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Rules of Origin in North-South Preferential Trading Arrangements with an Application to NAFTA[*]

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Abstract

All preferential trading agreements (PTAs) short of a customs union use Rules of Origin (RoO) to prevent trade deflection. RoO raise production costs and create administrative costs. This paper argues that in the case of the recent wave of North-South PTAs, the presence of RoO virtually limits the market access that these PTAs confer to the Southern partners. In the case of NAFTA, it is estimated that up to 45% of Mexico’s preferential access to the US market in 2000 (estimated at 4%) was absorbed by RoO-related administrative costs with non-administrative costs for Mexican firms of about 3% US of import value. These findings are coherent with the view that North-South PTAs could well be viewed like a principal-agent problem in which the Southern partners are just about left on their participation constraint.

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1. Introduction

With the proliferation of preferential trading arrangements (PTAs), much interest is being focussed on the effects of rules of origin (RoO), especially at the theoretical level (Krueger (1997), Krueger and Krishna (1995), Falvey and Reed (2000), Krishna and Krueger (1995), Krishna (2003)). Work has also been carried out on the detailed aspects of their implementation (Estevadeordal (2000), Estevadeordal and Suominen (2003))) as well as on the political-economy aspects (Duttagupta and Panagariya (2002), Flatters (2002)). To our knowledge, beyond the observation that RoO raise costs of production by constraining producers in their choice of inputs, there is little recent empirical work on these costs.[1]

At the same time, most recent PTAs have been of the North-South (or 'vertical') type involving one (or several) rich Northern partners and one (or several) substantially poorer Southern partners. This is the pattern for the myriad EU PTAs, but also for those involving the US. While it has been recognized that recent vertical PTAs are perceived as bringing several 'non-traditional' gains from integration for the Southern partner (see e.g. Fernandez and Portes (1999)), there is concern that little market access is in fact being provided by these agreements, both because MFN tariffs are falling, but also because of the complexity of RoO that invariably accompany all PTAs short of full CUs.[2] Taking the case of the recent

[1] Early estimates were for EFTA. Koskinen (1983) estimated administrative compliance costs under the EFTA-EC FTA at between 1.4% and 5.7% of the value of export transactions, while according to Holmes and Shephard (1983) the average export transaction from EFTA to the EC required 35 documents and 360 copies. Also see Herin (1986). For recent work, see Estevadeordal (2000), Estevadeordal and Suominen (2003), Brenton and Manchin (2003)), and Augier, Gasiorek and Lai-Tong (2003).

[2] For example, the EAs provided duty and quota free access to clothing products coming from the CEECs presumably an improvement over OPT status which deducted from the tariff, the duty paid on textile exports from the

implementation of NAFTA where substantial market access was provided to Mexican firms selling in the US market, this paper sets out to give estimates of the likely costs of RoO in the case of NAFTA and argues that these may be representative of a North-South PTA.

The remainder of the paper is organized as follows. Section 2 describes the general features of RoO operating under PANEURO and NAFTA, the two main examples of North-South PTAs and gives an estimate of their potential impact on the volume of trade. Section 3 then summarizes the standard positive theory of RoO which is subsequently applied to NAFTA. Section 4 provides indirect estimates of the likely compliance costs of RoO under NAFTA along with an attempt to disentangle administrative costs from costs associated with the rules themselves. Section 5 then examines to what extent the pattern of trade in manufactures between Mexico and the US was affected by NAFTA along the lines predicted in section 3. Section 6 concludes.

2. Rules of origin and trade patterns

RoO are in principle meant to ensure that goods being exported from one of the partners to another truly originate from the area and are not superficially assembled from components originating from third countries (henceforth “non-originating”). Two criteria are used to identify origin: the “wholly-obtained or produced” category which asks whether commodities and related products have been entirely grown, harvested or extracted from the soil in the territory or manufactured there from any of these products, thereby

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EU. Yet, Brenton and Manchin (2003) conclude that the use of OPT privileges rather than switching to the FTA status indicates that the costs of compliance with RoO was denying any additional market access beyond that obtained under OPT status. On AGOA, see Mattoo et al. (2002).

precluding the use of second-country components, and the more complex “substantial transformation” criterion which is used most frequently. Five basic components of RoO are used at the product level to substantiate the transformation criterion across PTAs, including the two most notable North-South PTAs: the EU FTAs now being negotiated under the PANEURO system which is in place since 1997, and NAFTA.

First is a Change of Tariff Classification (CTC) which requires the product to change either: its chapter (CC at the 2 digit level under the Harmonized System (HS)); or its heading (CH at the 4 digit level); or change its sub-heading (CS at the 6 digit level); or its item (CI at the 8-10 digit). In terms of restrictiveness, following Estevadeordal (2000), one can assume that the change at the item [chapter] level is the least [most] restrictive, i.e. that CI<CS<CH<CC. Next is an exception attached to a particular CTC (called an ECTC), usually forbidding the use of non-originating materials from certain subheadings, headings or chapters. Third is Value Content (VC) which specifies the minimum percentage value that must be added by the exporting country. VC can be expressed in one of three ways: (i) a minimum Regional Value content (RVC); (ii) a minimum difference between the value of the final good and the costs of imported inputs (import content, MC); (iii) a minimum Value of originating Parts (VP). Finally, the Technical requirement (TECH) criterion requires the product to undergo certain manufacturing operations.[3]

[3] On the one hand, the restrictiveness of these criteria is relaxed by the following: *de minimis* rules allowing for a specified maximum percentage of non-originating materials to be used without affecting origin; a roll-up or absorption principle that allows materials that have acquired origin by meeting specific processing requirements to be considered originating when used as inputs in subsequent transformation; cumulation (bilateral, diagonal or full) that allows producers of one PTA to use non-originating materials from another PTA member without losing the preferential status. On the other hand, the restrictiveness of RoO is increased because all PTAs impose administrative costs via the method used for certifying origin. Most PTAs require a two-step certification (public and private) while NAFTA is

Table 1 summarizes the structure of RoO in a typical EU FTA under the PANEURO system and under NAFTA according to the criteria described above (the PANEURO system applies for virtually all EU FTAs and NAFTA is likely to be the model for future FTAs involving the US). The table gives the percentage of HS-6 tariff line headings that fall under each of the broad categories of RoO presented above. Comparing PANEURO and NAFTA, one notices the high degree of selectivity. Both use the whole gamut of criteria although PANEURO relies more heavily on a CH rule (33% vs. 17%) while NAFTA relies mostly on a CC rule (2% vs 31%). Finally, the third column gives the value of a restrictiveness index r_i, ($1 \le r_i \le 7$) constructed from an extension of Estevadeordal's (2000) observation rule.[4] Perhaps the most important point to retain from that table is that, indeed, RoO are complex, and vary enormously in their details.

