A Free Trade Area of The Americas: Any Gains for the South?

Carrere, Céline; De Melo, Jaime

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Céline Carrère

Jaime de Melo

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Very preliminary and Incomplete.

Abstract

Building on the experience of NAFTA, and assuming that rules of origin (RoO) negotiated under NAFTA are likely to resemble those that would be agreed upon in an FTAA, this paper discusses how different RoO criteria would affect different Southern partners in a multi-stage production setting. Next, we use a combination of parametric and non-parametric methods to estimate the costs of RoO under NAFTA for Mexican exports to US based on NAFTA's utilization rates and preference margins in the US market, at the HS-6 level. Finally, we carry out illustrative simulations for Southern producers to estimate the levels of RoO and tariff preference which leaves these producers indifferent to exporting to Northern members under the regional preferential tariff rate or the MFN rate.

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INTRODUCTION

North-South free trade areas (FTAs) are spreading like wildfire. Just to cite a few, the United States has recently signed FTAs with Jordan, Singapore, Chile, and now talks are on the table for FTAs with Morocco, Singapore, and most recently, several Middle-East countries. In addition to the politics and hegemonic purposes that these agreements serve, there is a clear political economy dimension: it is easier to put these FTAs on the trade agenda of the European Union (EU) and Unites States (US), than going for the hard stuff by bargaining for reduction in protection in the context of a new round of multilateral negotiations. This was painfully evident at the recent ministerial in Cancùn (2003), where trade ministers were busily engaging in talks about regional trade agreements when it was becoming evident that no agreement would be reached. Recent events also suggest that the future of the Free Trade Area of the Americas (FTAA) launched by the US in December 1994 faces an uncertain future, as Brazil is pushing for a Common Market in Southern America as an extension of MERCOSUR.

Rules of origin (RoO) are a key ingredient in any preferential trading agreement (PTA) short of a customs union since they are necessary to prevent the import of any commodity from entering the area through the country with the lowest duty (who gets the tariff revenue) on the item in question which then gets re-exported to other countries in the PTA (Richardson, 1995, analyses the tariff competition that results). Trade deflection will occur if the transshipping costs are just below the tariff differential leading to welfare-decreasing transshipment since prices remain unchanged in the area.

Investigation of NAFTA suggests several effects of RoO that are likely to be present in a North-South FTA like the proposed FTAA. RoO can serve :(i) to alleviate costs during a transition to an FTA, when years of transition are being negotiated at the sector level (Estevadeordal, 2000); (ii) as a substitute for protection, suggesting little market access in the Northern market for the Southern partner (Anson et al., 2003); (iii) to encourage "RoO-jumping" foreign direct investment in intermediate activities in the Southern partner so that the final activity can meet RoO requirements (Krishna, 2003); (iv) to alter the distribution of the stages of production in a world of increasingly fragmented production processes (Anson et al., 2003).

In any event, whatever their ultimate objectives, RoO will be present in any eventual FTAA, and if the future resembles the past, the associated costs are likely to fall mostly on the Southern partners (even if they were to negotiate from a common stance). Indeed, there is increasing evidence that market access to the Southern partners have been limited in the recent North-South FTAs. For example, in the case of "Everything But Arms" (EBA), Brenton (2003) notes that there is very little market access. In a similar exercise on the African Growth and Opportunity Act (AGOA), Matoo et al. (2002) reach a similar conclusion.

In this ex-ante study, we rely on: (i) the examination of the costs of RoO in NAFTA which is arguably the relevant benchmark; (ii) analytical discussion of the likely effects of RoO in an FTAA in which partners have different areas of comparative advantage in a multi-stage production process; (iii) illustrative simulations of the effects of RoO that constrain producers in their choice of intermediate inputs. These different approaches, though only loosely connected, but arguably of interest in their own, will hopefully point to some of the effects one would expect to observe in an eventual FTAA.

The remainder of the paper is organized as follows. In section 2, we discuss what might be the eventual RoO that would be negotiated in an FTAA, looking at those currently in use in the Americas. We argue that the RoO map negotiated under NAFTA is relevant as a likely starting point. Section 3 then surveys the RoO map for NAFTA: utilization rates, preference margins, and the distribution of RoO criteria across broadly defined activities (2-digit HS). This examination reveals a great deal of diversity even at the relatively aggregated HS-2 level, suggesting caution in interpreting the statistical estimates in section 5. Section 4 uses a simple multi-stage model to show how RoO will shift the pattern of production across FTAA partners, and illustrate the associated efficiency costs. The remainder of the paper turns to the consequent costs and benefits of RoO in an eventual FTAA. Section 5 uses non-parametric and statistical methods to estimate the costs of RoO in NAFTA at the HS-2 level based on RoO information and utilization levels at the HS-6 level. Because it exploits all the information available on the types of RoO, it is potentially superior to the currently used synthetic index proposed by Estevadeordal (2000). Finally, section 6 carries out illustrative cost calculations of a regional value content scheme for illustrative parameters values. Conclusions follow in section 7.

2. WHAT RULES OF ORIGIN FOR AN FTAA?

Provisions and RoO will be subject to negotiation in a FTAA, and one can ask what types of RoO are likely to prevail. To this effect, table 1 summarizes the main features of the criteria selection for establishing origin in the PTAs currently in place in the Americas.

Table 1 here: distribution of RoO in the Current RTAs in the Americas

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Several comments are in order. First, there is a great variety across agreements, already creating administrative costs because of the "spaghetti-bowl" effect.[1] Second, one can distinguish some broad patterns:[2]

✓ LAIA is representative of RoO under the traditional trade agreements. It relies mostly on a general rule applicable across the board for all tariff items of tariff classification change at the heading level (or, alternatively, a regional value added of at least 50 percent of the FOB export value) criterion.

✓ NAFTA is representative of the new North-South PTAs which rely on the panoply of criteria: change of tariff classification at the chapter, heading, sub-heading or item level depending on the product, and a host of other criteria for specific products: regional value content, exception to change of tariff classification and/or technical requirement on product or process.

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[1]"spaghetti-bowl" effect referred to the figure 3.2, p. 64, of the Anti-American Development Bank report "Beyond Borders: The New Regionalism in Latin America", 2002.

[2] see Estevadeordal and Suominen (2003) for further discussion.

✓ MERCOSUR ranges in-between these two extremes. They are mainly based on change of heading and different combinations of regional value content and technical requirements.

Third, there is an international dimension to any agreement, especially in a world where the rush to FTAs means that when any negotiation is taking place, it is as the expense of market access to an existing partner. The EU, for instance, would not be too happy to see its market access eroded in MERCOSUR if they negotiate first, and the FTAA come in next. Spillover considerations might be taken out in the negotiations.

One might next ask how the criteria described in table 1 were actually negotiated. It is likely that in the traditional agreements (LAIA, Andean Pact, etc…) little market access was at stake as these involved mostly preferential trading arrangements (PTAs) were tariff reductions were not deep, nor across-the-board (the only exception was the CACM). With little market access at stake, RoO might well have been of little importance. On the other hand, under the current negotiations in the "new wave" of PTAs, free-trade is viewed as an implementable objective, and RoO become an integral part of the negotiation process.

In the case of the NAFTA negotiations, according to Reyna (1995), the negotiators faced the challenge that establishing RoO would restrict the preferential benefits of the agreement to the partners[3]. This means that the US and Mexico were concerned that NAFTA would not result in a flood of low-cost imports into their respective markets while at the same time not cutting off foreign investment and the availability of foreign materials, especially intermediates.

The issue of intermediates is interesting and can give a clue as to which interests, of Mexican and US producers, predominated when they were in conflict. Typically in the new wave of North-South FTAs, within the partnership, in Hecksher-Ohlinian fashion, the Northern partner has a comparative advantage in intermediate goods while the Southern partner has a comparative advantage in final goods. In the case of NAFTA, Anson et al (2003) show that in the case of textiles & apparel (a sector where RoO were particularly stringent), Mexico's pattern of revealed comparative advantage shifted away from intermediates towards final. In other words, NAFTA can be viewed as successfully implementing a "vertical exchange" of the offshore assembly type. Thanks to RoO, imports of intermediates by Mexico from the US increased substantially while exports of final goods did not increase significantly[4]. As shown in section 4, this implies a reallocation of stages of production both between partners (which we call trade suppression) and between the regional partners and the rest of the world (ROW) which is the standard trade diversion effect. This and other evidence led Anson et al. to conjecture that the RoO is likely to work mostly to the benefit of producers in the Northern partner in any North-South FTA.

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[3] According to Reyna (cited in Estevadeordal, 2000, p.148), shortly after NAFTA came into force, Mexico experienced a huge surge of imports from China which it addressed instituting extensive anti-dumping investigations.
[4] See Anson et al. (2003) for details on the resulting change in the pattern of comparative advantage between 1992-1994 and 1998-2000.

Further cursory evidence can be gleaned by comparing the average value of Estevadeordal's index which takes values in the range $0 < r_i < 7$ across sectors in NAFTA. Take US sectors with tariff peaks, i.e. 3 times or more the 2001 average (4.8%) and compare the value of r_i in those sectors with the corresponding values in the low-tariffs sectors (less than one-third the average tariff). Values for the index (number of observations in each group in parenthesis) are in decreasing order of protection: $r_i = 6.0\,(257)$, and $r_i = 4.8\,(1432)$. Since tariff escalation according to the stage of processing is widely observed across all countries, tariff peaks are concentrated in the final goods sectors. It follows that, at least according to this index of restrictiveness, under NAFTA, RoO would protect final-goods producing sectors while preserving the "vertical exchange of goods" that one often observes for manufactures between industrialized and developing-country partners.

In sum, on the basis of these observations, one can concur with Estevadeordal and Suominen (2003, p.12) conclusion that "the NAFTA model is also widely viewed as the likely blueprint for the RoO of the FTAA". In the following sections, we try to estimate the costs of RoO for Mexico in NAFTA under the assumption that these estimates could give ball-park estimates for the effects of RoO under a future FTAA.

3. RULES OF ORIGIN, PREFERENCES AND UTILIZATION RATES UNDER NAFTA

Table 2 describes the data used in the calculation of the compliance cost estimates for Mexican exporters of RoO under NAFTA. All data is for

2001, when NAFTA was in full force, and are defined at the HS-6 level of aggregation. For example, utilization rates, denoted u_i, are defined as the ratio of USA imports from Mexico under US-NAFTA preferential tariffs to total USA imports from Mexico (at the 6-digit HS-level). Tariff preference margins, $\tilde{\tau}_i$ are also calculated at the product line level and are defined as:

$$\tilde{\tau}_i = \frac{t_i - \tau_i}{1 + \tau_i}; \quad \left(t_i = t^{us}_{i,mfn} \quad ; \tau_i = t^{us}_{i,mex} \right) \tag{1.1}$$

where world prices are set equal to one by choice of units. Table 2 also reports in column the average value of Estevadeordal's index (which, as noted above, takes values in the range $0 < r_i < 7$). All data in table 2 are simple (unweighted) averages at the HS-2 level, i.e. for 20 sectors (with the number of HS-6 level tariff lines in each sector for 2001).

Table 2 here: Rules of Origin, Preferences and Utilization Rates

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In table 2, all data on RoO refers to percentage of tariff lines subject to the corresponding RoO. For example, sector 11 (textiles & apparel, henceforth T&A) had 618 observations at the HS-6 level, an average utilization rate of 79.9% and an average tariff preference margin of 10.4%, with 54% and 41% of the observations falling under respectively the final and intermediate good, according to the classification of the WTO. This sector represents 7.35% of the total Mexican exports to US in 2001. Within that sector, 80% [19.7%] percent of observations had to satisfy a change of classification at the chapter [heading] levels, and 42% of the tariff lines had technical requirements.

