sales, in columns (4) to (6) it is the change in technology spending, and in columns (7) to (9) it corresponds to the change in total investment between 1992 and 1996. The same controls are used as in Table 8.

in column (2) does not affect the sign or significance of the input-tariff coefficient. In columns (3) and (4), I add firm-level characteristics. I do not include firm productivity in this specification as imported intermediate goods and productivity could be considered as endogenous. The existing empirical work discussed in Section 1 finds robust evidence that the use of imported inputs is a key determinant of firms' productivity. As expected, employment growth positively affects the decision to import intermediate goods in column (3). However, the coefficient on input-tariff changes remains stable, negative and significant at the 5% confidence level, and the estimated coefficient indicates that a 10 percentage-point fall in input tariffs results in an almost 4 percentage-point increase in the likelihood of using foreign intermediate goods.

6.4. Input-tariff cuts, domestic sales, investment and technology upgrading

I now explore the channels through which input tariff reductions may affect firm performance. The theoretical and empirical literature noted in Section 1 emphasizes that input-tariff reductions allow firms to increase efficiency via access to (1) relative cheaper intermediate goods, (2) new imported input varieties and (3) higher-quality inputs. If the availability of imported inputs is a factor in greater efficiency, it should also affect other firm outcomes besides exports.

Following Goldberg et al. (2010), I explore the relationship between input-tariff cuts and the growth in domestic sales, investment and technology spending.[25] I thus estimate Eq. (II) with these firm performance variables as the dependent variables.

The ensuing estimation results are presented in Table 9. I first regress the change in domestic sales between 1992 and 1996 on the change in input tariffs. Most of the firms selling in the export market also sell in the domestic market. If firms became more efficient due to greater access to foreign inputs, we should also see higher domestic sales following a cut in input tariffs. Columns (1) to (3) show that input-trade liberalization did indeed also have a positive effect on domestic sales growth. The coefficient on input-tariff changes is negative and significant in all of the specifications.

Columns (4) to (9) of Table 9 explore the effects of input-tariff changes on technology spending and investment growth. I also find here that lower input tariffs are associated with increased firm technology upgrading. This empirical evidence is consistent with previous work. Goldberg et al. (2010) find an increase in both the number of new domestic products, productivity gains and domestic sales after cuts in input tariffs in India. Amiti and Konings (2007) show that the productivity gains of Indonesian firms rise with input-tariff reductions, and Teshima (2009) finds positive effects of output-tariff reductions on firm R&D activities via foreign competition, but insignificant effects from input-tariff cuts.

[25] I use the same definition of technology spending as Bustos (2011). Technology spending includes R&D investments, technology transfers, payments for patents, spending on computers and software, and spending on production factors related to innovation activities. Since these variables are reported on a yearly basis I use the change in technology spending between 1992 and the average of 1993–1996.

7. Conclusions

Does trade policy promoting the imports of intermediate goods expand export activities in developing countries? Since the access to modern technology embodied in foreign inputs allows firms to increase their efficiency, it might also lead to greater export opportunities by improving firm profitability and competitiveness in the export market. In developing countries, the export-selection process can be reinforced by the ability of firms to import intermediate goods. The main contribution of this paper to this literature is to investigate empirically the efficiency gains from input-trade liberalization on firms' export decisions.

The results show that the availability of foreign intermediate goods, through input-tariff changes, enhances Argentinean firms' performance in the export market. Firms in industries with greater input-tariff reductions were more likely to enter the export market. In addition, input-tariff cuts were also associated with an increase in export sales shares, with this effect being also present for initial non-exporting firms. These findings are robust to alternative specifications controlling for the MERCOSUR trade agreement, and observable industry and firm characteristics.

I also find evidence of a positive effect of input-tariff cuts on other firm performance measures such as the use of imported intermediate goods, domestic sales, and investment and technology spending. These results are in line with previous findings showing that foreign inputs enhance firm performance in developing countries in a number of ways. Access to imported inputs improves not only firm productivity (Amiti and Konings, 2007; Schor, 2004), but also the ability to manufacture new domestic products (Goldberg et al., 2010), and increases the varieties and quality of the intermediate goods available in the domestic market (Kugler and Verhoogen, 2009).