Insert table 1: Structure of RoO in Selected FTAs

As a first inquiry into the effects of RoO, we estimate a standard gravity model on cross-section data using average data for 1999-2001:

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an exception since it only requires self-certification. Krishna (2003) points out the importance of the specific details of RoO.

[4] More precisely, the observation rule, y^*, is carried out at the tariff line level i. The value of the RoO index, r_i, takes a value according to the following criterion: $r_i=1$ if $y^* \le CI$ (i.e. if the change of classification is at the item level); $r_i=2$ if $CI < y^* \le CS$; $r_i=3$ if $CS < y^* \le CS+VC$; $r_i=4$ if $CS+VC < y^* \le CH$; $r_i=5$ if $CH < y^* \le CH+VC$; $r_i=6$ if $CH+VC < y^* \le CC$; $r_i=7$ if $CC < y^* \le CC+TECH$. Finally, in the case of those EU RoO for which no CTC is specified, the following changes modifications are brought to the above rule. First, RoO based on the import content rule are equated to a change in heading (value 4) if the content requirement allows up to 50 percent of non-originating inputs of the ex-works price of the product. Value 5 is assigned when the share of permitted non-originating inputs is below 50 percent, as well as when an import content criterion is combined with a technical requirement. Second, RoO featuring an exception alone is assigned value 1 if exception concerns a heading or a number of headings, and 2 if the exception concerns

$$\ln M_{ij} = \alpha_0 + \delta_i + \delta_j + \alpha_1 \ln(Y_i Y_j) + \alpha_2 \ln(DIST_{ij}) + \alpha_{3k} \ln(DUM_{ij}^k) + \alpha_4 PTA_{ij} + \alpha_5 CU_{ij} + \beta \ln(1 + ROO_{ij}) + \mu_{ij} \quad [1]$$

The dependent variable is total bilateral imports of i from j, M_{ij}. Explanatory variables include the logarithm of the product of partners' GDPs ($Y_i Y_j$), also averaged over the 1999-2001 period, the logarithm of distance $DIST_{ij}$, a vector of dummy variables, DUM^k_{ij}, that take a value of 1 (zero otherwise) if the partners share a common border, a common language, or a common colonizer. The remaining variables are constructed from Estevadeordal and Suominen (2003 in progress) and are specific to this exercise. They include dummies that take a value of 1 (zero otherwise) if the partners belong to a PTA (1400 pairs of countries in the sample), or to a "perfect" PTA, i.e. a CU (318 pairs of countries in the sample)[5]. Finally, ($1+ROO_{ij}$) is the value of the restrictiveness index (an unweighted average of the r_{ij} values measured at the 6-digit HS level of disaggregation) if there is a PTA between i and j (but not a CU).

To conform to the recommended formulation of the gravity model in cross-section (see Anderson and Van Wincoop, 2003), the formulation [1] should also include a term that measures multilateral resistance (or relative distance) when estimated with ordinary least squares (OLS). An alternative approach to estimating the gravity equation, while using OLS, is to use fixed effects to take account of these unobserved multilateral resistance terms (see Anderson and Van Wincoop 2003, Feenstra 2003, chapter 5, p.35). Hence table 2 presents the results both in OLS and with country fixed effects (these are captured by the δ_i and δ_j dummies in equation [1]).

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a chapter or a number of chapters. Third, RoO based on the wholly-obtained criterion are assigned value 7.

[5] The PTA_{ij} dummy take the value one if the two countries i and j belong to the same PTA, except if the PTA is a "perfect" one, i.e. a CU.

Insert table 2:
Bilateral Trade and RoO Restrictiveness: A Cross-country Gravity analysis

Estimation of [1] is for 149 countries for 15280 observations.[6] For well-known reasons, one would expect the following signs: $\hat{\alpha}_1 > 0; \hat{\alpha}_2 < 0; \hat{\alpha}_3 > 0$. However of interest here, is the value of $\hat{\beta}$. After controlling for the effects of a CU (where RoO do not play the potential role of restricting trade) and after controlling for PTA partnership, both of which would be expected to yield positive estimates ($\hat{\alpha}_4, \hat{\alpha}_5 > 0$), one would expect $\hat{\beta} < 0$ if indeed, other things equal, ROO are impediments to trade.

As is customary in gravity estimates with a large number of observations, the coefficient estimates are stable across specifications, including several not reported here to save space. As predicted by the theory, the signs and values of the standard gravity coefficients on income, on distance, and on the vector of dummies are close to those in the literature, even though the estimated value of the income coefficient in the theoretically correct specification (column 2) departs from an expected coefficient close to unity.

Of particular interest here are the values for the coefficients on the PTA, CU, and restrictiveness index variables. According to the estimates in columns 1 and 2, a PTA augments significantly trade between countries as does a CU [except in

[6] The sample size is determined by the data collection in Estevadeordal and Suominen (2003). Trade data is from the IMF trade statistics, the GDP's are in 1995 constant dollars from the World Bank Indicators. A small value is assigned for zero values for bilateral imports. We do not report results from Tobit estimations since they yield very close values for all coefficient estimates.

column 2 where the coefficient is not significant which suggests that one should not place too much emphasis on the relative magnitude of the coefficients on these dummy variables]. Most importantly, the coefficient of the restrictiveness index has a negative, stable and statistically significant sign. If one is willing to accept the multiplicative form in [1], the net effect of a PTA is positive since the positive impact captured by the PTA dummy dominates the negative impact of the RoO variable.[7]

These results are only suggestive, since robustness to omitted variable bias[8] and potential endogeneity of right-side variables could modify the results. Yet, given the large sample, and the difficulty in obtaining the relevant omitted variables that might be correlated with the endogenous variable (those omitted variables that are correlated with the explanatory variables are controlled for with the bilateral dummies), it is likely that the results in table 2 would survive these checks.