Perusing the table in view of our objective to estimate costs of compliance of RoO, notice first that only the textiles & Apparel (T&A) and foodstuffs have average tariff preference margins above 10%. Second, note that some sectors with a substantial number of observations (i.e. over 100) have relatively high utilization rates in spite of low preference margins (e.g. sector 13). According to stages of processing, raw materials account only for 9% of the observations and of the total Mexican exports to US, about 30% of observations fall under the intermediate category (which represents only 4% of the total exports) and the remainder falls under the final good category (61% of the observations and 87% of the total exports). Finally, in spite of large dispersions within sectors, in the average, tariff preference margins are the same for final and intermediate goods producing sectors, even though average utilization rates are much higher for the intermediate goods sectors (74% vs. 54%).

Turn next to the distribution of types of RoO, recalling that their effects can only be captured by the use of dummy variables in the statistical analysis below. About 45% of the tariff lines have to meet a Change of Heading (CH) with the remainder (50%) having to meet a Change of Chapter (CC). This means that it would be futile to attempt to capture the effects of both types of changes in tariff classification since the dummy variables would be almost perfectly collinear. Along the same lines, note that exceptions (whose effects on costs are difficult to interpret anyway) , denoted E, cover about half of the tariff lines, being present for 98% of the lines in T&A (sector 11) and 85% in chemicals (sector 6). Turning to the technical requirements (TECH) which cover only 8.6% of the lines and 6 sectors, they are concentrated in sector 11. Finally regional value content (RVC) is prevalent in four sectors, and covers 5% of the observations.

Figure 1 plots the cumulative frequency distribution of the two variables of interest, utilization rates, u_i, and preference margins, $\tilde{\tau}_i$. Utilization rates are evenly distributed around three groups of values: one third of the total sample with u_i equal to zero, one quarter with u_i equal of 1 and the remainder in-between. As to preference rates, the total sample average preference is 4.11% with the following quartile distribution: [25%:0%]; [median or 50%:2.58%] and [75%:5.5%].

Figure 1 here: Cumulative distributions of the utilization and tariff preference rates

Note that this distribution of utilization rates and preference margins are quite different between intermediate and final goods. u_i=0% represent respectively 20% and 34% for the intermediate and final goods and u_i=100% respectively 50% and 16%. Concerning the distribution of $\tilde{\tau}_i$, the average for the intermediate goods sample is around 4.81% and the quartile repartition are: [25%: 0.6%]; [median or 50%: 3.7%] and [75%: 5.5%], whereas for the final goods the average is 4.13% and the quartile distribution: [25%: 0%]; [median or 50%: 2.5%] and [75%: 7.36%]

As a final check on the importance of preferential market access on the pattern of trade, note that in 2001, among the 131 US$ million exported from Mexico to the US, 62% benefited of the NAFTA regime. While proximity to the US market implies that stakes for Latin partners in an eventual FTAA would probably not be as great as for Mexico, getting a handle on the costs of RoO and the implied market access should still be a worthwhile. Actually tariff preferences to the US market for Mexican products are still substantial for some categories of products, utilization rates are at times high, and market access could likely still be substantial for FTAA partners, especially if the negotiations to launch a new multilateral round of trade negotiations were not to get off the ground.

4. RoO in a Multi-Stage Production Model

We wish to illustrate the effects of the RoO criteria identified in table 2 on efficiency and the incentives to relocate production activities among members, leaving it to section 6 to carry out illustrative welfare calculations. This is perhaps best done in a multi-stage production model. We adapt here the three-country model of Rodriguez (2001) inspired from the multi-stage production model with a continuum of goods first proposed by Dixit and Grossman (1982) to study the effects of domestic value-content restrictions on foreign direct investment (FDI). Let A, B, C be the countries, and assume that the i stages of production are ordered by increasing labor intensity in the interval [0,1]. Different factor endowments give different countries their respective comparative, with producers choosing where to produce each stage of the production process in function of the final goods prices and the costs of production processes, which in turn will depend on tariff policy and RoO criteria. Production takes place under constant returns to scale and perfect competition so that the marginal cost of producing each stage i, $c(i)$, is constant. Finally suppose that production costs are sufficiently different so that each country has a cost advantage in some stage of production, with the least labor-intensive [most labor-intensive] being undertaken in $C\ [A]$. Without loss of generality, we follow Rodriguez (2001) and assume that costs of production for each stage are unity in A, so unit cost functions are $C^C(i),\ C^B(i),\ C^A(i)=1$.

Figure 2 illustrates both the initial free trade (FT) situation, and also one in which A, B, C apply their MFN tariffs, $t^A,\ t^B,\ t^C$. We shall use superscripts *, T, and F(R) to represent values under free-trade, MFN tariff F(R), the corresponding values under an FTA without (with) binding RoO. Start then with FT where stages of production are indicated with an asterisk: C produces stages $0 < i < i^*_{CB}$; B produces stages $i^*_{CB} < i < i^*_{BA}$, and A produces stages $i^*_{BA} < i < 1$. The FT price of the final good, p^*, is obtained by summing the unit costs at each stage:

$$p^* = \int_0^{i^*_{CB}} C^C(i)di + \int_{i^*_{CB}}^{i^*_{BA}} C^B(i)di + \int_{i^*_{BA}}^{1} C^A(i)di \qquad (1.2)$$

which is the sum of the shaded areas $A,\ B,\ C$ delimited under the FT cost curves and the solid vertical lines in figure 2. Cost minimization ensures that producers split the stages of production so that the production costs are equivalent at the marginal stage of production separating each pair of countries. In this set-up, B trades with C and A trades with B. For future reference, when A and B will form an FTA $(FTA(A,B))$, when B exports to A, the percentage value-added in the zone, v^*, is given by: $v^* = (B)/(B+C)$.

Figure 2 here: Production stages under FT and MFN tariffs

Figure 2 also shows how the application of MFN tariffs t^A, t^B, t^C, alter the incentives of production and hence the distribution of stages of production across the three countries.[5] Start with B whose costs are increased on the stages of production imported from C to the dotted line $(1+t^C)C^B$. This means that stages of production in the area $i_{BA}^T < i < i_{BA}^*$ which were previously cheaper to produce in B are now produced in A. What about stages of production in C? These will be doubly penalized, both by the increased costs of stages produced in B and by stages produced in A, i.e. the cost curve for production in C shifts to $(1+t^A)(1+t^B)C^c$, so that stages $i_{CB}^T < i < i_{CB}^*$ are now produced in B. In the end, relative costs of production will have increased in C relative to B and in B relative to A.[6] The MFN tariffs have raised the costs of intermediates produced in C twice, once when exported to B at stage i_{CB}^T, and a second time when they are embodied in the good-in-process produced in B and exported to A at stage i_{BA}^T while intermediates produced in B only face the tariff at i_{CB}^T.

Figure 2 also shows the effects on tariff revenue, and on the efficiency of the distribution of stages of production (shaded triangles and parallelograms). Also because the share of value-added in C (evaluated at tariff-inclusive prices) is reduced relative to FT, we have $v^T > v^*$.

5 To simplify the graphical representation of tariffs on cost curves, we assume that an ad-valorem tariff t results in a vertical shift in the marginal cost of producing stage i.

6 Note the analogy with the analysis of effective protection where a tariff structure can stimulate [penalize] the value-added in an activity (ERP>0) [ERP<0] since here B could end up either producing more or less stages than under FT.

Let now A and B form an FTA, $FTA(A,B)$ with producers seeking to minimize the costs of producing a good for consumers in A. Recall that B exports to A. As shown in figure 3, the elimination of tariffs between the partners returns the distribution of stages between A and B to i^*_{BA}. However, the distribution of stages between B and C is unaffected (since B stills applies tariffs on imports of good-in-process from C). Now value-added originating in the zone when goods-in-process are exported from B to A has increased and is $v^F = (B^F)/(B^F + C^F) > v^T$. So the very fact of forming an FTA between the middle-stream and the downstream country raises FTA value-content. As noted by Rodriguez, a non-binding RoO between the partners satisfies the WTO's article XXIV requiring that it not raise barriers towards non-members.

Figure 3 here: FTA(A,B) with non-binding RoO

In this example, one could think of the middle-stream country, B, being a middle-income FTAA partner (Argentina, Brazil, Chile) and the downstream partner, A, the US. In the absence of a binding RoO, $FTA(A,B)$ is trade-creating (one of the inefficiency triangles disappears). One can also show that consumers in A pay a lower price since goods coming from B are cheaper, while consumers in C also benefit from a lower price, since they no longer bear the costs of inefficient distribution of stages between the FTA partners.

Introduce now a binding RoO. Suppose first that the criterion is a CC, a CH, a CS, or a CI. In this model where there is only one-way trade, the

RoO requires that imports coming from C be raw materials or goods-in-process in the zone $0 < i < i_{CB}^{T}$. Clearly, the greater the range of activities produced in the middle-stream country, the least likely it is that the change of tariff classification will be binding. Consider now the triple transformation requirement technical requirement (TECH) typically imposed for T&A products in which the transformation from yarn, to fiber to clothing must be carried out in the zone to meet the RoO criterion. Applied to figure 3, this would typically mean that stages of production that would typically be produced in C would have to be produced in B, and the closest is the cost-minimizing stage of production to the origin in the absence of the RoO, the greatest is the distortionary cost (equal to the vertical distance between the C^{B} and the $(1+t^{C})C^{C}$ cost lines. As in the case of the regional value content (RVC) criterion to be considered now, the TECH criterion increases the margins of production undertaken in the FTA zone, and is trade-diverting. This example also illustrates why RoO can result in much reallocation of production, often via (inefficient) FDI in the middle-stream country.

Take now a binding RoO in the form of an RVC scheme requiring $v^{R} > v^{F}$. As shown by Rodriguez, in this simple model where trade between the partners boils down to exports from the middle-stream to the downstream partners, producers, knowing that they must increase good-in-process in the zone, will relocate production so as to equalize at each stage the ratio of the marginal increase in FTA content to the additional cost at each marginal stage. This is illustrated in figure 4, where producers push the margins of stages of production in B from i_{BC}^{T} to i_{BC}^{R} at the expense of C (this is standard trade-diversion) and from i_{BA}^{*} to i_{BA}^{R} at the expense of A

(this is inefficient relocation of production in the zone which Rodriguez calls "trade suppression"). Compared with the non-binding RoO illustrated in figure 4, the efficiency loss is given by the sum of the areas $HIJK$ and EFG, the latter representing the costs of trade suppression induced by the RoO.

Figure 4 here: FTA(A,B) with binding RoO

One could also ask what would be the consequences of RoO in an FTA between the upstream and the middle-stream countries, i.e. $FTA(C,B)$ (this could correspond to the typical South-South FTAs in Latin America during the first wave of PTAs during the sixties). In this set-up (which might not have been that relevant in the sixties when production fragmentation was negligible), there would be no need for RoO. This is so because the partners only exchange goods-in-process since the final stage of production takes place outside the zone in A. While the change of tariff classification could have the effects outlined above, an RVC RoO would be of no consequence since the partners would never exchange goods that would have content originating outside the zone. While we would not want to make too much of this observation, this might partly explain why RoO criteria among typical Latin American countries are usually restricted to across-the-board change of tariff classifications.

