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Olivier Cadot
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Do rules of origin constrain export growth? Firm-level evidence from Colombia

Olivier Cadot[*]
Alejandro Graziano[+]
Jeremy Harris[⊥]
Christian Volpe[±]

Abstract

This paper estimates empirically the effect of preference utilization on export growth at the level of the firm using a unique transaction-level dataset of Colombia's imports from Argentina, Peru and Uruguay over 2000-2011, a period during which Colombia granted improved market access to Argentina and Uruguay. We show that preference utilization induces sorting among exporters on the basis of size and intermediates sourcing. We also show that preference utilization correlates strongly with export growth after controlling for firm-specific, time-variant unobservables through a powerful array of firm-year and product-year fixed effects. Our results suggest that the cost of complying with rules of origin is higher for larger firms because those tend to source internationally their intermediates.

Keywords: Trade preferences, heterogeneous firms, rules of origin, Colombia

JEL classification numbers: F1, F12, F13, F14

[*] Faculty of Business and Economics, University of Lausanne ; CEPR and FERDI ; olivier.cadot@unil.ch.
[+] InterAmerican Development Bank ; agraziano@IADB.ORG
[⊥] InterAmerican Development Bank ; JEREMYH@iadb.org
[±] InterAmerican Development Bank ; CHRISTIANV@iadb.org

1. Introduction

While preferential trade agreements have proliferated, many of them have been plagued by low utilization rates,[1] suggesting that they have not proved as attractive as initial pronouncements anticipated. While circumstances differ, factors contributing to low attractiveness typically include preference erosion, [2] multiple overlapping schemes,[3] stringent rules of origin,[4] long tariff phase-outs, and exceptions for sensitive products or, in the case of many South-South schemes, outright lack of trade complementarities between regional partners.

These many confounding and potentially conflicting features, together with severe endogeneity problems, have made the credible identification of the effect of tariff preferences on trade expansion difficult at the aggregate level, leaving policymakers with limited empirical guidance on the real benefits to be expected from preferential trade liberalization. This paper revisits the issue at a highly disaggregated level using a unique dataset of Colombian transaction-level import data from Peru, Argentina and Uruguay during a period where Colombia deepened preference margins with the latter two. Looking at preference utilization through the lens of South-South agreements provides a particularly interesting setting given the recent expansion of South-South trade and the fact that Southern countries have typically high MFN tariffs, making room for substantial preferences (which, in our case, had strong uptake).

What do we know about the effect of trade preferences on intra-bloc exports? One can distinguish three broad strands in a voluminous literature. The first one, which can be traced back to the work of Tinbergen (1962), is intimately related to the development of the gravity equation (see e.g. Aitken (1973), Abrams (1980), Brada and Mendez (1983), Bergstrand (1985), Frankel, Stein and Wei (1995), Frankel 1997, Soloaga and Winters 2001, Carrère 2006, or Baier and Bergstrand 2007). The challenge of estimating the effect of trade agreements on trade contributed to define the proper specification of the gravity equation (see Baldwin and Taglioni 2006 for a summary), particularly through Baier and Bergstrand's seminal contribution. While early estimates were notoriously fragile and conflicting (some returning implausible *negative* effects for the E.U., for instance), more recent approaches dealing with the endogeneity of

[1] ASEAN, the GSP, the E.U.'s EBA initiative, and many South-South agreements, especially in sub-Saharan Africa, are cases in point. See Pomfret et al. (2010) for recent evidence.
[2] See Grossman and Sykes (2005), or more recently Carrère and de Melo (2009) or Nicita (2011).
[3] See Candau and Jean (2005).
[4] See e.g. the essays in Cadot, Estevadeordal, Suwa-Eisenmann and Verdier (2006).

preferences through panel-data techniques led to more stable and *higher* estimates of their effect on trade flows.[5] However, a common feature of that literature was its crude characterization of preferences in the form of dummy variables, irrespective of their depth or utilization (see the discussion in Cardamone 2007); only a few recent (disaggregated) applications of the gravity equation to the evaluation of trade preferences made use of tariff-preference margins (e.g. Cipollina and Salvatici 2007 or Cardamone 2009).

The second strand, which goes back to the work of Herin (1986), focuses on the trade-inhibiting effect of rules of origin. Rules of origin (RoO) are typically spelled out in annexes to free-trade agreements (FTAs) and specify the minimum level of local transformation required to make manufactured products eligible for preferential treatment.[6] While ostensibly needed to prevent trade deflection in FTAs (by which is meant that the member with the lowest external tariff serve as gateway to the whole bloc, depriving others of tariff revenue), RoOs have been shown to be vulnerable to capture by special interests (Portugal-Perez 2010), especially in asymmetric North-South agreements. Some of that literature relied on a revealed-preference argument to infer a monetary equivalent of the cost of complying with RoO (e.g. Carrère, Cadot, de Melo and Tumurchudur 2006) while other papers used an index of RoO restrictiveness proposed by Estevadeordal (2000). This strand of the literature produced relatively consistent ad-valorem equivalents of the cost of complying with RoOs between 5% and 15%—in a range that could well offset the benefit of tariff-preference margins. It also provided fairly convincing evidence of special-interest influence in the determination of RoOs, especially in North-South agreements such as NAFTA.