3 The simple analytics of RoO

Table 1 indicates that value content (VC) and technical requirements (TECH) are pervasive across PTAs. To illustrate how VC (and TECH) reduce the gains from market access, suppose that a final good, denoted by the subscript F, is produced with

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[7] If we run the regression without the ln(ROO+1) variable, the coefficient for the PTA dummy is 1.37 by OLS and 1.09 with country fixed effects, both significant at 1%. The coefficient estimate is still larger than the corresponding coefficient for the CU dummy which is surprising but could be partly explained by the effects captured by the other dummy variables controlling.

[8] If we introduce the logarithm of the product of the populations, $\ln(N_i N_j)$ in addition to the logarithm of the GDP’s product, notably to take into account the Balassa-Samuelson effect, the results are still very similar to those in column 2.

labor (l) and an intermediate good, denoted by the subscript I, according to the following Leontief technology:

$$X_F = \min\left\{ f(l_F); (X_I + X_I^*)/a \right\} \quad [2]$$

where a is an input-output coefficient, X_I represents the quantity of intermediate originating from the free-trade area (henceforth called “home-made”) and X_I^* the quantity imported from the rest of the world. The formulation in [2] presupposes that the home-made and imported varieties of the intermediate good are perfect substitutes in production, an assumption maintained throughout. Due to the presence of a fixed factor omitted from the formulation, technology f effectively produces value-added with labor under decreasing returns to scale. To represent the Mexican situation under NAFTA (and other ‘vertical’ PTAs), suppose that two countries, North (N) and South (S) form an FTA whereby goods produced in one of the two countries can be exported to the other at preferential (reduced) tariff rates, provided that they satisfy the RoO criterion here reduced to a VC criterion.

To keep things simple, suppose that the South does not produce the intermediate good and hence does not protect it. Let p_F^* and t_F be respectively the final good's world price and ad-valorem external tariff in the North, p_I^* and p_I be the intermediate good's world price and domestic price in the FTA, the latter being determined endogenously by the RoO.

Let the VC take the form of a regional value content (RVC) expressed by weight which is a constraint on the quantity (volume) of the imported variety that can be used by the final-good producer in order to qualify for preferential treatment.

Let the RoO specify that a proportion α of intermediate consumption must originate from the area. Formally, the rule then takes the form:

$$X_I \geq \alpha\left(X_I + X_I^*\right) \quad [3]$$

If the Northern intermediate-good industry is inefficient at world prices, the RoO is binding, in which case [3] can be written as:

$$X_I = \frac{\alpha}{1-\alpha} X_I^* \quad [4]$$

Using this, the total value of intermediate consumption at domestic prices is

$$\varphi(\alpha) = p_I X_I + p_I^* X_I^* = \left[\frac{\alpha}{1-\alpha} p_I + p_I^*\right] X_I^* = \frac{\overline{p}_I}{1-\alpha} X_I^* \quad [5]$$

where $\overline{p}_I = \alpha p_I + (1-\alpha) p_I^*$ is the price index of the composite intermediate good in the presence of a RoO. Because the RoO segments the intermediate-good market in the free-trade area, the price of the home-made one is determined endogenously by supply and demand. Let then $X_I^N(p_I)$ be its supply (in the North, since the South does not produce it) and $X_I\left(p_I, p_F^*\left(1+t_F\right), \alpha\right)$ its demand. Demand for the home-made intermediate comes only from the South, since Northern producers won't bother to use it when its price is higher than $p_I^*\left(1+t_I\right)$. That price is determined by[9]

$$X_I\left(p_I, p_F^*\left(1+t_F\right), \alpha\right) = X_I^N(p_I) \quad [6]$$

[9] Several cases must be considered, but in order to avoid a taxonomy of little interest here we will suppose that the price satisfying the market-equilibrium condition is above $p_I^*(1+t_I)$.

Suppose first that Southern producers of the final good enjoy tariff-free access to the Northern market (i.e. they obtain $p_F^*(1+t_F)$ if they satisfy the RoO). Unit value added is then

$$v(t_I,\alpha) = p_F^*(1+t_F) - a\overline{p}_I(\alpha)$$

whereas, under an MFN regime $v^* = p_F^* - ap_I^*$. The benefit from using the preferential regime, b, is thus

$$b = v(t_I,\alpha) - v^* = p_F^* t_F - a(\overline{p}_I - p_I^*) = p_F^* t_F - \alpha a(p_I - p_I^*) \quad [7]$$

Let $\rho_I = (p_I - p_I^*)/p_I^*$ be the ad-valorem equivalent (AVE) of the premium on the home-made intermediate good generated by the RoO. Expression [7] can be rewritten in an effective rate of protection (ERP) format as:

$$b = p_F^* t_F - \alpha a p_I^* \rho_I \quad [8]$$

Expression [8] states that the net incentives to Southern producers granted under the application of the RoO is positive (negative) if the gain in terms of market access resulting from a higher price obtained for the final good exceeds the extra costs on intermediate goods due to the application of the RoO, so that a profit maximizing Southern producer of a final good will avail himself of duty-free access to the Northerner's market under the FTA, only if b>0.[10]

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[10] Note that when $\alpha < 1$, the preferential regime can be profitable ($b > 0$) even when the rate of effective protection given tariff equivalents t_F and ρ_I is negative. This is because $\alpha < 1$ implies that the tariff equivalent on the composite intermediate good, $x_I + x_I^*$, is less than ρ_I, the tariff equivalent on the home-made intermediate good. Herin (1986) used this insight to develop a revealed-preference approach to detecting the extent of market access provided by an FTA, which we use in section 4.

If, instead of having tariff-free access to the Northern market, Southern producers eligible for preferential treatment benefit from a reduced tariff at rate τ_F, their producer price on the Northern market is $p_F^*(1+t_F)/(1+\tau_F)$.

We have not yet mentioned administrative costs. If θ are per unit administrative costs (temporarily assumed homogenous across activities), the benefit, net of administrative costs, from using the preferential regime is thus:

$$b = p_F^*\left(\frac{t_F - \tau_F}{1+\tau_F}\right) - a\alpha(p_I - p_I^*) - \theta \qquad [9]$$

It follows directly from [9] that *b* is increasing in the rate of preference (i.e. decreasing in τ_F), and decreasing in α, the restrictiveness of the RoO. One can see easily from [9] that, for a given value of τ_F, a suitable combination of α and θ values will leave the Southern partner on his “participation constraint”. Suppose then that the value of *b* can be set identically equal to zero in [9]. The right-hand side of the equation can then be differentiated totally with respect to τ_F and α, giving $d\alpha/d\tau_F < 0$: deeper preferences (a lower value of τ_F) are associated with stricter RoOs (a higher value of α).