Finally consider an FTA between the extremes, C and A. Now an RVC would be necessary since C imports from A a final good which has content originating outside the zone in B. Since C and A do not share a cost margin, there can be no trade creation, and a binding RoO will necessarily lead to trade diversion. How pertinent is this case for an FTAA? One could think of RoO origin in the case of the US and Bolivia, Peru, or some other country in the lower-income range. In this set-up of fragmented production, goods into the Southern partner would come from the US, though they would have some content outside the zone (say the EU or Japan). This is possible, but if one recognizes that transaction costs increase with distance, it is likely that close to the entire range of production would take place in the zone.

5. ESTIMATES OF ROO-RELATED COMPLIANCE COSTS UNDER NAFTA

We now turn to estimates of the compliance costs associated with the RoO under NAFTA. In section 5.1, we carry out non-parametric estimates relying on the synthetic Estevadeordal's index of RoO, r_i. While this approach has the advantage of simplicity, it does not exploit all the available information. In section 5.2, we propose a simple reduced-form that exploits the data on the distribution of types of RoO across sectors. The objective is to see if the there are systematic differences in the costs of RoO across sectors once one controls for utilization rates. Results of the estimation are reported in section 5.3.

5.1. NON-PARAMETRIC ESTIMATES

Based on data for 2000 (very close to the data reported in table 2), Anson et al. (2003) used revealed preference arguments and Estevadeordal's (2000) synthetic index, r_i, to estimate the total compliance costs for Mexican exporters to NAFTA. As a starting point, we carry out the same exercise here with 2001 data when the average margin of preference was the almost the same (4.11% in 2001 vs. 4.10% in 2000) and the average utilization rate slightly higher (58% vs. 57%). The data only covers headings at the HS-6 level with positive exports to the US. This represents 3555 observations[7], 99 chapters and 20 sectors (see Appendix A.2 for the HS trade classification).

As a first step, we reproduce for 2001, the non-parametric estimates of compliance costs of RoO, c_i, of Anson et al. carried out for 2000. This involves comparing preference margins and utilization rates for selected values of the index of restrictiveness, r_i. By revealed preference, for headings with $u_i = 100\%$, the preference margin is an upper-bound for compliance costs (as c_i cannot be greater than the benefit conferred by $\tilde{\tau}_i$). Likewise, for headings with $u_i = 0\%$, the preference margin gives a lower-bound estimate. For the remaining sectors with $0\% < u_i < 100\%$, assumptions must be made. Anson et al. (2003) assumed that firms were indifferent to export to the US under the NAFTA or the MFN regimes (heterogeneity of firms notwithstanding). Then, an approximation of compliance costs would be given by the average rate of tariff preference computed for the remaining sectors, i.e. on the sample $0\% < u_i < 100\%$. Applying this reasoning, we obtain for 2000, [2001], $c = \tilde{\tau} = 6.13\%$, $\left[c = \tilde{\tau} = 6.16\%\right]$.

[7] We have eliminated 5 outliers with $\tilde{\tau}_i > 100\%$, 3 of these observations belonging to Chapter 24 (Tobacco) and 2 to Chapter 12 (Vegetables). All of these 5 outliers are classified as "raw materials" according to the WTO and faced only a Change of Chapter, without exception, technical requirement or regional value content. The utilization rates of these five products are 100%.

Anson et al. (2003) further break down total compliance costs, c_i, into an administrative component, δ_i, and a distortionary component, σ_i:

$$c_i = \delta_i + \sigma_i \qquad (1.3)$$

To come up with an estimate of administrative costs, they further assume that administrative costs would be negligible for firms on their participation constraint, ($0\% < u_i < 100\%$), provided that they would also have low values of r_i i.e. values corresponding to a change of tariff classification at the heading level, CH, i.e. when $r_i \leq 2$ (not much paperwork is involved in "proving" a change of heading).

We repeat their non-parametric estimate for 2001 and compare then with those they obtained for 2000. Hence, calculating preference margins for utilization rates close to 100% (say u_i=95%) when $r_i \leq 2$, gives an upper bound of the distortionary component, σ_i. These average preference margins for 2000, [2001] are $\tilde{\tau} = 4.30\%$ $\left[\tilde{\tau} = 4.44\%\right]$. Recalling that the average total compliance costs for 2000, [2001] are $c = \tilde{\tau} = 6.13\%$, $\left[c = \tilde{\tau} = 6.16\%\right]$, we get average administrative cost estimates for δ of $\delta = 6.13\% - 4.30\% = 1.83\%$ $\left[\delta = 6.16\% - 4.44\% = 1.72\%\right]$. Again, both estimates are close, though interestingly the administrative cost estimate for 2001 is less than for 2000 both in absolute terms and in relative terms, as it falls from 45% to 42% of the total compliance costs (by assumption equal to the average preference margin).

5.2. A SIMPLE MODEL

These non-parametric estimates are at best suggestive. The estimates are averages and, as mentioned above, they rely only on the values taken by the r_i index. In addition they assume that the spread in utilization rates reflects differences in administrative costs rather than firm heterogeneity[8]. While we no data to control for firm heterogeneity, these estimates gloss over important differences across sectors which we attempt to control for by developing the following simple statistical model.

Assume that aggregation from the firm to the tariff line level does not introduce systematic biases (which we can't check for anyway in the absence of firm data)[9]. Assume next that the utilization rate of NAFTA for the product line i is a positive function of the difference between the tariff preference rate, τ_i, and (unobserved) total compliance costs, c_i associated with applying the RoO criteria, i.e.:

$$u_i = f(\tilde{\tau}_i - c_i) \quad ; \quad f^{'}(.) > 0 \qquad (1.4)$$

where $\tilde{\tau}_i$ is defined in (1.1). In (1.4), u_i is defined as the ratio of USA imports from Mexico under US-NAFTA preferential tariffs to total USA imports from Mexico (including other programs) summed over all firms exporting at the HS-6 level.

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[8] Note that in Anson et al. (2003) sample, sectors with $0\%<u_i<100\%$ account for 75.6% of the total value of Mexican exports to the US so we need to take into account this information.

[9] Observed utilization rates at the HS-6 level are an aggregation of binary firm decisions of using or not the NAFTA regime (see the description of the firm's decision problem in the Appendix A.3.1).

For the compliance costs associated with the RoO, c_i, we assume

$$c_i = \beta' RoO_i + v_i \tag{1.5}$$

where RoO_i is a vector of dummies capturing the RoO described in table 2. For reasons discussed in section 3, in the estimation, we include dummy variables for tariff classification change at the chapter level (*CC$_i$*), regional value content (*RVC$_i$*) , and technical requirement (*TECH$_i$*) .

Equations (1.4) and (1.5), lead to the reduced form for estimation:

$$u_i = \alpha(\tilde{\tau}_i - \beta' RoO_i) + (\mu_i - \alpha v_i) \tag{1.6}$$

Hence we estimate the following equation:

$$u_i = \lambda_0 + \alpha\tau_i + \theta RoO_i + \varepsilon_i \tag{1.7}$$

Estimation of equation (1.7) yields estimates of $\hat{\alpha}$ and $\hat{\theta}$ from which we can approximate RoO costs, $\hat{c}_i$ from:

$$\hat{c}_i = \frac{\hat{\theta}}{\hat{\alpha}} RoO_i \tag{1.8}$$

The appropriate estimation procedure for the reduced form (1.7), since the dependent variable (the utilization rate) takes a value of only between zero or one, is a two-limit (or double-censored) Tobit (see e.g. Maddala, 1983, chap. 6, and the Appendix A.3.2 for details). The use of the maximum likelihood Tobit estimates of linear model coefficients is preferred to standard OLS estimates, because the Tobit model makes expected values of the dependent conditional on the probability of censoring sample. Hence estimation is performed first with OLS (with the

White correction for heteroscedasticity), and second with a two-limit Tobit model.

5.3. RESULTS

Our objective is to recover an estimate of costs from (1.8). Such indirect estimates can at best only be subjective, and totally depend on the first stage results for the reduced form estimation (1.7) of utilization rates in terms of the preference margins and of the RoO variables.

The first stage estimates are obtained from estimating the utilization rate for the whole sample and for broad categories of goods (intermediates and final goods):

$$u_i = \lambda_0 + \alpha\tau_i + \theta RoO_i + \sum_k D_k + \varepsilon_i \quad (1.9)$$

where $i = 1,\cdots,3555; \quad k = 1,\cdots,20; \quad RoO_i = CC_i, TECH_i, RVC_i$.[10]

The estimation of (1.9) is over the entire sample excluding the observations falling under the category raw materials[11], and a vector of dummy variables, D_k, is included to control for sector-specific heterogeneity. If misspecification and other omissions are not too important, one would hope to obtain the following signs in estimating (1.9): $\hat{\alpha} > 0; \hat{\theta}_1 < 0; \hat{\theta}_2 < 0; \hat{\theta}_3 < 0$.

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[10] As explained in section 3, for multicollinearity reasons, we could not add a dummy for CH and for E in addition to CC_i. Note also that the vector RoO_i depends on the category considered. For instance, the estimation on the intermediate goods sample does not include the dummy $TECH_i$ as none of the intermediate product faced technical requirement.

[11] Adding raw materials does not affect overall results as this category represents only 9% of the sample. Furthermore, the only RoO component for these products is a CC.

Before turning to the results, note the bounds on the estimated coefficient values in (1.9). Since all variables are in the interval zero-one (we have eliminated the five preference rates above one), one should obtain reasonable values in (1.8), provided that measurement errors and biases for the coefficients in the numerator and denominator are not systematic. One might also expect different coefficient values for the dummy variables across broad category of goods: for example a change of chapter should have a greater negative impact on utilization rates for final than for intermediate goods.

We start with aggregate results, and then turn to results for the T&A sector. Table 3 reports the results of the OLS and two-limit Tobit estimates of (1.9). For the entire sample (3225 observations) all coefficients are strongly significant with the expected sign: the tariff preference margin influences positively the utilization rate and the variables relative to RoO represents an impediment to the utilization of the NAFTA regime. In this linear specification, in terms of magnitude, the strongest negative impact on utilization rates comes from the TECH requirement. This is not surprising when one recalls that these requirements are added when it is felt that a change of tariff heading is "insufficient".

Turning to the comparison of estimates for final and intermediate goods, note that TECH is only present for final goods (and applied mostly to the T&A sector), but RVC is present and significant for both categories. [12]

However, as previously explained, we eliminated this part of the sample because all the outliers in terms of tariff preference margins belonged to this category.

[12] Note that when the reduced form is estimated for raw materials, the tariff preference margin is positive and strongly significant (due to some outliers). But CC, the only RoO faced by this category is not significant. This is not surprising, and conforms with a priori expectations.

Before comparing the magnitude of coefficients on RoO dummies, recall that only 5% of the tariff lines have an RVC, and less than 9% a TECH requirement. Finally, the comparisons across broad categories of goods (final and intermediates) may be difficult to interpret, not least because the WTO classification of goods into three categories may be open to question.

Table 3 here: Determinants of utilization rates

From the "structural form" in equation (1.3), the coefficient for $\tilde{\tau}_i$ represents in fact the impact of the difference between $\tilde{\tau}_i$ and c_i on the utilization rate. Hence, results in table 3 show that an increase in $(\tilde{\tau}_i - c_i)$ has an impact on u_i about three times as large for intermediates than for final goods. This could be for several reasons including that biases in cost estimates differ systematically across these broad categories of goods. Likewise, the coefficients on the RoO variables combine the impact of the RoO variables on the cost c_i and the impact of the difference $(\tilde{\tau}_i - c_i)$ on u_i discussed above.

Reassuringly, all the coefficients have the expected signs and are significant at the 5% level. In our view, these results justify moving on to the second stage, i.e. recuperating costs estimates from (1.8), to have the decomposition of the two impacts.