The third and most recent strand of the literature builds on the so-called "new-new" trade theory and focuses on factors of heterogeneity in preference utilization across firms. Demidova and Krishna (2008) showed that the effect of RoOs on input prices did not display the non-

[5] Baier and Berstrand showed that panel estimates were five times those of pooled cross-section ones. Carrère's panel estimates, also higher and more precisely estimated than pooled ones, suggested that the Andean pact led to a doubling of intra-bloc exports, while LAIA led to a 43% increase. Neither Mercosur nor NAFTA, by contrast, had significant effects.

[6] These rules can take a variety of forms. A common one is the change of tariff classification, which specifies that if a final product, exported from member A to member B under the bloc's preferential regime, is produced using intermediates imported from outside of the bloc, those should not belong to the same tariff classification (subheading, heading, or chapter) as the final product. This is an indirect way of mandating substantial local transformation. Alternatively, the rule can mandate that local value added be above a minimum percentage of the ex-factory price (or that imported intermediates be below a maximum percentage of total intermediates). The rule can also take the form of a technical requirement on the production process. For details, see e.g. Cadot et al. (2006).

monotonicity uncovered by Ju and Krishna (2002, 2005) in the presence of heterogeneous firms.[7] Demidova, Kee and Krishna (2006) used the combination of trade preferences and rules of origin facing Bangladeshi apparel exporters on the U.S. and E.U. markets as an identification mechanism to estimate productivity at the firm level. Using data on Japanese affiliates in ASEAN, Hayakawa et al. (2009) showed that preferences were used by larger affiliates and by those with the most widely spread intermediate sourcing, suggesting that ASEAN RoO were not binding on those firms. Cherkashin et al. (2010) set up a model with two-way firm heterogeneity (in terms of both productivity and firm- and market-specific demand-shifters) and showed that improved access to one market, by raising the expected return to entry into the industry, could boost the extensive margin of exports *on other markets* as well. Their results suggest that the benefit of market access may have been underestimated by traditional approaches ignoring their induced effect on firms serving multiple destinations. By contrast, Ulloa and Wagner-Brizzi (2013) show theoretically that small firms for whom trade preferences are too costly to meet can be made worse off by the mere existence of those preferences as large firms expand to take advantage of them and bid up the price of domestic factors of production. Empirically, they *assume* sorting by size in terms of preference utilization (with only firms above a critical size using them) to identify the fixed cost of compliance at the product level.

We build on the last two strands of literature to estimate the effect of trade preferences on export growth at the firm-product level using data from Colombia's trade preferences to Argentina, Peru and Uruguay. Our dataset allows us to filter out most confounding influences, including firm-specific and market-specific time-variant shocks, by using a powerful array of fixed effects (in particular by firm-year and country-product-year). We can also directly estimate sorting in terms of a number of firm attributes, disentangling the effect of firm size *per se* vs. breadth of intermediate sourcing (whose effects work at cross-purposes). We find that preference utilization tends to be higher for larger firms, but lower for those with a wider sourcing of intermediates. We also find that preference utilization correlates strongly with export growth, and more so for large firms. This suggests that the real cost of complying with trade preferences is the variable cost of sourcing locally rather than the fixed cost of proving compliance. Panel-data techniques

[7] In a nutshell, the non-monotonicity comes form the fact that when all firms use the preferential regime, a stricter RoO raises the equilibrium price of the domestic input (labor), while in an interior equilibrium where only some of them do, a stricter RoO must push it down in order to maintain indifference between using preferences or not.

(fixed effects) work better than IV estimation to control for the endogeneity of preference utilization.[8]

The rest of the paper is organized as follows. Section 2 presents the data and some stylized facts about Colombia's preferential market access for Argentina, Peru and Uruguay. Section 3 discusses estimation issues and results, including baseline and some robustness/extension exercises. Section 4 concludes.

2. Data and stylized facts

2.1 Colombia's trade preferences

Colombia has FTAs in force with a significant and growing number of countries. Until the turn of the century, Colombia's focus in terms of economic integration was limited to South America, primarily membership in the Andean Community of Nations (CAN in Spanish, formerly the Andean Pact), with a variety of partial-scope agreements within the broad framework of the Latin American Integration Association (ALADI in spanish). In the early 2000s, negotiations began on a comprehensive agreement between the CAN (including Peru, Ecuador, and Venezuela) and the Mercosur trading bloc (Argentina, Brazil, Paraguay, and Uruguay). These negotiations proceeded, with Peru signing separately an agreement known as ACE58, and the other three signing together under ACE59.[9]

Due to a series of political pressures to complete the agreement quickly, the countries opted to structure the market access-related aspects of the agreement as a package of bilateral negotiations between each of the three Andean countries and each of the four Mercosur countries. This resulted in 24 tariff elimination schedules (four each for the Andean countries and three each for the Mercosur countries) and 12 sets of product-specific rules of origin.