Finally, in view of the application to NAFTA below, it is useful to rewrite [9] as:

$$b = p_F^*(\tilde{\tau}_F) - a\alpha\rho_I p_I^* - \theta = \tilde{\tau}_F - (r+\theta) = \tilde{\tau}_F - c \qquad [10]$$

where $\tilde{\tau}_F = \frac{t_F - \tau_F}{1+\tau_F}$ is the ad-valorem tariff preference when market access is not tariff-free, world prices have been set equal to unity by choice of units, the costs of RoO are replaced by the proxy value given by the restrictiveness index presented in table 1 (rescaled since the choice of units here imply $0 < r_i < 1$), and c represents total RoO-related compliance costs.

If the participation-constraint view is indeed prevalent in North-South PTAs, one would expect that there is *substitutability* between tariffs and RoO as instruments of intra-bloc protection. If so, suppose that Southern final-good producers used to purchase their intermediate inputs outside of the bloc before the preferential agreement. Then, as RoO are substituted for tariff protection, they start purchasing within the bloc, say in the North if the South does not produce the intermediate inputs. As a result, their costs go up and they enjoy only marginally improved market access. But Northern producers of intermediates now enjoy a captive market and emerge as the winners. Thus, Northern (US, EU) intermediate-good producers can be expected to lobby in favor of RoO. Taking the argument one step further, as stiffer RoO require deeper tariff preferences along the Southern member's participation constraint (because $d\alpha/d\tau_F < 0$ along $b = 0$, see supra and the dotted indifferent participation curves drawn in figure 1), Northern intermediate-good producers can be expected to lobby in favor of deeper tariff preferences in their downstream sectors. When they succeed, tariff revenue for the Northern country is replaced by rents and inefficiencies at the level of intermediate-good producers.[11]

[11] While this outcome can be derived from common agency political economy models (see e.g. Cadot et al. 2003), it can also be viewed as an application of the obfuscation principle in the endogenous tariff literature. See Magee, Brock and Young (1989, chp. 18). Alternatively, one may take as exogenously given that all intra-bloc tariffs must go to zero, which then implies that the rate of tariff preference is equal to the rate of MFN tariffs. Then, if MFN tariffs proxy for lobbying power, ROOs will be positively correlated with them (and with tariff preference since the two

With specific functional forms, one can get an idea of the trade-offs involved between preference rates, $\tilde{\tau}$, and the costs associated with a VC of the type analyzed here. Portugal-Perez (2003), simulates a modified version of [10] in which Southern-partner producers purchase intermediates from the Northern partner and from the ROW under the assumption of a Leontief technology for intermediates, a CES technology (with elasticity of substitution σ) for intermediates by country of origin, a CES technology for value-added using capital and labor (with elasticity of substitution σ_V) and a CET (constant elasticity of transformation function with transformation elasticity Ω). To reflect the partial equilibrium set-up, assume also that prior of the FTA, half of the exports go to the (future) Northern FTA partner, and that the Southern partner faces an infinitely elastic demand for its exports, and an infinitely elastic supply of capital and labor. Let α_0, α_1 represent the Northern partner's share in intermediate imports before and after the FTA respectively. Portugal-Perez obtains the following preference values for the final good, $\tilde{\tau}_F$, (which are plausible in light of the Mexican experience discussed below) that will leave the Southern partner on his participation constraint:

$[\alpha_0 = .2, \alpha_1 = .3\,(\sigma = 1, \sigma_V = 1, \Omega = 1) \rightarrow \tilde{\tau}_F = 5.1\%]$;
$[\alpha_0 = .2, \alpha_1 = .3\,(\sigma = 2, \sigma_V = 1, \Omega = 2) \rightarrow \tilde{\tau}_F = 2.7\%]$.

To summarize, we may ask how the above analysis could help predict how the application of RoO would affect the pattern of trade in manufactures under a typical FTA like NAFTA. At the minimum we must consider three countries: two forming an FTA (intra-FTA trade), and a third (the rest-of-the-world (ROW).

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are just the same thing) but for a reason that is unrelated to the Southern member's participation constraint.

Suppose then that manufacturing trade is aggregated into intermediates goods and final goods trade. Then, in the absence of a change in tariffs, the application of RoO would be expected to have the following effects:

1) Final goods producers would shift their purchases of intermediates to intra-FTA intermediates.
2) If final goods are imperfect substitutes by origin, consumers will shift towards (away from) intra-FTA from (to) ROW trade if b>0 (b<0) in [8].
3) Should there be a shift in consumer goods consumption towards FTA partners that is not too strong (τ_F not too large relative to ρ_I), an FTA would be expected to raise the share of intermediates goods trade in total intra-FTA trade.

Alternatively, if market-access is substantial (τ_F is large and ρ_I is small) then predictions 1) and 3) would not be borne out in the data, intra-partners final goods trade would rise markedly. Below, we shall examine whether or not these predictions were borne out in the case of NAFTA using the WTO classification of goods into raw materials, intermediates and final goods classification.

4. Assessing the costs of NAFTA's RoO

The remaining sections use NAFTA to assess the costs of RoO and to see whether trade patterns have been altered along the lines predicted above.[12] This section provides estimates of total compliance costs and section 5 looks for changes in the pattern of manufacturing trade.

[12] NAFTA has four broad types or RoO (see Cadot et al. (2002) for a detailed description).

Tariff preferences granted under NAFTA are substantial. In 1998 (about half-way down the tariff phase-out) [in 2000, near completion], the US average tariff on Mexican goods was 0.28% [0.08%], whereas the US average MFN tariff on the same goods was 4.8% [4.02%], giving a preference for Mexican exports to the US of 4.51% [3.94].[13] As a result, it would seem that Mexican products enjoy substantial access to the US market.[14] However, in spite of these preferences, as shown in table 3, in 2000, NAFTA's utilization rates, U_i, computed at the HS-6 level varied widely across sectors, being sometimes substantially below 100% in sectors with deep tariff preferences, suggests that hidden barriers associated with RoO-related compliance costs undid the positive effect of tariff preferences, and that firm heterogeneity may be important.