According to equation (1.5) we obtain, from the two-limit Tobit estimation

- ✓ For the entire sample:

$$\hat{c}_i^{TOBIT} = 0.038 * CC_i + 0.114 * TECH_i + 0.035 * RVC_i$$

- ✓ For the intermediate goods sample:

$$\hat{c}_i^{TOBIT} = 0.025 * CC_i + 0.045 * RVC_i$$

- ✓ For the final goods sample:

$$\hat{c}_i^{TOBIT} = 0.037 * CC_i + 0.112 * TECH_i + 0.046 * RVC_i$$

The contributions of the different RoO to costs are reported for the same category of sectors in table 4. The comparisons reveal that RVC criteria have similar effects for intermediate and final goods: the imposition of an RVC on a product generates a cost estimated at 4.5% [4.6%] for intermediate [final] goods. However, a change of classification at the chapter level generates a higher cost for final (3.7%) than for intermediate goods (2.3%).[13] This result is in conformity with expectations as a change of chapter is more difficult to realize at the final than at the intermediate stage of production. Finally the greatest cost for final product results from technical requirements, with on impact of 11% on total compliance costs. The costs associated to each of the components of RoO (or to a combination of these components) by category are reported in the Table of Appendix A.4.

Table 4 here : Costs and preference rates

For the estimates to be useful, they should meet the revealed preference criterion used in the non-parametric estimates reported in section 4.1. This means, that the estimated compliance costs should, on average, be lower [greater] than the average preference margin for products with an utilization rate of NAFTA of 100% [0%], whatever the category (total, final or intermediate). This is indeed the case for all product categories, for utilization rates of 100% [0%]. As to the products with $0\% < u_i < 100\%$, the estimated compliance costs are systematically inferior to the tariff preference margin, often by non-negligible margins.[14] Given that the preference margins are almost at the same level for sectors with non-zero utilization rates, it could be there is not enough variation in the data to identify costs, so that even with sector dummies, there is too much uncontrolled firm heterogeneity.

The problem of uncontrolled firm heterogeneity is still present when we turn to estimates at the sector level. It turns out that among the 2-digit sectors with more than 100 observations and average preference margins above 4% (an estimate of total compliance costs of 3% of which there are 6 sectors if one omits the misc. manuf. category), only the largest sector (the T&A sector with 618 observations) gives significant and plausible results.

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[13] this still holds when one replaces the CC_i dummy by a CH_i dummy.

[14] The ordinary least square estimates are biased on the sample due to the double censored data. But in many cases applying the OLS to just non-limit observations, i.e. to the $0\%<u_i<100\%$ data, yields better estimates for this subsample. Hence, we apply the OLS on the $0\%<u_i<100\%$ data for the total sample, and we run a simple Probit on the remainder $u_i=0\%$ and $u_i=100\%$ sample. These specifications lead to very similar compliance costs estimates to those presented in this section for the total sample. Detailed results are reported in Appendix A.5.1. Otherwise, we perform the same Tobit regression of equation (1.9) than in this section but with the Estevadeordal index of RoO, r_i, instead of the vector RoO_i of zero-one dummies capturing separately the effects of each RoO. And again we have still similar estimates of the RoO costs. See Appendix A.5.2 for detailed results.

Since this is an important sector for Mexico in NAFTA and is likely to be an important for Southern members in an FTAA, estimates are reported below and in table 5.

Table 5 here: Costs and Preference Rates in sector 11 (T&A).

The estimation of equation (1.4) for T&A sample (618 observations) by the two-limit Tobit model, gives:

$$u_i = \underset{(0.06)}{1.15} + \underset{(0.32)}{3.11}\,\tau_i - \underset{(0.06)}{0.21}\,CC_i - \underset{(0.05)}{0.37}\,TECH_i$$

with the associate compliance cost function :

$$\hat{c}_i = 0.067 * CC_i + 0.118 * TECH_i$$

Comparing the cost of CC and TECH to the estimated costs obtained earlier, note that both CC and TECH criteria represent larger costs (respectively 6.7% vs. 3.01% and 11.8% vs. 9.17%). This result could reflect partly composition effects (large component of final goods with TECH criteria), though the CC and TECH costs are also larger for the T&A sector 11 than for final goods in the aggregate. It could also be that the CC and TECH coefficients capture some of the effects associated with "exceptions" (98% percent of the lines face an exception in sector 11). Also according to the distribution of TECH requirements, these are mostly on production processes (33% of technical requirements) with the remaining (9%) on both product and process.

To summarize, the classification of the RoO components in terms of estimated compliance costs is indeed $CC < RVC < TECH$ which is the observation rule adopted by Estevadeordal (2000) in constructing his synthetic index. However, the costs of each component are found to be different across the stages of production: CC and RVC represent a greater cost for final goods producing than for intermediate goods sectors. Since final goods producers also faced technical requirements, it is not surprising to find total compliance costs (on average over all product lines) are greater for final goods producing sectors than for intermediate-goods producing sectors (3.2% vs. 2.0%). And given than the tariff preference margin is lower for final goods that for intermediate (4.3% vs. 4.8%), we can also expect (still in average terms over all product lines), a lower utilization rate lower for final goods producing sectors, than for intermediate goods producing sectors. This is indeed confirmed in table 2 (utilization rates are 53.9% and 74.3% respectively).

6. ILLUSTRATIVE WELFARE CALCULATIONS

The model is presented but not the simulation results. To be completed.

The cost estimates in section 5 reveal much firm heterogeneity. It is therefore useful to check the orders of magnitude suggested there by some simple simulations imposing accepted functional forms. Suppose then that a Mexican firm, produces under constant returns to scale and perfect competition a final good, X which it can sell either in the US partner market, or on the ROW market. The final good is produced with value-added, VA, and intermediates, Z, i.e. $X = F(VA, Z)$. Value-added is produced by capital and labor, i.e. $VA = H(K, L)$ at exogenously determined prices, (w,r) while intermediates either come from the US partner, Z^A, or from the ROW, Z^C so that $Z = G(Z^A, Z^C)$, also with exogenously given prices $p^{Z,A}$ and $p^{Z,C}$. Let $F(.)$ be Leontief, and $H(.)$ and $G(.)$, be CES functions. Profit maximization will imply that the unit cost function can be written as:

$$c(.) = a_z P^z + a_v P^v \tag{1.10}$$

where a_Z, a_V are the per-unit input coefficients for intermediates and value-added respectively, with P^z, P^v their corresponding per-unit prices. Under the CES aggregation functions, the expressions for unit prices are:

$$P^z = CES(p^{Z,A}, p^{Z,C};\ \gamma_z, \alpha_z, \sigma_z) \tag{1.11}$$

where γ_Z is a calibration parameter, α_Z is the share parameter and σ_Z is the elasticity of substitution between intermediates of different origin. Likewise, the unit value-added price is given by:

$$P^v = CES(w, r;\ \gamma_v, \alpha_v, \sigma_v) \tag{1.12}$$

where the parameters have the same meaning as in the previous expression. Perfect competition implies that unit price for the good, P^X equals unit cost, i.e.:

$$P^x = c(.) \tag{1.13}$$

Assume that all of the production is sold on the export market so that firm profits are equivalent to national welfare. Also assume that it costly to reallocate X across markets, and that unit prices obtained in each market are $P^{X,A}$ in the US and $P^{X,C}$ in the ROW. Let the ease of substitution across markets be captured by the constant elasticity of transformation (CET) function, with unit sales given by:

$$P^x = CET(p^{X,A}, p^{X,C};\ \gamma_x, \alpha_x, \sigma_x) \tag{1.14}$$

where the parameters have the same meaning as in the CES case.

Let, t^A be the US ad-valorem tariff, and let the RoO be a RVC in quantity terms. If subscript zero denotes the optimal per-unit use of the intermediate originating in the US, and subscript one, the corresponding choices by the firm when it faces a RoO and preferential access, on the cost side:

$$z^R = Z_1^A / Z^C > z^* = Z_0^A / Z^C;\ Z_1^A > Z_0^A$$

leading to the restricted cost function, $c^R(.)$. Since $c^R(z^R) > c^0(z^0)$, one can ask what rate of preference in the US market is necessary to leave the Mexican firm indifferent between choosing to export under NAFTA or under MFN, i.e. compute $\tau = (P_1^{X.A})/(P_0^{X.A})$ so that:

$$P_1^x = CET(p_1^{X,A}, p^{X,C}) = c^R(.) \tag{1.15}$$

Table 6 reports the results of simulations under different starting values for the share of intermediates purchased from and sold to the US market.

Table 6 here (*Forthcoming*): Marginal Preferences and Costs under RVC

7. Conclusions

To be completed.

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TABLES AND FIGURES TO A FREE TRADE AREA OF THE AMERICAS: ANY GAINS FOR THE SOUTH?

Céline Carrère and Jaime de Melo

TABLE 1: DISTRIBUTION OF RoO IN THE CURRENT RTAs IN THE AMERICAS.

Requirement	NAFTA	G3	MEX-CR	MEX-BOL	CAN-CHI	CACM-CHI	MERC-CHI	LAIA
NC	0.54	4.05	0.55	0.95				
NC+E								
NC+TECH								
NC+E+TECH								
NC+RVC			0.02					
NC+E+RVC								
NC+RVC+TECH								
NC+WHOLLY OBTAINED CHAPTER								
NC+WHOLLY OBTAINED HEADING								
SubTotal	***0.54***	***4.05***	***0.57***	***0.95***	***0.00***	***0.00***	***0.00***	***0.00***
CI								
CI+E	0.02		0.04					
CI+TECH								
CI+E+TECH								
CI+RVC								
CI+E+RVC	0.02							
CI+RVC+TECH								
SubTotal	***0.04***	***0.00***	***0.04***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***
CS	1.29	1.54	2.99	2.94	11.00	19.16		
CS+E	2.52	0.73	2.14	1.32	1.60	0.20		
CS+TECH	0.04	0.10		0.02				
CS+E+TECH	0.40	0.04	0.28	0.43				
CS+RVC		4.60	4.25	4.24		0.03		
CS+E+RVC	0.10							
CS+RVC+TECH		0.04		0.026				
CS+E+RVC+TECH		0.83						
SubTotal	***4.35***	***7.88***	***9.66***	***9.21***	***12.60***	***19.39***	***0.00***	***0.00***
CH	17.09	16.45	24.32	17.00	17.50	57.15	46.00	100.00
CH+E	19.18	13.45	19.66	14.27	17.10	0.26		
CH+TECH	0.02	0.97		0.22			20.04	
CH+E+TECH	0.14	0.26		1.74				
CH+RVC	3.54	2.01	2.67	2.17	3.40		9.99	
CH+E+RVC	0.58		0.52	0.85				
CH+RVC+TECH	0.10	8.06	0.02	10.01			23.97	
CH+E+RVC+TECH		4.82		0.89				
SubTotal	***40.65***	***46.02***	***47.19***	***47.15***	***38.00***	***57.41***	***100.00***	***100.00***
CC	30.95	21.09	31.05	21.80	29.50	22.94		
CC+E	17.71	5.90	5.65	6.67	5.30	0.26		
CC+TECH	0.02	5.43		6.30				
CC+E+TECH	5.76	6.65	5.81	6.24	7.90			
CC+RVC		0.14	0.26	0.43				
CC+E+RVC		0.00						
CC+RVC+TECH		2.67						
CC+E+RVC+TECH		0.20						
SubTotal	***54.44***	***42.08***	***42.77***	***42.68***	***42.70***	***23.20***	***0.00***	***0.00***
TOTAL	**100**	**100**	**100**	**100**	**93**	**100**	**100**	**100**

NC = No Change / CC = Change in Chapter / CH = Change in Heading / CS = Change in Subheading / E = Exception to Change of Tariff Classification / RVC = Regional Value Content / TECH = Technical Requirement.
Calculations at 6-digit level of the Harmonized System.
Source: Cols.6-13 from Estevadeordal and Suominen (2003, table 4).