In the tariff elimination schedules each tariff line is assigned to a tariff phase-out category, which defines a specific evolution of the margin of preference with respect to the MFN tariff rate. These margins of preference increase over time until they reach 100%, which implies duty-free preferential tariff treatment. The transition period extends over 15 years, such that starting in

[8] In a different context, Baier and Bergstrand (2007) also found that panel-data estimation worked better than instrumental variables to control for the endogeneity of trade preferences.
[9] The normative chapters of ACE 58 and ACE 59 are identical in most important aspects.

2005 the longest phase-out chronograms will be completed in 2019. Due to the combination of having to accommodate existing preferences from the partial scope ALADI agreements and the decision to establish bilateral chronograms, ACE 59 includes a total of over 150 phase-out categories.

The rules of origin for ACE 59 are structured around a default general rule that applies to all products across the board, with a series of specific rules that trump the general rule for the products for which they are defined. The general rule gives traders the option of demonstrating origin with either a change of tariff classification at the HS 4-digit level (change of heading) or a regional value content rule that limits the CIF value of non-originating materials to a fixed percentage of the FOB value of the good. The limitation varies a bit across the bilateral sets of rules, with looser requirements for the less developed exporters (Ecuador and Paraguay), and also in some cases across products, but is generally between 40% and 60%. The ACE 59 rules of origin also permit cumulation from all partners, plus Peru and Bolivia.

The Colombian phase-out schedules are among the faster ones in ACE 59. Most schedules start with 10%-30% of lines duty free. These are a mix of lines liberalized upon entry into force and lines with pre-existing preferences from partial scope agreements. Around 40% of tariff lines are liberalized on a 6-year schedule (by 2010) to Brazil, Uruguay, and Paraguay, though only about 15% of lines are liberalized for imports from Argentina that quickly. The bulk of the tariff lines are liberalized on a 12-year schedule, reaching over 90% of tariff lines liberalized to all partners but Brazil, which remains around 85%, in 2016. Nearly all remaining lines are phased out in 2019.

At the sector level, tariff elimination proceeds fastest in Vegetable Products, Chemical/Industrial Products, and in Mineral Products for Uruguay, while advancing slowest in the schedules for Argentina and Uruguay in Animal/Vegetable Fats, Footwear, and Motor Vehicles.

Additionally, Colombia concluded negotiations on an FTA with the United States in 2006 including tariff elimination schedules that were designed to give substantial and rapid duty-free access to imports from the US. However, ratification and implementation were repeatedly delayed, such that the agreement did not go into force until 2012. Thus, there was an ongoing expectation since the entry into force of ACE 59 that those preferences could be substantially or

completely eroded by the market access granted to the US at almost any moment once the political impediments to ratification were resolved.

2.2 Data

Our dataset consists of four main databases. First, we have highly disaggregated import data for Colombia from the National Tax Agency (Dirección de Impuestos y Aduanas Nacionales - DIAN). The data are reported at the transaction-level and cover all transactions entering Colombia over the period 2000-2011. Specifically, each record includes the importing firm's tax ID, the origin country, the product code (10-digit HS), the import value in US dollars, the quantity (weight) in kilograms, the tariff actually paid, and the foreign seller. This last piece of information is seldom reported in customs datasets such as those collected for the World Bank Exporters Dynamics project.

Second, we also have highly disaggregated export data for Argentina, Uruguay, and Peru over the same period (2000-2008 only Argentina) from their respective customs agencies (Administración Federal de Ingresos Públicos –AFIP, Dirección Nacional de Aduanas-DNA, and Superintendencia Nacional de Administración Tributaria-SUNAT). In this case, each record informs the exporting firm's tax ID and name, the destination country, the product code (10-digit HS), the export value in US dollars, and the quantity (weight) in kilograms. Together with the information from the Colombian side on the seller's identity, the combination of sources makes it possible to match buyers and sellers using the name of the selling companies reported both in the import and export databases.

Third, our dataset includes year-specific, product-level MFN tariffs and preference margins along with the import regime (specific trade agreements) and indices of restrictiveness of the relevant rules of origin from INTRADE, Estevadeordal and Suominen (2005), and Harris (2009). This information allows us to identify which transactions made use of preferences. Finally, we gathered data on employment for all Argentine and Peruvian exporters. Firms are also identified by their tax ID in these cases, so that the respective databases could be easily merged. The resulting sample is an unbalanced panel of close to 30'000 observations over a decade.

2.3 Stylized facts

Table 1 shows the evolution of Colombia's trade preferences vis-à-vis Peru, Argentina and Uruguay. For each origin country, the first three columns show the percentage of lines with both nonzero MFN tariffs and positive preference margins, while the last three show the average margin, in percentage points (rounded to the nearest integer). Over our sample period, Peru appears as a "control group", as all imports from Peru were already eligible for tariff-free treatment in 2000. By contrast, imports from Argentina and Uruguay experienced a substantial liberalization from 2004 onward, in terms of both coverage of eligible products and preference margins. In the case of Uruguay, the liberalization took the form of relatively shallow preference margins on a limited number of products that accounted for the bulk of its exports to Colombia.