Following Herin's (1986) approach in the case of EFTA, in sectors where NAFTA's u_i=100%, the benefit of tariff preference is revealed larger than total compliance costs (including administrative costs), while for sectors where u_i=0%, tariff preference rates, τ_i, provide a lower bound on total compliance costs. Finally, for sectors with $0\% \leq u_i \leq 100\%$, if Mexican exporters had identical (homogeneous) compliance costs they would be revealed indifferent between shipping under NAFTA or MFN, so the rate of tariff preference would be revealed equal to compliance costs.[15] Recognizing that compliance costs are

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[13] Average tariffs are ad-valorem equivalents weighted by shares in Mexican exports to the US. Thus, the weighted-average MFN tariff reported here is computed using the product shares in Mexican exports to the US as weights, rather than product shares in total US imports. Mexico's maquiladora exports amounted to $223 million in 2000 (see Cadot et al. 2002 for details).

[14] For specific examples, in 1998, Mexican apparel products faced a tariff of less than 1% whereas similar products from China and Hong-Kong faced tariffs of 12.7% and 17.5% respectively. For automobile products the corresponding tariff rates were 0.4% for Mexican products, against 2.7% for German products.

[15] Out of a total of 3641 lines, 1471 lines had $0\% < u_i < 100\%$, accounting for 75.6% of the total value of exports to the US.

likely to be heterogeneous even within sectors (some firms are better at dealing with compliance costs than others), all that can be said is that the tariff preference gives a rough estimate of compliance costs in the sense that at least some firms have higher compliance costs whereas others have lower ones.

According to table 3, NAFTA's overall utilization rate, $\bar{u}$ was 64% in 2000, with the utilization rate computed at the HTS-6 level, measuring the share of Mexican exports to the US that entered under the NAFTA regime. When tariff lines with zero US MFN tariffs (and hence no tariff preferences) are excluded (last column of Table 4), $\bar{u} = 83\%$. Among sectors with significant exports, despite substantial preferential access, the T&A sector (HTS2 chapters 50-63, $10.3 billion) had a slightly lower-than average utilization rate. At the other end of the spectrum, the lowest utilization rates among significant sectors were u_i=20% for furniture (HTS chapter 94, $3.8 billion), u_i=42% for optics (HTS2 90,$4.6 billion), u_i=48% for knitting products (HTS2 61,$ 3.5 billion), the lowest rate in the textile-clothing sector.

Insert table 3 here
Mexican exports to the US and NAFTA’s regime

Further inspection of Table 3 suggests much heterogeneity in compliance costs, justifying exploring further sources of this heterogeneity using the restrictiveness index, r, introduced in table 1. For example, in T&A (sector 11 in table 3), $t_i^{MFN} = t_i = 16.69\%$ (weighted at the 6-digit level by the value of Mexican exports) and $t_i^{NAFTA} = \tau_i = 0.06\%$, yet u_i=66.7% but r_i=6.9. The transport equipment (HTS17) and leather goods (HTS8) sectors have similar tariff preferences (τ_i=6.28%; τ_i=6.38%), yet utilization rates are very different, though in the direction predicted by values of r_i ([u_i=94.9%; r_i=4.8] versus [u_i=57%; r_i=5.6]).

To construct a ‘rule-of-thumb’ estimate for the share of administrative costs in total compliance costs, we assume that differences in administrative costs, θ, in equation [10] are mostly related to differences in administrative capabilities to deal with red tape compliance across firms, rather than to differences across sectors (at least when the severity of the RoO is supposedly the same as measured by the index, r).

By revealed preference, for those tariff headings that are eligible for NAFTA treatment and where 100% of Mexico's exports to the US enter under the NAFTA regime (i.e. u_i=100%), the combined cost of complying with RoO and other NAFTA-related administrative procedures cannot be greater than the benefit conferred by preferential tariff access. In other words, the value of b in [9] is positive. For those tariff headings, thus, the rate of preference gives an upper bound on total compliance. By the same reasoning, for those tariff headings where none of Mexico's exports enter the US under NAFTA regime (i.e. u_i=0%), the rate of preference gives a lower bound on those costs.

The first approximation on combined ROO and administrative costs associated with the preferential regime is given by the rate of tariff preference for the remaining sectors (i.e. 0%<u_i<100%). This is because, as explained above one can suppose that, at least for the marginal firms (administrative and ROO compliance costs may vary across firms), $b = 0$. Thus, for those tariff headings, the rate of preference $\tilde{\tau}_i = \left[\left(t_i^{MFN} - t_i^{NAFTA}\right)/\left(1+t_i^{NAFTA}\right)\right]$ would be an upper bound estimate on combined ROO and administrative costs. Eliminating tariff headings with either u_i= 100% or u_i= 0%, the import-weighted average of the rate of preference is 6.13% (1471 tariff line observations, standard error 0.58%).[16] In terms of [10] total compliance costs, c_i, for sectors on the participation constraint are: $b_i=0 \Leftrightarrow 0\%<u_i<100\% \Rightarrow (r_i+\theta_i)=c_i=\tilde{\tau}_i=6.13\%$.

When can we consider administrative costs to be negligible? For those tariff lines corresponding to industries that are on their participation constraint (i.e. $0\%<u_i<100\%$), administrative costs should be low when it is easy to comply, which should correspond to easy-to-document 'proof of origin' (e.g. a change of classification at the item level or at the sub-heading), i.e. for tariff lines for whom the value of r_i is low. We take as a cut-off r^* of 2 (only one tariff line has a value of 1), i.e. $R = \{i: r_i \leq r^*=2\}$. This corresponds to the case where the RoO boils down to a change of tariff subheading, CS, or at the item level, CI.

A calculation of the average, minimum and maximum values of tariff preferences for three different sets $R \cap U$ (low restrictiveness values defined above cum different cut-off utilization rates values) corresponding to cut-offs for u^* of 90%, 95% and 99% gives average values for preference margins between 4.18% (u^*=90%) and 4.69% (u^*=99%) and robust to changes in u^*.[17] Take then the average tariff-preference level for u^* = 95% ($\tilde{\tau}_i=4.30\%$) as the closest upper bound on non-ROO administrative costs. In terms of [10] if $b_i=0 \Leftrightarrow 0\%<u_i<100\% \Rightarrow$

[16] In the calculations, we have eliminated 5 outlier observations with $\tilde{\tau}_i>100\%$ belonging to chapter 24 (Tobacco) and 12 (vegetables). Excluding outliers, the average margin of preference was 4.1%.
[17] As a further check, the frequency distribution of tariff preference levels by intervals of two percentage points in $R \cap U$ (218 observations) for $u^* = 95\%$ and confirms that the range 2-4% is not only the average but also the mode of the distribution.