TABLE 2 : RULES OF ORIGINS, PREFERENCES AND UTILIZATION RATES.

Section		Obs		Export to US	u_i	τ_i	CC	CH	CSI	E	TECH	RVC	r_i	Interm	Final
			%	%	Mean	Mean	%	%	%	%	%	%	Mean	%	%
1	Live Animals	80	2,3	0,71	30,7%	4,1%	100	0,0	0,0	15,0	0,0	0,0	6	6,3	23,8
2	Vegetable Products	150	4,2	2,17	70,3%	3,6%	100	0,0	0,0	0,0	0,0	0,0	6	12,7	8,0
3	Fats and Oils	27	0,8	0,02	77,9%	5,1%	100	0,0	0,0	0,0	0,0	0,0	5.9	0,0	100,0
4	Food, Bev. and Tobacco	123	3,5	1,75	76,6%	7,6%	79,7	18,7	1,6	17,1	0,8	0,0	5.6	11,4	86,2
5	Mineral Products	86	2,4	7,17	11,8%	0,3%	80,2	19,8	0,0	19,8	0,0	0,0	5.6	16,3	4,7
6	Chemicals	430	12,1	1,35	62,3%	3,4%	75,4	20,0	4,7	84,7	1,2	0,9	5.5	73,5	26,3
7	Plastics - Rubber	175	4,9	1,36	71,7%	3,8%	11,4	88,0	0,6	26,3	5,7	64,0	4.9	60,6	30,9
8	Leather Goods	52	1,5	0,18	51,3%	4,0%	61,5	38,5	0,0	42,3	0,0	0,0	5.5	32,7	46,2
9	Wood Products	55	1,5	0,24	37,3%	2,1%	7,3	92,7	0,0	7,3	0,0	0,0	4.2	43,6	45,5
10	Pulp and Paper	97	2,7	0,52	56,2%	0,7%	57,7	42,3	0,0	42,3	0,0	0,0	5.2	39,2	55,7
11	Textiles and Apparel	618	17,4	7,35	79,9%	10,4%	80,3	19,7	0,0	97,9	41,6	0,0	6.0	40,9	53,9
12	Footwear	47	1,3	0,28	67,6%	6,8%	19,2	80,9	0,0	72,3	0,0	48,9	4.9	0,0	100,0
13	Stone and Glass	129	3,6	1,15	60,1%	3,2%	54,3	43,4	2,3	43,4	0,0	0,0	5.0	10,1	89,9
14	Jewellery	35	1,0	0,37	45,5%	2,7%	60,0	40,0	0,0	40,0	0,0	0,0	5.2	34,3	40,0
15	Base Metals	430	12,1	3,56	67,9%	2,0%	42,6	56,1	1,4	45,4	1,2	0,0	4.8	50,5	48,1
16	Machinery and Electrical Eq.	631	17,7	39,52	35,5%	1,5%	0,0	81,3	18,7	31,9	4,6	1,4	3.8	0,0	100,0
17	Transport Equipment	85	2,4	20,38	56,4%	3,4%	2,4	91,8	5,9	14,1	0,0	22,4	4.2	0,0	100,0
18	Medical Instruments	170	4,8	3,69	45,2%	2,1%	15,3	76,5	8,2	14,7	0,0	3,5	4.2	0,0	100,0
19	Arms and Ammunition	8	0,2	0,02	13,4%	0,5%	62,5	37,5	0,0	0,0	0,0	0,0	5.3	0,0	100,0
20	Misc. Manufactures	127	3,6	8,20	40,4%	3,1%	82,7	11,8	5,5	0,8	0,0	0,0	5.4	0,0	100,0
Total		**3555**	**100**	**100** a)	**58,0%**	**4,1%**	**50,0**	**45,1**	**5,0**	**47,0**	**8,6**	**4,9**	**5.1**	**29,5**	**61,2**
Raw		330	9,3	9,4	34,2%	1,8%	95,2	4,5	0,3	10,3	0,9	0,0	5.9	-	-
Interm.		1048	29,5	4,1	74,2%	4,8%	58,4	39,4	2,2	68,4	0,2	8,7	5.2	-	-
Final		2177	61,2	86,6	53,9%	4,2%	39,1	53,9	7,0	42,2	13,9	3,8	4.9	-	-

a) correspond to a total USA imports from Mexico of 1.31e+11 US$

u_i = utilization rate of the NAFTA regime; τ_i= tariff preference margin; r_i = the Estevadeordal (2000) index of Rules of Origin ($1<r_i<7$, a higher value indicating a more restrictive RoO, see text).
CC = Change in Chapter / CH = Change in Heading / CS = Change in Subheading / E = Exception to Change of Tariff Classification / RVC = Regional Value Content / TECH = Technical Requirement.

All calculations are at the 6-digit level of the HS (so the table presents simple *average* by sector and category and not the *aggregate* indicator, i.e. weighted by the imports values of each line).

TABLE 3: DETERMINANTS OF UTILIZATION RATES.

u_i	Total Sample		Intermediate Goods		Final Goods	
	OLS	Tobit	OLS	Tobit	OLS	Tobit
$\tilde{\tau}_i$	2.2757**	4.3683**	3.0389**	9.0450**	2.0910**	3.9310**
	(0.41)	(0.20)	(0.47)	(0.54)	(0.45)	(0.21)
CC_i	-0.0684**	-0.1676**	-0.0604**	-0.2122**	-0.0801**	-0.1447**
	(0.02)	(0.04)	(0.03)	(0.09)	(0.02)	(0.04)
$TECH_i$	-0.2088**	-0.4975**	-	-	-0.2288**	-0.4391**
	(0.03)	(0.08)			(0.04)	(0.09)
RVC_i	-0.1065**	-0.1517**	-0.2850**	-0.4058*	-0.1147**	-0.1811*
	(0.05)	(0.04)	(0.12)	(-0.24)	(0.05)	(0.11)
Obs.	*3225*	*3225*	*1048*	*1048*	*2177*	*2177*
R^2-adj	*0.39*		*0.38*		*0.40*	
Log likelihood		*-2995.5*		*-959.8*		*-2024.8*

Dummies for section and stage of production are included but not reported in order to save space
OLS: coefficients estimate with Ordinary Least Squared with White correction.
TOBIT: coefficients estimate with the Two-Limit Tobit Model .
Standard deviations in parenthesis.
** and * respectively significant at the 5% and 10% level.

TABLE 4: COSTS AND PREFERENCE RATES.

	Total Sample				Intermediate Goods				Final Goods			
	Obs	$\tilde{\tau}_i$	$\hat{c}_i^{OLS}$	$\hat{c}_i^{TOBIT}$	Obs	$\tilde{\tau}_i$	$\hat{c}_i^{OLS}$	$\hat{c}_i^{TOBIT}$	Obs	$\tilde{\tau}_i$	$\hat{c}_i^{OLS}$	$\hat{c}_i^{TOBIT}$
0%< u_i <100%	1410	5.92%	3.24%	3.86%	322	5.28%	2.87%	2.04%	1088	6.10%	4.24%	4.17%
u_i =0%	954	0.38%	1.40%	1.71%	211	0.76%	1.65%	1.69%	743	0.27%	1.48%	1.43%
u_i =100%	861	6.32%	2.44%	3.01%	515	6.17%	1.55%	1.61%	346	6.55%	3.78%	3.69%

$\hat{c}_i^{OLS}$ [$\hat{c}_i^{TOBIT}$]: cost obtained from the Ordinary Least Squared [Two-Limit Tobit Model] estimations.

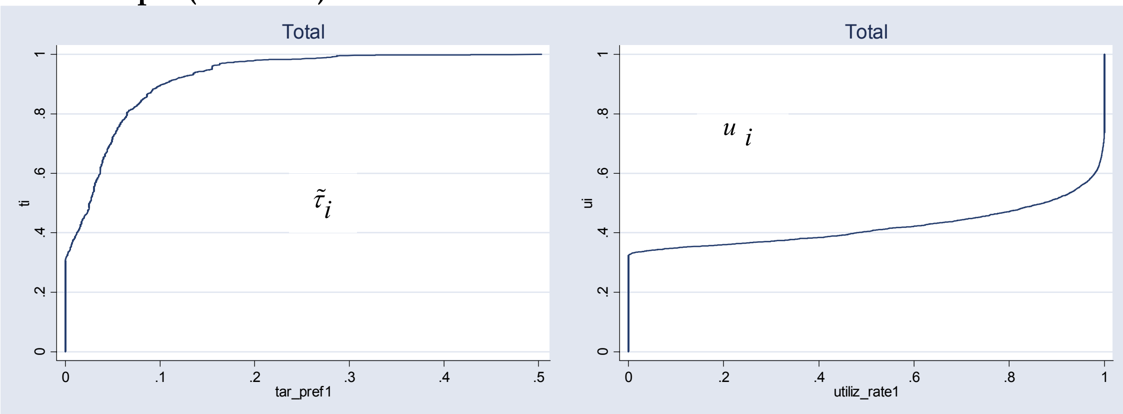
TABLE 5: COSTS AND PREFERENCE RATES IN SECTOR 11 (TEXTILES &APPAREL).

	Obs	$\tilde{\tau}_i$	$\hat{c}_i^{TOBIT}$
0%< u_i <100%	337	11.82%	13.01%
u_i =0%	34	1.87%	6.63%
u_i =100%	247	9.71%	5.65%

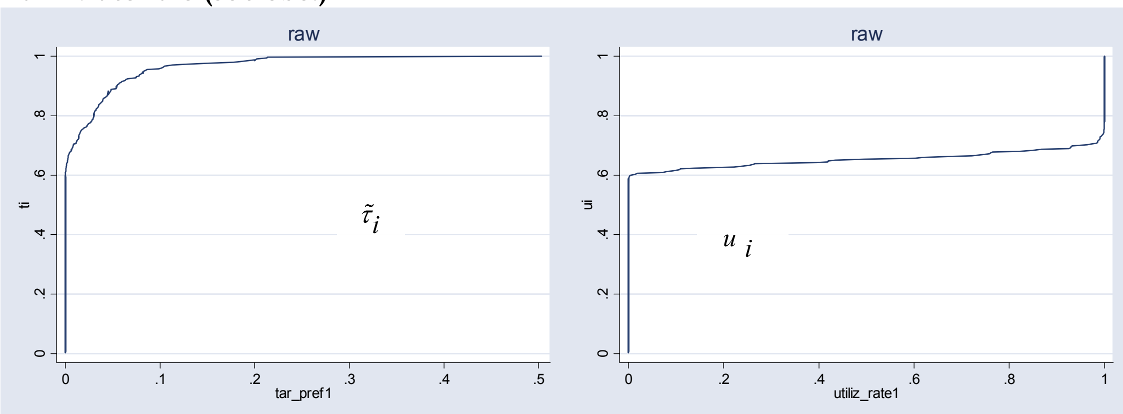
$\hat{c}_i^{TOBIT}$: cost obtained from Two-Limit Tobit Model estimations.