Table 1

	Percentage of Products with PM > 0 and MFN tariff > 0			Mean preference margin, in percentage points		
	Argent.	Peru	Uruguay	Argent.	Peru	Uruguay
2000	9.5	100.0	9.4	0	12	0
2001	9.5	100.0	9.4	0	12	0
2002	9.4	100.0	9.3	0	12	0
2003	9.4	100.0	9.3	0	12	0
2004	80.4	100.0	81.8	2	13	4
2005	80.7	100.0	82.4	3	12	4
2006	80.7	100.0	82.4	4	12	5
2007	79.8	100.0	81.4	4	12	6
2008	79.6	100.0	81.3	5	12	6
2009	79.6	100.0	81.3	6	13	7
2010	79.6	100.0	81.2	4	9	5
2011	79.8	100.0	81.2	6	12	7

Source: Authors' calculations based on IDB INTrade database.

Table 2

Exports to Colombia from Argentina, Uruguay and Peru, 2000-2011: Intensive and extensive margins

	Dollar value of exports to Colombia from			Number of products exported to Colombia from			Number of firms exporting to Colombia from			Number of Colombian firms importing from		
	Argentina	Uruguay	Peru	Argentina	Uruguay	Peru	Argentina	Uruguay	Peru	Argentina	Uruguay	Peru
2000	81'198	8'349	156'166	624	34	503	486	27	275	643	34	512
2001	122'006	8'609	189'301	754	39	598	555	30	358	737	40	568
2002	141'032	8'826	153'755	822	56	646	617	35	356	810	46	566
2003	214'066	13'807	170'266	1'082	95	689	838	42	375	1'043	64	586
2004	226'835	10'390	221'856	1'188	88	754	945	44	403	1'195	69	675
2005	277'872	8'901	288'731	1'473	129	765	1'130	62	419	1'390	80	663
2006	430'759	9'412	476'897	1'491	110	1'001	1'242	61	548	1'513	82	787
2007	481'830	11'564	559'730	1'539	121	1'097	1'345	58	585	1'533	84	830
2008	664'882	27'481	729'326	1'654	120	1'224	1'344	73	728	1'469	102	997
2009		12'162	589'400		114	1'146		64	728		97	1'016
2010		15'337	743'562		110	1'101		72	739		110	1'065
2011		25'065	982'764		99	1'209		67	853		109	1'161

Table 3

Preference utilization rate in terms of export value, products, exporters and importers

Export value			Products			Exporters			Importers		
Argent.	Peru	Uruguay	Argent.	Peru	Uruguay	Argent.	Peru	Uruguay	Argent.	Peru	Uruguay
0.23	0.97	0.93	0.51	0.71	0.38	0.36	0.77	0.47	0.42	0.83	0.55
0.33	0.98	0.96	0.58	0.71	0.36	0.43	0.74	0.54	0.51	0.82	0.56
0.74	0.97	0.83	0.53	0.75	0.31	0.47	0.76	0.53	0.58	0.83	0.53
0.72	0.98	0.80	0.66	0.72	0.27	0.58	0.75	0.57	0.63	0.82	0.49
0.82	0.99	0.53	0.42	0.74	0.27	0.47	0.72	0.50	0.55	0.81	0.47
0.84	0.99	0.56	0.66	0.76	0.37	0.60	0.73	0.51	0.66	0.81	0.52
0.90	0.98	0.49	0.74	0.73	0.48	0.68	0.72	0.55	0.72	0.77	0.57
0.91	0.98	0.65	0.77	0.68	0.40	0.70	0.74	0.51	0.75	0.80	0.53
0.94	0.98	0.76	0.81	0.75	0.47	0.78	0.76	0.64	0.80	0.81	0.65
0.86	0.98	0.75	0.80	0.74	0.37	0.78	0.75	0.56	0.82	0.81	0.66
0.94	0.99	0.67	0.74	0.74	0.35	0.73	0.78	0.50	0.77	0.82	0.62
0.98	0.99	0.80	0.87	0.78	0.53	0.82	0.74	0.65	0.84	0.79	0.75