$\theta_i = c_i - \tilde{\tau}_i = 6.13\% - 4.3\% = 1.83\%$, or close to 45% of the preference margin.[18]

This estimate should be interpreted with caution. Referring back to [10], if firms that export at the HS-8 level are heterogenous (which must certainly be the case), then some firms will not meet the RoO, which Ju and Krishna (2003) call a heterogenous regime. In evaluating the average administrative costs, we obviously ignore regime switches as estimates of the restrictiveness change. Fortunately this problem is not too important in these non-parametric estimates, since all but one of the values of the r_i index are equal to 2. However, since we are taking averages across industries, some observations that enter the calculation must include firms for which b>0.

Finally recent estimates of compliance costs (Carrère and de Melo (2004)) using the same data set, but distinguishing the cost-raising effects of different RoO (change of chapter heading, regional value content, and technical requirements) yields both estimates that justify the observation rule used by Estevadeordal (2000). They also find that for each of three broad product categories (raw materials, intermediates and final goods), unconstrained cost estimates within the zero-one range), are lower than the average preference margin for products with a utilization rate of 100%. They also find, as expected, that total compliance costs are greater for final goods than for intermediates, and fairly close to the non-parametric estimates reported here.

5. Tariff Preferences and RoO: Offsetting instruments?

[18] Carrère and de Melo (2003) repeated these non-parametric estimates for 2001 data when the average preference margin and utilization rates were

If RoO and tariff preferences largely offset each other, one would only expect marginal changes in trade patterns between the US and Mexico following NAFTA, with these changes being along the lines suggested in section 3. To see if NAFTA shifted patterns of purchases and sales along the lines predicted above, we computed several indices of the regional intensity of trade according to the following formulas. Let x_{ijk} be country i’s exports of good k to country (or region) j, $x_{ij} = \Sigma_k x_{ijk}$ country i’s exports aggregated over all goods to country (or region) j, $x_{ik} = \Sigma_j x_{ijk}$ country i’s exports of good k to the world, and $x_i = \Sigma_k \Sigma_j x_{ijk}$. Then, letting i be Mexico, j the US, a regional intensity of trade index, R_{ijk} would indicate the intensity of exports of good k by Mexico to the US (an index greater (less) than 1 indicating concentration (lack of concentration)):

$$R_{ijk} = \frac{x_{ijk} / x_{ij}}{x_{ik} / x_i} \qquad [11]$$

Using the same notation, let m_{ijk} denote Mexican imports from the US of good k, and let k=I denote the set of intermediate goods, k=F the set of final goods, and period (0) 0=92-94 and (1), 1=98-00, the pre and post-NAFTA two year average values. Then, according to the discussion in section 3, and as shown in the first two inequalities, R_I and R_F in [12], we would expect imports of intermediates to shift towards the US, and exports of final goods to the US. Alternatively, if one views NAFTA as specializing Mexico-US trade into a ‘vertical exchange’ of the offshore-assembly type whereby the US ships semi-finished goods for assembly in Mexico and then re-imports them as finished products, then, as shown in the third inequality, V, in [12],

slightly higher. Their corresponding estimates for 2001 are: $\theta_i = c_i - \tilde{\tau}_i = 6.16\% - 4.44\% = 1.72\%$

one would expect the pattern of Mexican revealed comparative advantage towards the US to shift away from finished towards intermediates:

$$R_I = \frac{m_{ijI}(1)/m_{ij}(1)}{m_{ijI}(0)/m_{ij}(0)} > 1; R_F = \frac{x_{ijF}(1)/x_{ij}(1)}{x_{ijF}(0)/x_{ij}(0)} > 1;$$
$$V(1) = \frac{R_{ijI}(1)}{R_{ijF}(1)} > V(0) = \frac{R_{ijI}(0)}{R_{ijF}(0)} \qquad [12]$$

Computation of [12] shows a strong shift in sales of final goods towards the US (R_F=1.12), but only a small change in the pattern of intermediate purchases (R_I=0.98) away from the US, and little evidence of 'vertical exchange' at the aggregate level. However, stronger patterns of specialization along the lines predicted in section 3 are apparent for textiles and apparel (T&A) (784 tariff lines). For the T&A tariff lines, the above indices take the values: R_I= 1.24>1; R_F=1.02>1; V(1)=0.57>V(0)=0.33.

Figure 1 explores the issue further by reporting data on tariff preferences and the restrictiveness estimate of the costs of RoO at the HTS1 level from Cadot et al. (2002).[19]

Insert figure 1 here

Mexico: Exports to the US in PREF/ROO ($\tilde{\tau}_i / r_i$) space, 2000

According to [10], 45^0 lines would trace equal benefit curves in preference-restrictiveness space, with lines closer to the North-West corner indicating higher market access values since they would correspond to large preferences and low RoO compliance costs. On the assumption that r integer values are an approximation of RoO compliance costs, it is immediately

[19] These data are aggregated from ITC data on US imports from Mexico (overall and under NAFTA regime) at the HTS 6-digit with ad-valorem tariff equivalents computed at the 8-digit level using US ad-valorem and specific tariffs under MFN and NAFTA regimes and aggregated to the 6-digit level using US imports from Mexico as weights.

apparent that the attractiveness of the high-preference, high-RoO package offered by NAFTA to HTS 11 (T&A) cannot be directly compared with the low-preference, low-ROO package offered to HTS 16 (machinery & electrical equipment) since they could be on the same b ‘indifference locus’, but one can say that the latter is unambiguously better than that offered to HTS 2 (vegetable products) and probably better than that offered to HTS15 (base metals). At the HTS1 level, figure 1 clearly suggests a 'frontier' in terms of tariff preferences and RoO with all points lying Southeast of that frontier.