Figure 1: Cumulative distributions of the Utilization and the Tariff Preference Rates

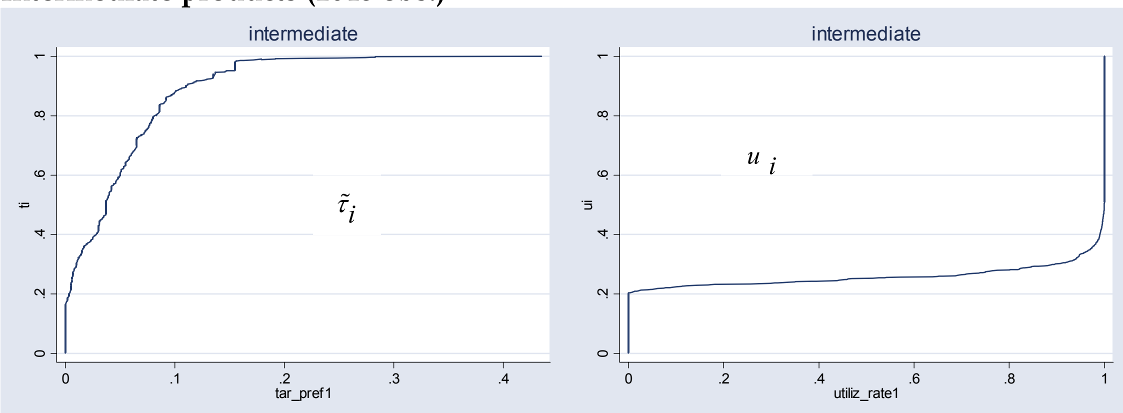
Total Sample (3555 obs.)



Raw Materials (330 obs.)



Intermediate products (1048 obs.)



Final products (2177 obs.)

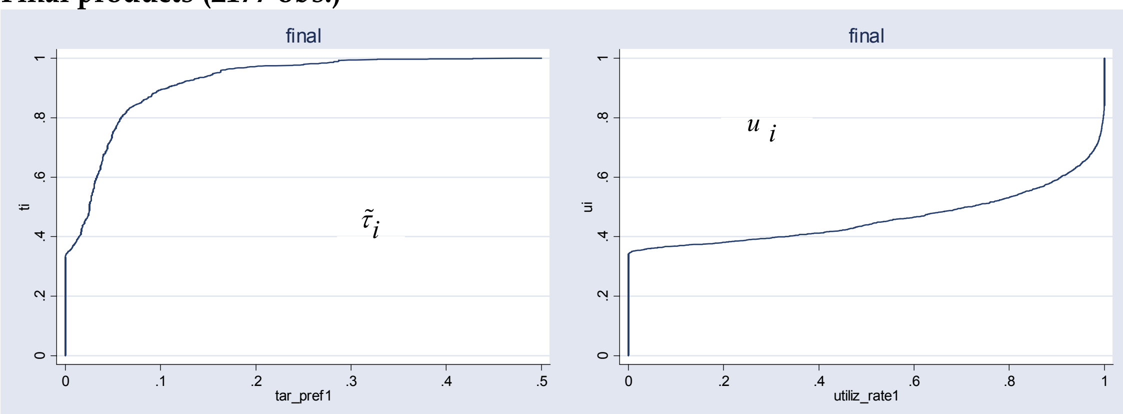


Figure 2: Production stages under Free trade and with MFN tariffs: ν^{MFN} =(B)/(B+C)