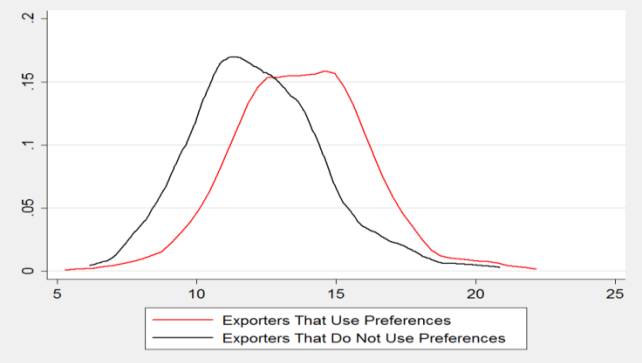
Table 2 shows the evolution of Colombian imports from Argentina, Peru, and Uruguay over the sample period (2000-2011). Imports grew substantially over the period at both the intensive and extensive margins, and from all three origin countries, including Peru vis-à-vis which preferences did not change. Thus, the evolution of Colombia's imports from its trade partners was driven not just by deepening preferences toward some of them, but by some other factors as well. Table 3 shows the evolution of preference utilization rates for Argentina, Peru, and Uruguay, in terms of four different margins: the value of exports (the intensive margin), the number of products, the number of exporters, and the number of buyers on the Colombian side. Unsurprisingly, utilization rates are stable over the period for Peru, whose access to the Colombian market did not change. Moreover, the numbers suggest that the uptake was high throughout, consistent with the deep tariff preference margins shown in Table 1. Argentina's uptake rate rose substantially at all margins, consistent with the improvement in the coverage and depth of its preferences on the Colombian market. In the case of Uruguay, the pattern is more idiosyncratic, as preference uptake in terms of dollar export value was already very high at the beginning of the sample period where the tariff-preference margin was near zero (as mentioned, preference margins in Table 1 are rounded to the nearest integer) and less than 10% of its export lines were eligible.

All in all, the data in Table 1-Table 3 suggests that Colombia's preferential access to Argentina, Peru and Uruguay has been characterized by high uptake (unlike many North-South and South-South preferential schemes, as discussed in footnote 1), making it a good setting to explore the effect of preferences on export growth at the firm level.

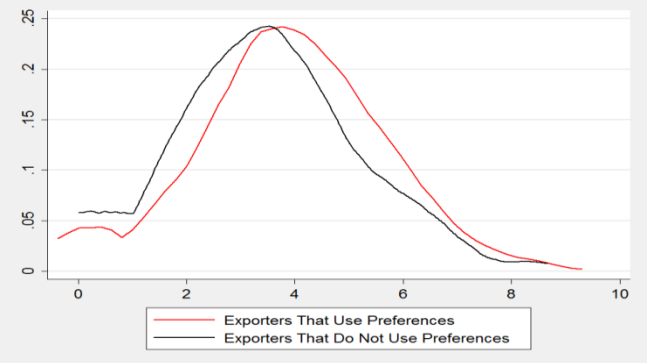
Figure 1

Distribution of firms by preference-using status, 2006

(a) Argentina: Sorting in terms of overall firm export value

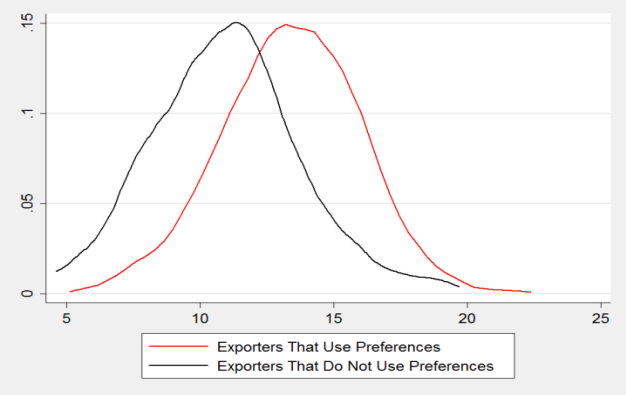


(b) Argentina: Sorting in terms of firm employment

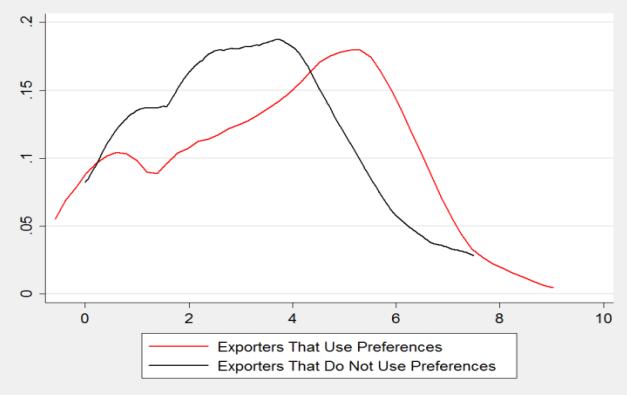


Note: The horizontal axis measures the log of export value in panel (a) and the log of employment in panel (b), both measured in 2006.