As a final check, we ran the following double-log ad-hoc specification:

$$\ln XUS_i = \underset{(10.15)}{5.48} + \underset{(70.33)}{0.54} \ln XROW_i + \underset{(9.57)}{0.015} \ln \tilde{\tau}_i - \underset{(7.10)}{(0.338)} \ln r_i \qquad [13]$$
$$NOBS = 3,617; \quad \overline{R}^2 = 0.831$$

where XUS_i ($XROW_i$) stands for exports to the US (rest of the world) at the HS 6 level in 2000, $\tilde{\tau}_i$ stands for the rate of tariff preference under NAFTA, r_i is the restrictiveness index, and where a vector of dummy variables at the HS 2 level that controls for omitted variables have not been reported in [13]. As can be seen, the coefficients have the expected signs, suggesting that preferences and RoO have opposite effects on exports to the US, and if one were to trust the relative magnitude of the coefficients, that preferential access has a quantitatively smaller effect than increases in the stringency of RoO.[20] But, alternative specifications in which changes in export shares (post vs. pre NAFTA) to the US were regressed on the same set of variables yielded generally statistically

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[20] Tariff lines with $\tilde{\tau}_i = 0$ were assigned a value arbitrarily close to zero (10E-13). Strictly speaking, one cannot compare the magnitude of the coefficients since the values taken by r are ordinal rather than cardinal.

insignificant coefficients suggesting both little systematic changes in the destination composition of Mexican manufacturing exports, as would be expected under the ‘participation constraint’ view of North-South PTAs.

6. Concluding remarks

This paper has described and analyzed the functioning of RoO present in all PTAs. Having developed the basic analytics of RoO in a typical North-South PTA, we have argued that in the predominantly North-South recent wave of PTAs these RoO have been set up in a complex and non-uniform manner, so that in practice these PTAs provide little market access. As a result, compliance costs have largely eroded the preferential access afforded by the PTA, leading us to suggest that Southern partners are effectively left on their ‘participation constraint’.

To estimate the likely effects of RoO, we have modified an existing index of ‘restrictiveness’ of RoO based on an observation rule on the various criteria used to establish origin. A cross-country regression on determinants of the volume of bilateral trade indicates (after controlling for several factors affecting the volume of trade) that if the presence of PTAs increased the volume of trade, the restrictiveness of RoO had a negative impact on the volume of trade.

The second part of the paper was devoted to estimating the likely effects of NAFTA on the pattern of Mexican exports to the US in 2000, a year when the treaty was almost in full force. At that time, Mexican exports were getting an average

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Interpreting the coefficient of r as an elasticity would thus be preferential access of 4% in the US market. Based on utilization rates, U_i, computed at the HS-6 tariff classification level, for sectors on the participation constraint (i.e. with $0\%<U_i<100\%$), we estimated total compliance costs of 5% with up to 40% attributable to administrative costs. Turning to the pattern of trade, calculations of indices of comparative advantage at the HS-6 level revealed (with few exceptions like textiles & apparel), only marginal changes in trade patterns although sectoral exports to the US were positively (negatively) related to preferential access (the restrictveness of RoO). Taken together, it would seem that for NAFTA, RoO largely undid preferential tariff access, suggesting that North-South PTAs may well offer little market access to the Southern partners.

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misleading.

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Table 1: Structure of RoO in Selected FTAs

(calculated at the HS-6 level tariff line)

	EUROPE	AMERICAS	
	PANEURO	NAFTA	ROO INDEX[a]
NC	0.39	0.54	1
NC+ECTC	2.39		1-2
NC+TECH	1.39		2
NC+ECTC+TECH	0.00		2
NC+VC	11.46		4-5
NC+ECTC+VC	1.57		5
NC+VC+TECH	0.08		7
NC+WHOLLY OBTAINED CHAPTER	7.62		7
NC+WHOLLY OBTAINED HEADING	0.70		
[redacted]	*25.60*	*0.54*	
CI			
CI+ECTC		0.02	1
CI+TECH			
CI+ECTC+TECH			
CI+VC			
CI+ECTC+VC		0.02	2
CI+VC+TECH			
SUBTOTAL	*0.00*	*0.04*	
CS	0.20	1.29	2
CS+ECTC	0.00	2.52	2
CS+TECH	1.90	0.04	2
CS+ECTC+TECH	0.00	0.40	2
CS+VC	0.27		3
CS+ECTC+VC	0.00	0.10	3
CS+VC+TECH	0.00		3
CS+ECTC+VC+TECH	0.00		3
[redacted]	*2.37*	*4.35*	
CH	32.99	17.09	4
CH+ECTC	4.60	19.18	4
CH+TECH	0.00	0.02	4
CH+ECTC+TECH	6.66	0.14	4
CH+VC	13.01	3.54	5
CH+ECTC+VC	0.37	0.58	5
CH+VC+TECH	0.00	0.10	5
CH+ECTC+VC+TECH	0.02		5
[redacted]	*57.65*	*40.65*	
CC	2.16	30.95	6
CC+ECTC	1.02	17.71	6
CC+TECH	0.04	0.02	6
CC+ECTC+TECH	11.02	5.76	6
CC+VC	0.00		7
CC+ECTC+VC	0.00		7
CC+VC+TECH	0.00		7
CC+ECTC+VC+TECH	0.00		7
[redacted]	14.24	*54.44*	
TOTAL	100	100	

Sources: Cols.1-3 from Estevadeordal and Suominen (2003, table --) and authors' computations

NC= No change; ECTC=exception to change of tariff classification; TECH= technical requirement; VC= value content; CI=Change of item; CS= change of subheading; CH=change of heading; CC=change of chapter

[a] The index r_i is calculated at the HS-6 level following Estevadeordal (2000) and takes a value in the range $1<r_i<7$, a higher value indicating a more restrictive RoO (see text).

Table 2: Bilateral Imports and RoO Restrictiveness: A Cross-Country Gravity Analysis

Dependent variable: Ln (Average Bilateral Imports 1999-2001)

Column	1 OLS	2 Country Fixed Effects
Ln(Y_iY_j)	0.95 (158.4)	0.80 (13.6)
Ln($DIST_{ij}$)	-0.75 (29.3)	-0.98 (32.8)
Former colony	1.28 (12.5)	1.14 (10.6)
Common colonizer	0.64 (9.4)	0.77 (12.1)
Common language	0.60 (10.8)	0.43 (7.9)
Common border	1.08 (10.3)	1.10 (10.2)
PTA	3.67 (9.4)	3.38 (10.4)
Perfect CU	0.60 (7.3)	0.11 (1.2)
Ln (RoO_{ij}+1)	-1.46 (6.3)	-2.11 (8.3)
Constant	-24.88 (72.0)	-15.90 (5.6)
Observations	15,280	15,280
Adjusted/Pseudo R-sq.	0.67	0.76

Source: Authors’ estimation; data from Estevadeordal and Suominen (2003)
Notes: Absolute value of t-statistics in parentheses.