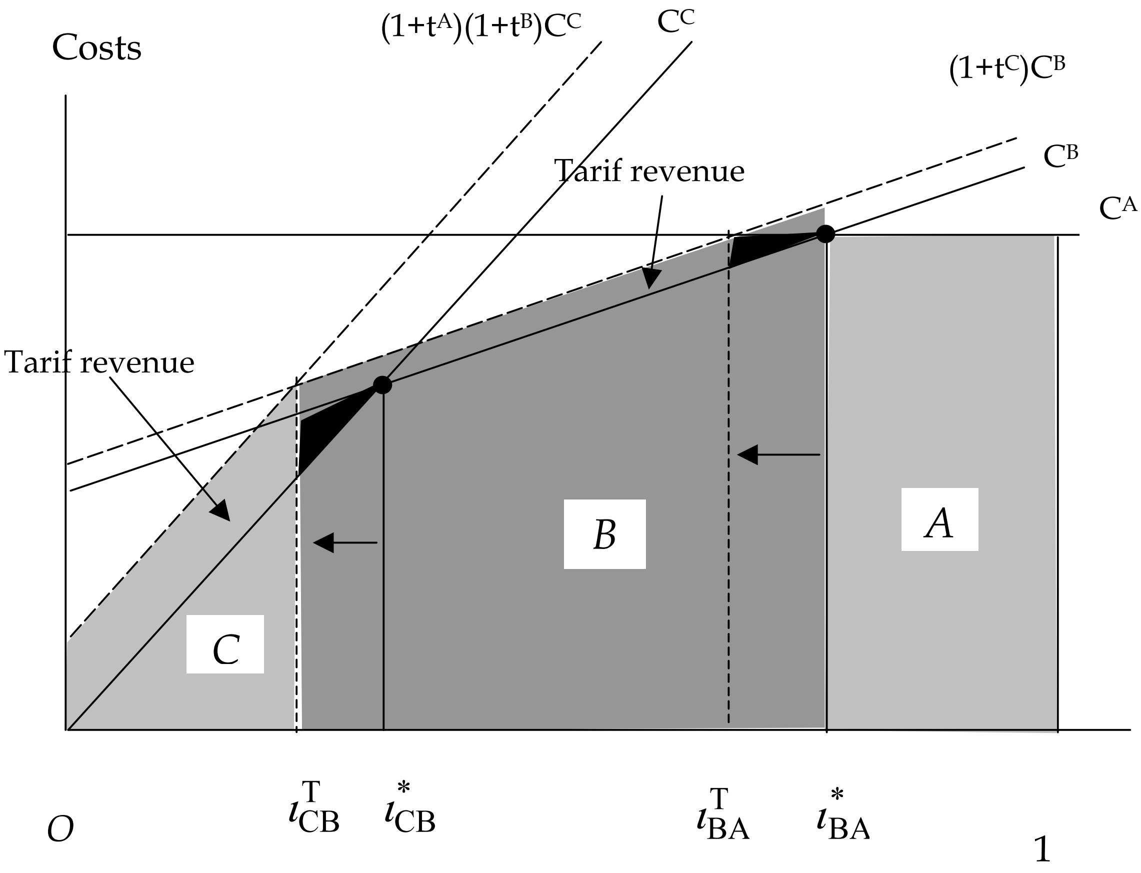


Figure 3. FTA(A,B) with non-binding RoO $\nu^F = (B^F)/(B^F + C^F)$

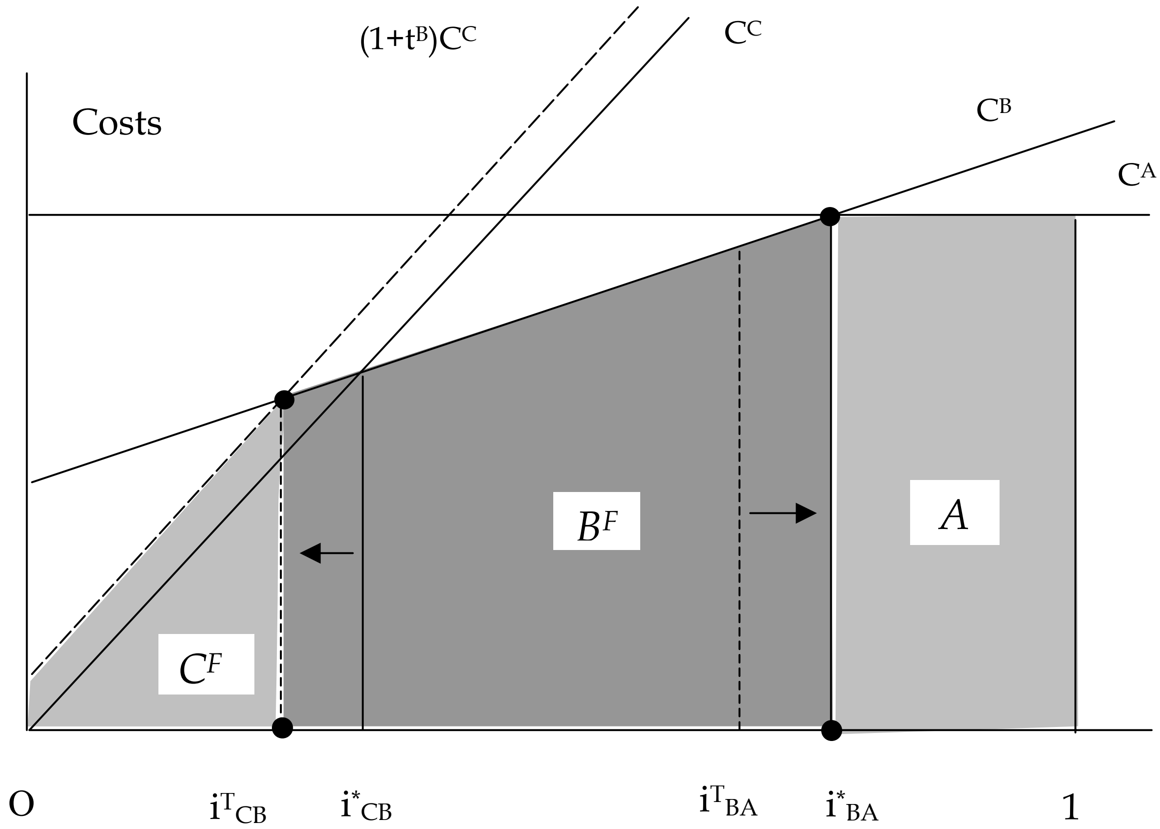


Figure 4. FTA(A,B) with binding RoO $\nu^R=(B^R)/(B^R+C^R)\geq\nu^F$

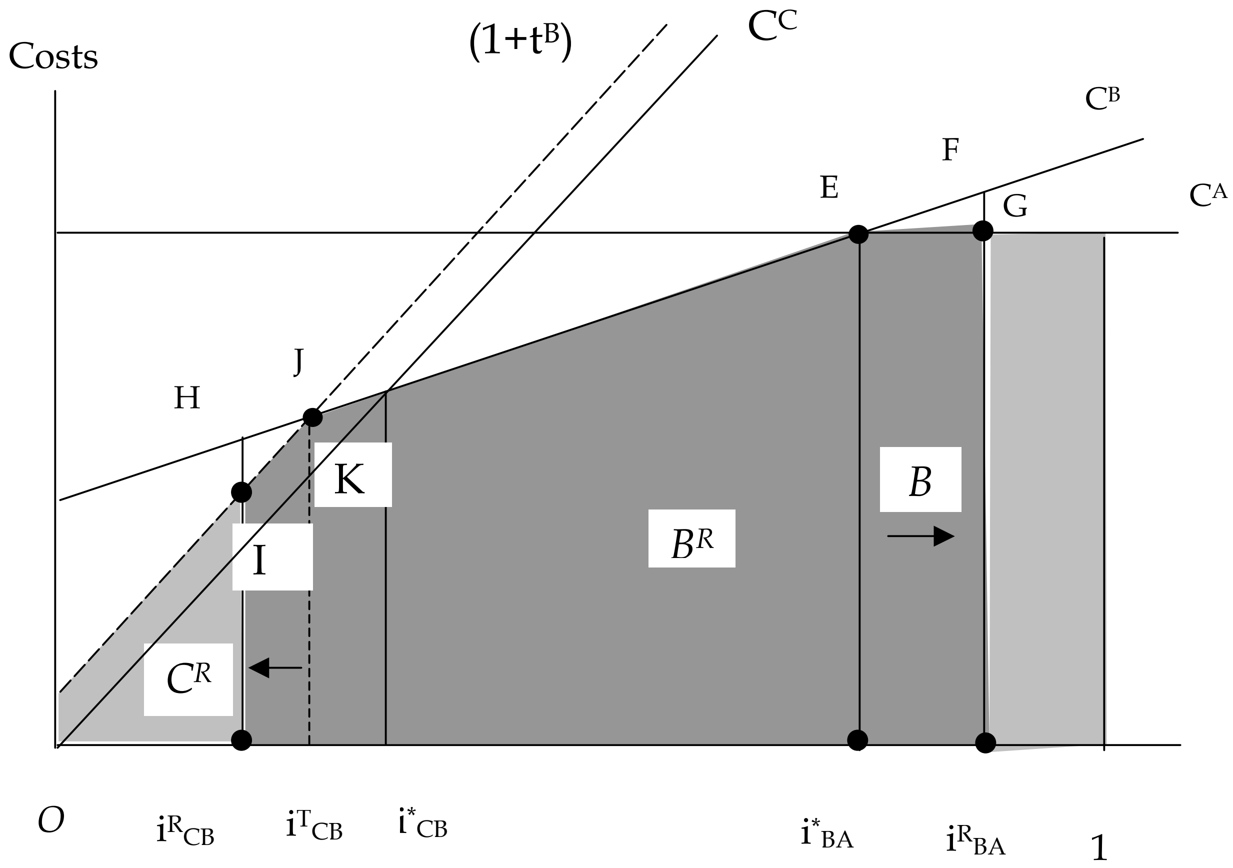
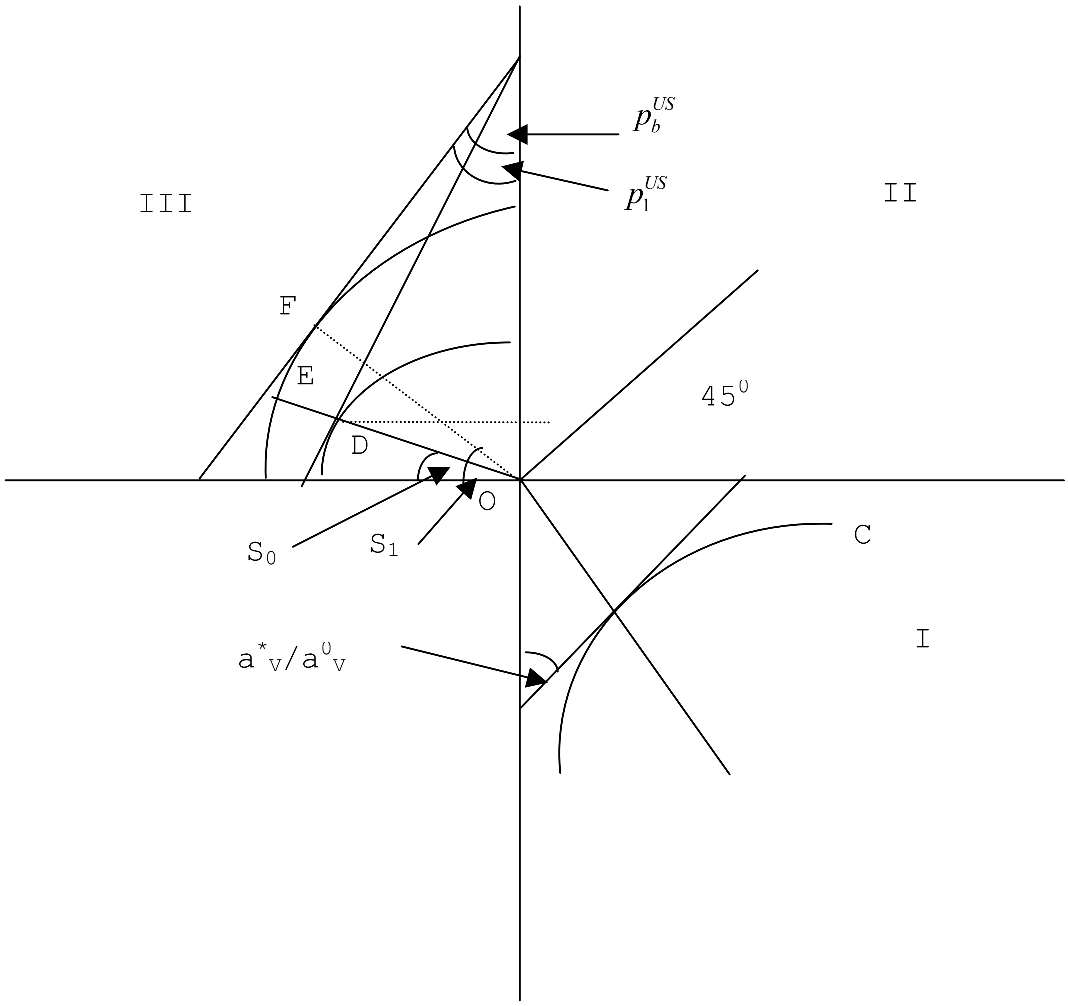


Figure 5. Export allocation decision with RoO and preferences



Appendices to

A FREE TRADE AREA OF THE AMERICAS: ANY GAINS FOR THE SOUTH?

Céline Carrère and Jaime de Melo

Appendix A.1: Variables

utilization rate, u : defined as the ratio of USA imports from Mexico under US-NAFTA preferential tariffs to total USA imports from Mexico (including other programs) at the HS-6 level.

tariff preference margin, $\tilde{\tau}$ **:** difference between the ad-valorem tariff rates

$$\tilde{\tau}_i = \frac{t_i - \tau_i}{1 + \tau_i} \text{ with } \left(t_i = t_{i,mfn}^{us} \quad ; \tau_i = t_{i,mex}^{us} \right)$$

Variables relative to Rules of Origin (according to Estevadeordal, 2000)

- ✓ **Change in tariff classification, requiring the product to change its heading under the Harmonized Commodity Description System (see A.2) in the originating country:**

CC: Dummy equal to 1 if a change of *Chapter* is required, otherwise 0 ;
CH: Dummy equal to 1 if a change of *Heading* is required, otherwise 0;
CSI: Dummy equal to 1 if a change of *Sub-heading* or *Item* is required, otherwise 0;
E: Dummy equal to 1 if exceptions exist in the change of tariff classification, otherwise 0;

- ✓ **Domestic content rule or Regional Value Content requiring a minimum percentage of local value added in the originating country:**

RVC: Dummy equal to 1 if a Regional Value Content is required, otherwise 0;

- ✓ **Technical requirement prescribing that the product must undergo specific manufacturing processing operations in the originating country:**

TECH: Dummy equal to 1 if a Technical Requirement exists, otherwise 0;

Variables relative to the stage of production (according to the WTO classification of goods and services)

Raw: ***Dummy equal to 1 if the product is a raw materials, otherwise 0;***
Interm.: Dummy equal to 1 if the product is a an intermediate good, otherwise 0;
Final: Dummy equal to 1 if the product is a final good, otherwise 0;

APPENDIX A.2: HS TRADE CLASSIFICATION.

SECTION I

Chapter	Live Animals; Animal Products (Chapters 01-05)
1	Live Animals
2	Meat and Edible Meat Offal
3	Fish & Crustaceans, Molluscs & Other Aquatic Invertebrates
4	Dairy Produce: Birds' Eggs; Natural Honey; Edible Products of Animal Origin, Not Elsewhere Specified or Included.
5	Products of Animal Origin, Not Elsewhere Specified or Included

SECTION II

Chapter	Vegetable Products (Chapters 6-14)
6	Live Trees and Other Plants; Bulbs, Roots and the Like; Cut Flowers and Ornamental Foliage.
7	Edible Vegetables and Certain Roots and Tubers
8	Edible Fruit and Nuts; Peel of Citrus Fruit or Melons
9	Coffee, Tea, Mate and Spices
10	Cereals
11	Products of the Milling Industry; Malt; Starches; Inulin; Wheat Gluten
12	Oil Seeds and Oleaginous Fruits; Misc. Grains, Seeds & Fruit; Industrial or Medicinal Plants; Straw and Fodder
13	Lac; Gums Resins and Other Vegetable Saps and Extracts
14	Vegetable Plaiting Materials; Vegetable Products not Elsewhere Specified or Included

SECTION III

Chapter	Animal or Vegetable Fats and Oils and Their Cleavage Products; Prepared Edible Fats; (Chapter 15)
15	Animal or Vegetable Fats and Oils and their Cleavage Products; Prepared Edible Fats; Animal or Vegetable Waxes

SECTION IV

Prepared Foodstuffs; Beverages, Spirits, and Vinegar;
Tobacco and Manufactured Tobacco Substitutes
(Chapters 16-24)

Chapter	
16	Preparations of Meat, of Fish Or of Crustaceans, Molluscs or Other Aquatic Invertebrates
17	Sugars and Sugar Confectionery
18	Cocoa and Cocoa Preparations
19	Preparations of Cereals, Flour, Starch or Milk; Pastry Cooks' Products
20	Preparations of Vegetables, Fruit, Nuts or Other Parts of Plants
21	Misc. Edible Preparations
22	Beverages, Spirits and Vinegar
23	Residues and Waste From the Food Industries; Prepared Animal Fodder
24	Tobacco and Manufactured Tobacco Substitutes

SECTION V

Mineral Products (Chapters 25-27)

Chapter	Description
25	Salt, Sulphur, Earths and Stone; Plastering Materials, Lime and Cement
26	Ores, Slag and Ash
27	Mineral Fuels, Mineral Oils and Products Or Their Distillation; Bituminous Substances; Mineral Waxes

SECTION VI

Products of the Chemical or Allied Industries (Chapters 28-38)

Chapter	
28	Inorganic Chemicals; Organic or Inorganic Compounds of Precious Metals, Of Rare-earth Metals, of Radioactive Elements or of Isotopes
29	Organic Chemicals
30	Pharmaceutical Products
31	Fertilisers
32	Tanning Or Dyeing Extracts; Tannins & Their Derivatives; Dyes, Pigments Other Colouring Matter; Paints and Varnishes; Putty and Other Mastics; Inks
33	Essential Oils and Resinoids; Perfumery, Cosmetic or Toilet Preparations
34	Soap, Organic Surface-active Agents, Washing Preparations, Lubricating Preparations, Artificial Waxes, Prepared Waxes, Polishing or Scouring Preparations, Candles and Similar Articles, Modelling Pastes, "Dental Waxes" and Dental Preparations with a Basis of Plaster.
35	Albuminoidal Substances; Modified Starches; Glues; Enzymes
36	Explosives; Pyrotechnic Products; Matches; Pyrophoric Alloys; Certain Combustible Preparations
37	Photographic Or Cinematographic Goods
38	Misc. Chemical Products

SECTION VII

Plastics and Articles Thereof; Rubber and Articles Thereof (Chapters 39-40)

Chapter
39 Plastics and Articles Thereof
40 Rubber and Articles Thereof

SECTION VIII

Raw Hides and Skins,Leather, Furskins and Articles Thereof; Saddlery and Harness; Travel Goods, Handbags, and Similar Containers;Articles of Animal Gut (Other Than Silkworm Gut) (Chapters 41-43)

Chapter
41 Raw Hides and Skins (Other Than Furskins) and Leather
42 Articles of Leather; Saddlery and Harness; Travel Goods, Handbags and Similar Containers; Articles of Animal Gut (Other Than Silk-worm Gut)
43 Furskins and Artificial Fur; Manufactures Thereof