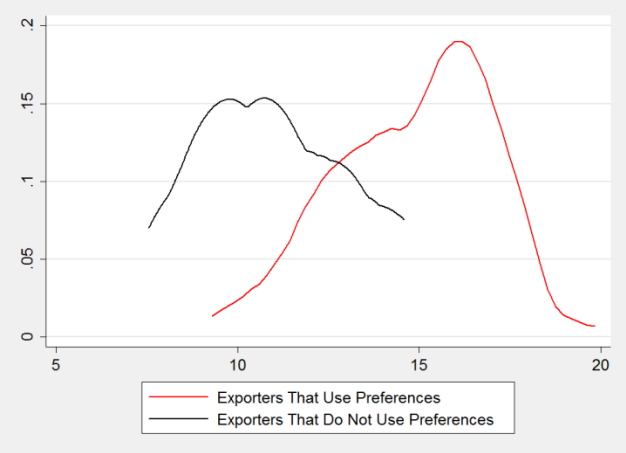
(c) Peru: Sorting in terms of overall firm export value



(d) Peru: Sorting in terms of firm employment



(e) Uruguay: Sorting in terms of overall firm export value



Who uses trade preferences? Our sample shows heterogeneity across firms, with sorting in terms of overall export value but not employment in the case of Argentina and both export value and employment for Peru (Figure 1). In the case of Uruguay, the sorting is drastic, suggesting that preference-using firms are of a different nature altogether than others, consistent with the earlier observation that Uruguay had a high rate of preference uptake in spite of shallow preference margins.

Moving beyond descriptive statistics, Table 4 shows the results of a "kitchen-sink" regression of the determinants of preference utilization at the firm level on firm and product characteristics available in the dataset. Sorting by firm type depends on a number of firm attributes, each of which is a typical correlate of firm size but also interacts with preference utilization independently of size. A firm's total exports and the number of its exported products both contribute to a high preference utilization rate, but the number of destinations does not.[10] Total imports from third countries and the number of origin countries for the firm's intermediates contribute negatively to preference utilization, although they are likely to correlate with firm size; but that is intuitive given that rules of origin penalize the use of out-of-bloc intermediates. In other words, sorting in terms of firm size is complicated by the fact that larger firms tend to source intermediates from a wider range of countries (the cross-border value-chain syndrome) which makes rules of origin more costly for them. Within-firm and within-firm-year results in columns (7)-(9) show that the attractiveness of tariff preferences is a robust effect.

[10] Further regressions (not reported) using transactions originating from Argentina and Peru only, for which we have census data on the exporters involved, returns an unstable coefficient on employment. In a pooled regression, the coefficient on employment is negative and significant, while in a within-firm regression, it is positive but only weakly significant.

Table 4

Determinants of preference utilization: Estimation results

Sample	All Countries								
Dep. var.: Utilization rate Estimator: OLS	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Firm-level determinants									
Total Exports a/	0.023*** (0.002)								
Number of Destinations		-0.005 (0.003)							
Number of Exported Products			0.041*** (0.004)						
Total Imports a/				-0.006*** (0.002)					
Number of Origins b/					-0.009*** (0.003)				
Number of Imported Products						-0.005 (0.004)			
Product-level determinants									
Tariff preference Margin c/	0.023*** (0.001)	0.022*** (0.001)	0.023*** (0.001)	0.022*** (0.001)	0.022*** (0.001)	0.022*** (0.001)	0.011*** (0.002)	0.010*** (0.002)	0.012*** (0.002)
ROO restrictiveness index							0.011*** (0.003)	0.014*** (0.004)	
Fixed effects									
Firm	No	No	No	No	No	No	Yes	No	No
Firm-year	No	No	No	No	No	No	No	Yes	Yes
Product	No	No	No	No	No	No	No	No	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Number of Observations	23,561	23,561	23,561	20,697	20,697	20,697	16,621	16,621	24,794

a/ Colombia excluded

b/ Number of countries from which the firm imports intermediates

c/ Absolute difference between MFN and preferential tariff

3. Estimation and results

3.1 Estimation issues

We now turn to the paper's central question, namely how export growth correlates with the use of trade preferences at the firm-product level. The interest of carrying out the exploration at this level is that, as the stylized facts presented in section 2 suggest, preference utilization is affected by both product characteristics (the stringency of rules of origin and the dependence of the technology on imported inputs) and firm characteristics, some of which are observable (those included in the

regression in Table 4) while others may not (e.g. the capacity to cope with administrative complexity in proving compliance).

Unsurprisingly, the basic estimation issue is endogeneity, as the decision to use a preferential regime correlates with a host of observable and unobservable firm attributes (indeed, as we just argued this is why we carry out the exercise at the firm level) that also correlate, independently of preference use, with export growth. There are basically two ways of dealing with this: instrumentation, or, alternatively, a sufficiently powerful array of fixed effects to capture at least some of the variation in unobservables between and within firms.