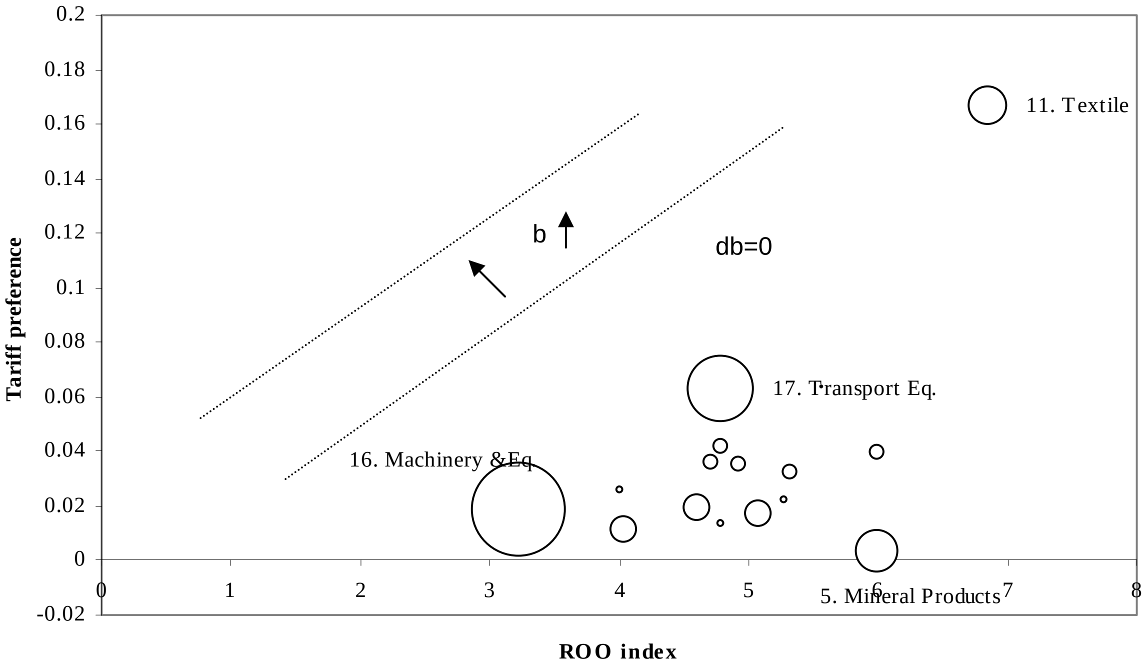
Table 3: Mexican exports to the US and NAFTA's regime

Section	Mexican exports to the US ($ million)		US Ad-valorem tariff equivalents (%)			ROO index	NAFTA utilization Rates [u_i] (%)	
	All regimes	NAFTA	MFN	NAFTA	Preferen ce rate	[r_i]	All tariff lines	Positive preference
	a	B	C	D	(c-d) / (1+d)	e	F	g
1. Live animals	974	434	0.41	0.00	0.41 (0.0066)	6.0	44.60 (23.97)	85.82 (10.74)
2. Veg. Products	3'070	2'210	4.73	0.75	3.92 (0.246)	6.0	71.95 (15.04)	85.30 (6.12)
3. Fats and Oils	30	18	4.35	0.00	4.35 (0.056)	6.0	58.60 (7.64)	62.51 (5.71)
4. Food, Bev & Tob	2'130	1'520	3.96	0.34	3.56 (4.891)	4.7	71.18 (16.30)	74.18 (14.82)
5. Min. prod.	12'700	10'500	0.40	0.08	0.32 (0.000)	6.0	82.62 (1.57)	84.76 (0.01)
6. Chemicals	1'640	928	3.42	0.21	3.19 (0.067)	5.3	56.47 (20.46)	79.10 (10.76)
7. Plastics	1'800	1'530	4.21	0.01	4.20 (0.043)	4.8	84.69 (8.16)	93.08 (1.17)
8. Leather goods	289	165	9.13	2.49	6.38 (0.180)	5.6	56.97 (17.32)	58.74 (16.82)
9. Wood products	389	208	2.66	0.08	2.58 (0.071)	4.0	53.57 (22.59)	68.06 (18.84)
10. Pulp & paper	685	462	1.34	0.00	1.34 (0.082)	4.8	67.45 (18.44)	84.76 (8.50)
11. Text.& apparel	10'300	6'790	16.75	0.06	16.69 (0.628)	6.9	65.70 (4.40)	66.72 (4.29)
12. Footwear	414	333	10.69	4.07	6.13 (0.173)	4.9	80.39 (9.73)	82.16 (8.48)
13. Stone & glass	1'540	1'050	5.01	1.45	3.50 (0.068)	4.9	67.80 (16.34)	77.53 (11.14)
14. Jewelry	507	191	2.18	0.00	2.18 (0.081)	5.3	37.70 (20.51)	40.74 (20.93)
15. Base metals	4'940	3'580	2.34	0.41	1.92 (0.031)	4.6	72.47 (14.90)	82.13 (8.96)
16. Mach. & elec.	53'000	25'300	1.86	0.00	1.86 (0.038)	3.2	47.78 (17.00)	75.60 (5.82)
17. Trans. equip.	26'800	25'400	6.31	0.03	6.28 (0.717)	4.8	94.93 (2.73)	97.64 (0.16)
18. Optics	4'610	1'950	1.14	0.00	1.14 (0.030)	4.0	42.25 (20.02)	85.99 (3.14)
19. Arms & ammun.	13	2	0.87	0.00	0.87 (0.018)	4.7	12.82 (9.50)	40.81 (18.80)
20. Miscellaneous	4'770	1'130	1.72	0.01	1.71 (0.113)	5.1	23.72 (17.05)	91.22 (4.00)
Total	130'601	83'700	4.02	0.10	3.92*	4.5†	64.03	82.68

Standard deviations in parentheses
* Standard deviation: 0.49 † Standard deviation: 2.35
Source: Cadot et al. (2002, table 1).

Figure 1

Mexico: Exports to the US in PREF/ROO ($\tilde{\tau}_i / r_i$) space, 2000



Source: Cadot et al. (2002), figure 4
Notes:
Sectors are those defined in table 3. Size of each dot is proportional to HTS1 share in country's exports (see column 1 of table 3)
b: net market access benefit. Dotted line is locus of points that give a net benefit of zero.