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Appendix A

Table A
Descriptive evidence of firm characteristics.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Number of firms	Domestic sales	Export share	Import share	Labor productivity	Total employment	Skilled labor	Investment
1992								
Full sample	1403	15.5	0.06	0.08	11	4.6	2.2	12.1
		(1.6)	(0.17)	(0.15)	(0.8)	(1.3)	(1.4)	(2.2)
Neither exporters nor importers	38%	14.5	0	0	10.8	3.7	1.4	10.9
		(1.4)			(0.8)	(1.1)	(1.1)	(2.1)
Only exporters	11%	15.6	0.18	0	11.2	4.7	2.1	11.6
		(1.6)	(0.25)		(0.8)	(1.2)	(1.4)	(2.3)
Only importers	22%	15.9	0	0.17	11.1	4.7	1.9	12.3
		(1.3)		(0.19)	(0.8)	(1).	(1.2)	(1.9)
Exporter–importer	30%	16.5	0.14	0.14	11.2	5.5	2.9	13
		(1.4)	(0.25)	(0.17)	(0.7)	(1.1)	(1.4)	(1.9)
1996								
Full sample	1403	15.6	0.09	0.09	11.3	4.5	2.3	12.6
		(1.7)	(0.18)	(0.15)	(0.9)	(1.2)	(1.4)	(2.1)
Neither exporters nor importers	27%	14.1	0	0	10.7	3.4	1.2	11.1
		(1.4)			(0.9)	(0.9)	(0.9)	(1.8)
Only exporters	13%	15.3	0.19	0	11.3	4.3	1.9	11.6
		(1.6)	(0.23)		(0.9)	(1.1)	(1.2)	(2.0)
Only importers	16%	15.8	0	0.13	11.3	4.5	1.9	12.3
		(1.4)		(0.17)	(0.7)	(1.0)	(1.2)	(1.7)
Exporter–importer	44%	16.6	0.15	0.15	11.6	5.3	2.7	13.4
		(1.4)	(0.22)	(0.17)	(0.7)	(1.1)	(1.4)	(1.9)

Notes: The table shows mean values (and standard deviation in parentheses) of the main variables used in the empirical analysis by firm-trade orientation status in 1992 and 1996. All variables are expressed in logarithms except export and import shares. Export share is measured as the ratio of export sales over total sales, and import share is measured by the ratio of imports of inputs over total costs. Labor productivity is measured by value added over total employment, and skilled labor corresponds to non-production workers.

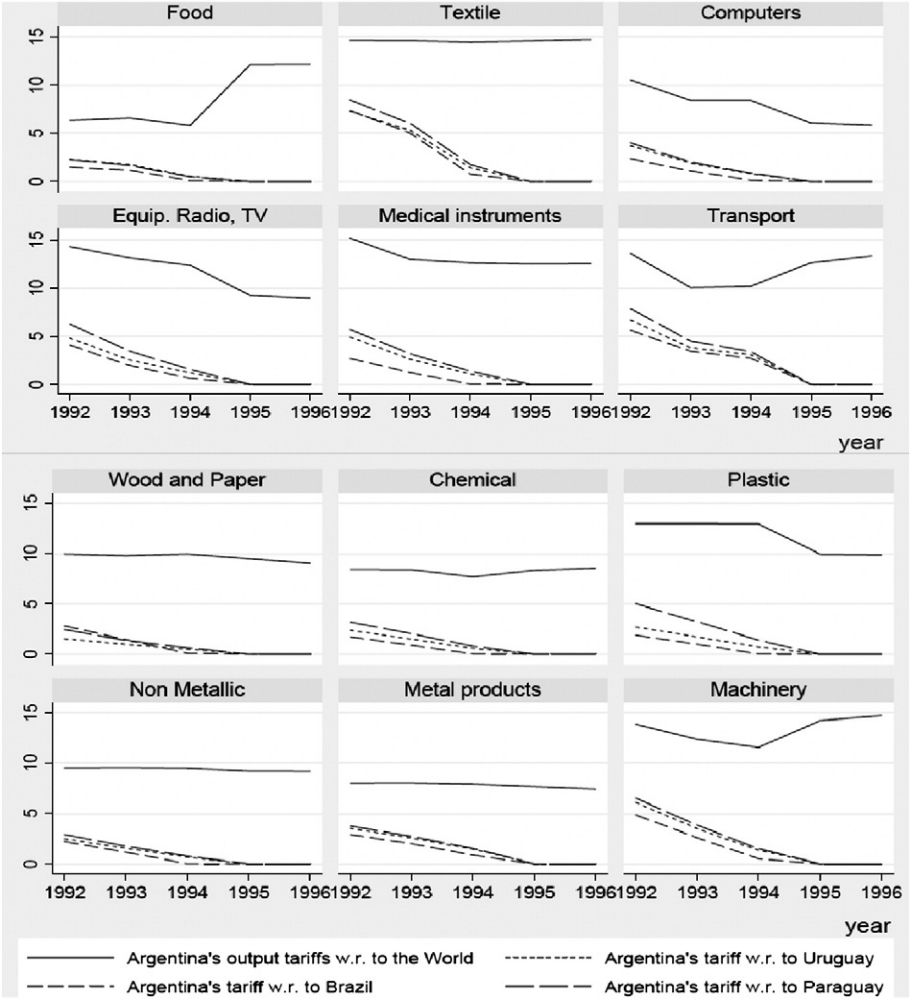

Fig. A1. Argentina's MFN tariffs and tariffs on goods of its MERCOSUR partners.

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