We start with the second approach. Let *o* stand for origin, *t* for year, *f* for firm, and *p* for product (the destination is always Colombia). Our unit of observation is an *ofpt* cell. Likely correlates of future firm growth include aggregate demand shocks, sectoral supply shocks at the *opt* (origin × product × time) level, including possibly aggregate (origin × time) shocks such as exchange-rate fluctuations, or firm-specific shocks at the *ft* (firm × time) level. By including all three dimensions of fixed effects, we control for a vast range of confounding influences. Let $\Delta \ln\left(y_{ofpt}\right)$ be the log-difference of firm *f*'s exports of product *p* to Colombia at *t* (*o* being firm *f*'s origin country), from year *t* to year *t*+1, u_{ofpt} the average rate of utilization of eligible preferences by firm *f* on all its shipments of product *p* to Colombia in year *t*,[11] δ_t a vector of year effects, δ_{opt} a vector of origin-product-year effects, δ_{ft} a vector of firm-year effects, and ε_{ofpt} an error term. Our baseline estimation equation is

$$\Delta \ln\left(y_{ofpt}\right) = \beta u_{ofpt} + \delta_t + \delta_{opt} + \delta_{ft} + \varepsilon_{ofpt} \qquad (1)$$

We further decompose the effect by firm size, splitting our sample between small and large firms.

The alternative route is to instrument for preference utilization. In the first-stage regression, firm-level correlates of preference utilization in Table 4 are subsumed by fixed effects. As for product-specific instruments, the stringency of RoO on intermediates used in the manufacturing of product *p* should correlate, together with tariff preference margins, with the use of preferences by firm *f*. However, given that product-specific RoOs do not vary much across products—unlike in NAFTA—and exporters are given the choice between a change of tariff classification and a local

[11] Firms do not necessarily make the same decision to use or not a preferential regime on all their shipments.

value content one cannot be too optimistic about the explanatory power of RoOs in determining preference utilization. In addition, a key question is whether there is any reason why RoO stringency could affect the growth of firm *f*'s export of product *p* otherwise than through its use of preferences (the exclusion restriction). This cannot be completely ruled out. To see this, consider the case of an Argentine firm that intends to use preferences irrespective of RoO stiffness because it is vertically integrated and has a uniquely efficient upstream production process, RoO are never binding for this firm, but stiffer RoO raise the costs of *other* Argentine firms, thus reducing competition for firm *f* and potentially raising its export growth. Thus, whether RoO stringency is a valid instrument or not (i.e. whether this competitiveness channel is significant or not) is an empirical question.

Moreover, RoO may be endogenous to aggregate (cross-firm) export growth at the product level in the following sense. If, in negotiating RoO, Colombian special interests insisted on imposing stiffer rules on products where Colombia's trading partners had the strongest comparative advantage, but did not succeed in imposing RoO so stiff that they would entirely offset their comparative advantage, RoO stringency would correlate positively with future export growth.

We control for this using an approach developed in Portugal-Perez (2009) where he splits the determinants of product-specific RoO between non-political-economy factors (tariff differentials, which would fuel trade deflection in the absence of RoO) and political-economy factors (essentially industry competitiveness proxies such as revealed-comparative advantage and exports to the rest of the world). Regressing Estevadeordal's (2000) index of RoO stringency on this two blocks of explanatory variables yields two predicted components of RoO stringency: one explained by trade-deflection variables, one explained by political-economy variables. We build on this approach by using the component of RoO stringency explained by tariff differentials in order to "purge" endogeneity driven by political economy.

The tariff-differential variable we use is the difference between the tariff preference margin on Colombia's imports from Argentina and the tariff preference margin to be offered by Colombia to the U.S. according to the terms of the XX agreement.

The second candidate instrument for preference utilization (which can be used in combination with RoO stiffness) is the price of intermediates exported to Argentina (respectively Peru and Uruguay). The reasoning here is that RoO, which force local sourcing, become costlier when those prices go

down, thus discouraging preference utilization. Again, the exclusion restriction cannot be taken for granted, as the price of imported intermediates can affect firm *f*'s export growth through industry-wide competition effects. Moreover, there may be reverse causation as export growth at the industry level may feed back on imported intermediates' prices (although exports from Argentina, Peru and Uruguay are likely to be too small to affect world prices). In order to filter out this channel, we use the unit values of intermediates exported by our origin countries' own (upstream) trading partners to *other* destinations.

In terms of estimation, there is a trade-off between instrumenting and fixed effects in that the combination of fixed effects used in (1) is likely to exhaust the information in the data, annihilating the weak signal in instrumental-variable estimation, instrumental variables and fixed effects being both used to control for omitted variables. Thus, in IV estimation we use a slightly weaker set of fixed effects than in OLS estimation; namely, either firm, product, or firm-product, depending on the specification.

3.2. Results

3.2.1 Baseline

Table 5 shows baseline estimation results for (1) using OLS with fixed effects by firm-year, country-product-year, and year in various combinations in columns (1)-(6), and interacting preference utilization with a firm-size indicator in columns (7)-(9). The effect of preference utilization on firm growth is positive and highly significant in all cases; moreover, the strength of the effect increases with firm size. If this effect is interpreted as the shadow value of relaxing the constraints associated with the use of preferences, our results suggest that the cost of using preferences stems more from the constraint on sourcing (a variable cost borne by larger firms whose sourcing is wider than that of smaller firms) than from the fixed cost of proving compliance through paperwork.

Table 5

Export growth and preference utilization: Baseline results

Sample	All countries								
Estimator: FE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Regressors									
Preference Utilization	0.725***	0.717***	0.701***	1.000***	0.994***	0.764***			
	(0.037)	(0.038)	(0.154)	(0.061)	(0.062)	(0.253)			
Preference Utilization × Small							0.948***	0.948***	0.721**
							(0.071)	(0.072)	(0.303)
Preference Utilization × Large							1.102***	1.087***	0.808*
							(0.117)	(0.118)	(0.398)
Fixed effects									
Firm-Year	No	No	Yes	No	No	Yes	No	No	Yes
Country-Product-Year	No	No	Yes	No	No	Yes	No	No	Yes
Year Fixed Effect	No	Yes	No	No	Yes	No	No	Yes	No
Number of Observations	27,871	27,871	27,871	13,327	13,327	13,327	13,327	13,327	13,327

3.2.2 Robustness and extensions

Table 6 reports the results of IV estimation using the instruments described in Section 3 linearly and interacted with each other. The regressor of interest is now the *change* in preference utilization between 2004 and 2008 rather than its level, so we report OLS results in columns (5)-(8) for comparison.

Table 6

Export growth and preference utilization: Instrumental variable estimation

SECOND STAGE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample: all countries								
Dependent variable: $\Delta \ln y_{ofpt}$								
Estimator:	IV				OLS			
Regressors								
Δ Preference utilization (2004/2008)	2.165***	2.322	4.990*	3.116**	1.006***	0.604***	0.922***	0.681*
	(0.476)	(1.443)	(2.717)	(1.462)	(0.121)	(0.167)	(0.211)	(0.362)
Observations	1,465	1,465	1,465	1,465	1,465	1,465	1,465	1,465
Fixed effects								
Firm	no	yes	no	no	no	yes	no	no
Product	no	no	yes	no	no	no	yes	no
Firm × product	no	no	no	yes	no	no	no	yes

FIRST STAGE								
Dependent variable: Δu_{ofpt}	(1)	(2)	(3)	(4)				
Regressors								
Colombia's share at *fp* level in 2004 (1)	-0.240	-0.033	-0.131	-0.103				
	(0.160)	(0.271)	(0.174)	(0.474)				
US share at *p* level in 2004 (2)	-0.057	0.010						
	(0.074)	(0.108)						
Δ Tariff Diff. (AR-US) (2004/2008) (3) a/	-1.225***	0.048						
	(0.283)	(0.465)						
Interaction terms								
(1) × (2)	0.506	-0.145	-0.108	-0.058				
	(0.424)	(0.694)	(0.497)	(1.200)				
(2) × (3)	-0.897	-1.500						
	(0.795)	(1.119)						
(1) × (3)	-1.240	-3.076	-2.047	2.275				
	(1.725)	(3.586)	(2.079)	(5.796)				
(1) × (2) × (3)	6.148	8.148	0.846	-21.749				
	(4.887)	(9.819)	(6.555)	(18.313)				
Fixed effects								
Firm	no	yes	no	no	no	yes	no	no
Product	no	no	yes	no	no	no	yes	no
Firm × product	no	no	no	yes	no	no	no	yes
F-Stats.	12.50	1.078	1.050	1.004	-	-	-	-
p-val	0.000	0.376	0.381	0.405	-	-	-	-
Hansen Stats.	27.754	8.285	7.651	1.174	-	-	-	-
p-val	0.000	0.218	0.054	0.759	-	-	-	-

Notes

a/ Variation between the difference of the tariff faced by Argentina and the MFN in 2004 and the tariff faced by Argentina in 2008 and the prospective US tariff.

First-stage results are weak, as none of the specifications (which differ by the type of fixed effects included) manages to pass both instrument-weakness and instrument-validity tests.

4. Concluding remarks

During our sample period (2000-2011), Colombia offered deep trade preferences to Peruvian exporters while improving market access for Argentina and Uruguay in 2004. The preferential market access granted to Argentina and Uruguay was very substantial in terms of tariff-preference margins, and, unlike many South-South schemes, it was widely used by exporters from then on. Thus, our sample period provides a policy experiment to explore the effect of market access on

export growth at the firm level, using a detailed transaction-level dataset that can filter out many confounding influences.

At the product level, we find that preference utilization correlates robustly with the depth of tariff preference margins, suggesting that they are sufficient to offset compliance costs at least for some firms. At the firm level, we find that preference utilization correlates positively with firm size but negatively with the breadth of input sourcing, suggesting that rules of origin constrain the benefits of tariff preference margins.

While preliminary, our results suggest two observations. First, if the coefficient on preference utilization in our export-growth equation is taken as the shadow value of relaxing the constraints on preference utilization (the rules of origin) in terms of additional export growth, that value is large, suggesting that the constraint is binding and costly. Second, the constraint seems to be more binding for large firms than for smaller ones. This suggests that, of the two costs associated with using preferential regimes—proving compliance through paperwork, a fixed cost, and sourcing locally inputs that would be more efficiently sourced outside of the bloc, a variable cost—the latter seems to be the most important one.

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