SECTION IX

Wood and Articles of Wood; Wood Charcoal; Cork and Articles of Cork; Manufactures of Straw, of Esparto or of Other Plaiting Materials; Basketware and Wickerwork (Chapters 44-46)

Chapter
44 Wood and Articles of Wood; Wood Charcoal
45 Cork and Articles of Cork
46 Manufactures of Straw, of Esparto Or of Other Plaiting Materials; Basketware and Wickerwork

SECTION X

Pulp of Wood or of other Fibrous Cellulosic Material; Waste and Scrap of Paper or Paperboard; Paper and Paperboard and Articles Thereof (Chapters 47-49)

Chapter
47 Pulp of Wood Or Other Fibrous Cellulosic Material; Waster and Scrap of Paper Or Paperboard
48 Paper and Paperboard; Articles of Paper Pulp, of Paper Or of Paperboard
49 Printed Books, Newspapers, Pictures and Other Products of the Printing Industry; Manuscripts, Typescripts and Plans

SECTION XI

Textiles and Textile Articles (Chapters 50-63)

Chapter
50 Silk
51 Wool, Fine Or Coarse Animal Hair; Horsehair Yarn and Woven Fabric
52 Cotton
53 Other Vegetable Textile Fibres; Paper Yarn and Woven Fabrics of Paper Yarn
54 Man-made Filaments
55 Man-made Staple Fibres
56 Wadding, Felt and Nonwovens; Special Yarns; Twine, Cordage, Ropes and Cables and Articles Thereof
57 Carpets and Other Textile Floor Coverings
58 Special Woven Fabrics; Tufted Textile Fabrics; Lace; Tapestries; Trimmings; Embroidery
59 Impregnated, Coated, Covered Or Laminated Textile Fabrics, Textiles Articles Of A Kind Suitable for Industrial Use
60 Knitted Or Crocheted Fabrics
61 Articles of Apparel and Clothing Accessories, Knitted Or Crocheted
62 Articles of Apparel and Clothing Accessories, Not Knitted Or Crocheted
63 Other Made Up Textile Articles; Sets; Worn Clothing and Worn Textile Articles; Rags

SECTION XII

Footwear, Headgear, Umbrellas, Sun Umbrellas, Walking-Sticks, Seat-Sticks, Whips, Riding-Crops and Parts Thereof; Prepared Feathers and Articles Made Therewith; Artificial Flowers; Articles of Human Hair (Chapters 64-67)

Chapter
64 Footwear, Gaiters and the Like; Parts of Such Articles
65 Headgear and Parts Thereof
66 Umbrellas, Sun Umbrellas, Walking-sticks, Seat-sticks, Whips, Riding-crops and Parts Thereof
67 Prepared Feathers and Down and Articles Made of Feathers or of Down; Artificial Flowers; Articles of Human Hair

SECTION XIII

Articles of Stone, Plaster, Cement, Asbestos, Mica or Similar Materials; Ceramic Products; Glass and Glassware (Chapters 68-70)

Chapter
68 Articles of Stone, Plaster, Cement, Asbestos, Mica or Similar Materials
69 Ceramic Products
70 Glass and Glassware

SECTION XIV

Natural or Cultured Pearls, Precious or Semiprecious Stones, Precious Metals, Metals Clad with Precious Metal, and

Articles Thereof; Imitation Jewellery; Coin (Chapter 71)

Chapter

71 Natural Or Cultured Pearls, Precious Or Semi-precious Stones, Precious Metals, Metals Clad with Precious Metal, and Articles Thereof: Imitation Jewellery; Coin

SECTION XV

Base Metals and Articles of Base Metal (Chapters 72-83)

Chapter

72 Iron and Steel
73 Articles of Iron Or Steel
74 Copper and Articles of Thereof
75 Nickel and Articles Thereof
76 Aluminum and Articles Thereof
78 Lead and Articles Thereof
79 Zinc and Articles Thereof
80 Tin and Articles Thereof
81 Other Base Metals; Cermets; Articles Thereof
82 Tools, Implements, Cutlery, Spoons, and Forks, of Base Metal; Parts Thereof of Base Metal
83 Misc. Articles of Base Metal

SECTION XVI

Machinery and Mechanical Appliances; Electrical Equipment; Parts Thereof; Sound Recorders and Reproducers, Television Image and Sound Recorders and Reproducers, and Parts and Accessories of Such Articles (Chapters 84-85)

Chapter

84 Nuclear Reactors, Boilers, Machinery and Mechanical Appliances; Parts Thereof
85 Electrical Machinery and Equipment and Parts Thereof Sound Recorders and Reproducers, TV Image and Sound Recorders and Reproducers, and Parts and Accessories of Such Articles

SECTION XVII

Vehicles, Aircraft, Vessels and Associated Transport Equipment (Chapters 86-89)

Chapter

86 Railway or Tramway Locomotives, Rolling-stock and Parts Thereof; Railway or Tramway Track Fixtures and Fittings and Parts Thereof; Mechanical (Including Other Than Railway Or Tramway Rolling-stock, and Parts and Accessories Thereof
87 Vehicles Other Than Railway Or Tramway Rolling-stock, and Parts and Accessories Thereof
88 Aircraft, Spacecraft and Parts Thereof
89 Ships, Boats and Floating Structures.

SECTION XVIII

Optical, Photographic, Cinematographic, Measuring, Checking, Precision, Medical or Surgical Instruments and Apparatus; Clocks and Watches; Musical Instruments; Parts and Accessories Thereof (Chapters 90-92)

Chapter

90 Optical, Photographic, Cinematographic, Measuring, Checking, Precision, Medical Or Surgical Instruments and Apparatus; Parts and Accessories Thereof
91 Clocks and Watches and Parts Thereof
92 Musical Instruments; Parts and Accessories of Such Articles

SECTION XIX

Arms and Ammunition; Parts and Accessories Thereof (Chapter 93)

Chapter

93 Arms and Ammunition; Parts and Accessories Thereof

SECTION XX

Miscellaneous Manufactured Articles and other Headings (Chapters 94-99)

Chapter

94 Furniture; Bedding; Mattress; Mattress Supports, Cushions and Similar Stuffed Furnishings; Lamps and Lighting Fittings, not Elsewhere Specified or Included; Illuminated Signs, Illuminated Name-plates and the Like; Prefabricated Buildings.
95 Toys, Games and Sports Requisites; Parts and Accessories Thereof
96 Misc. Manufactured Articles
97 Works of Art, Collectors' Pieces and Antiques
98 Reserved for special use by Contracting Parties
99 Reserved for special use by Contracting Parties

APPENDIX A.3: THE MODEL

A.3.1 the firm's decision

Let index i refer to an HS-6 tariff line observation (this is the product line for which we have observations on utilization rates and preference rates). Let there be j=1,…,n Mexican firms export to the US under product category i. Rank firms so that j=1,…,k export to the US under NAFTA regime and j=k+1,…,n export under the MFN regime. Let u_j =1 [0] represent the firm's decision to export under NAFTA [MFN], and E_j firm's j exports to the US. Finally total unit compliance costs, c_j, associated with RoO include an administrative component, δ_j, and a distortionary cost associated with implementing the RoO requirement itself, σ_j, i.e. $c_j = \delta_j + \sigma_j$. The above relations suggest that we can write the firm's costs as :

$$c_j = f(RoO_i, \delta_j) \tag{1.16}$$

Implicitly, in (1.16) we have assumed that all firms differ in their costs when they sell product i only because of costs associated with implementing RoO, an assumption that will certainly be violated in practice. With this notation, the firm's decision will boil down to:

$$\begin{aligned} u_j = 0 \Leftrightarrow E_j = E_j^{MFN} \quad if \quad \tilde{\tau}_i < c_j \\ u_j = 1 \Leftrightarrow E_j = E_j^{NAFTA} \quad if \quad \tilde{\tau}_i \geq c_j \end{aligned} \tag{1.17}$$

Note that the rate of preference is observed at the HS-6 product level while the utilization rate decision takes place at the firm level. However, the utilization rate in the data is also observed at the product level, and it is defined as:

$$u_i = \frac{\sum_{j=1,\ldots,k} E_j^{NAFTA}}{\sum_{j=1,\ldots,k} E_j^{NAFTA} + \sum_{j=k+1\ldots,n} E_j^{MFN}} \tag{1.18}$$

with $\begin{cases} u_i = 0 \quad if \quad k = 0 \\ u_i = 1 \quad if \quad k = n \\ 0 < u_i < 1 \quad if \quad 0 < k < n \end{cases}$

We assume linear specifications for the utilization rate of NAFTA at the product level:

$$u_i = \alpha(\tilde{\tau}_i - c_i) + \mu_i \tag{1.19}$$

with c_i, the unit costs associated with RoO at the product level. c_i is a weighted average of the firms' costs c_j. Unfortunately we have no information on the distribution of these c_j in each HS-6 level, *i*. However, we can reasonably assume that:

$$c_i = \beta' RoO_i + v_i \tag{1.20}$$

where β is a t×1 vector of unknown parameters and *RoOi* is a is a t×1 vector of explanatory variables.

Equations (1.19) and (1.20), lead to the reduced form for estimation:

$$u_i = \alpha(\tilde{\tau}_i - \beta' RoO_i) + (\mu_i - \alpha v_i) \tag{1.21}$$

A.3.2. the econometric specification

The dependent variable being truncated at both high and low values, the model becomes:

$$u_i^* = \lambda + \alpha\tilde{\tau}_i + \theta' RoO_i + \varepsilon_i \tag{1.22}$$

where u_i^* is the latent variable, ε_i are residuals that are independently and normally distributed, with mean zero and a common variance σ^2 and:

$$\begin{cases} u_i = 0 & if \quad u_i^* \le 0 \\ u_i = u_i^* & if \quad 0 < u_i^* < 1 \\ u_i = 1 & if \quad u_i^* \ge 1 \end{cases}$$

Here, 0 and 1 are the lower and upper limits. The likelihood function for this model is given by:

$$L(\lambda, \alpha, \beta, \sigma \mid u_i, \tilde{\tau}_i, RoO_i, 0, 1)$$
$$=$$
$$\prod_{u_i=0} \Phi\left(\frac{0 - \lambda - \alpha\tilde{\tau}_i - \theta' RoO_i}{\sigma}\right) \prod_{u_i=u_i^*} \frac{1}{\sigma} \phi\left(\frac{u_i - \lambda - \alpha\tilde{\tau}_i - \theta' RoO_i}{\sigma}\right) \prod_{u_i=1} \left[1 - \Phi\left(\frac{1 - \lambda - \alpha\tilde{\tau}_i - \theta' RoO_i}{\sigma}\right)\right]$$

(1.23)

In (1.23), $\phi(.)$ and $\Phi(.)$ are, respectively, the density function and distribution function of the standard normal evaluated at $\frac{\lambda + \alpha\tilde{\tau}_i + \theta' RoO_i}{\sigma}$ (see Maddala, 1983, chapter 6 and Appendix, for algebraic details).

APPENDIX A.4: SUMMARY OF THE RoO COSTS ESTIMATES.

TOTAL SAMPLE							
Correspond to	*obs.*	*Cumul.*	$\hat{c}_i^{OLS}$	$\hat{c}_i^{TOBIT}$	τ_i	$\tau_i - \hat{c}_i^{TOBIT}$	u_i
others (CH, CSI, or no RoO)	1 543	47.84%	**0.00%**	**0.00%**	2.66%	**2.66%**	**52.17%**
CC	1 209	85.33%	**3.01%**	**3.47%**	5.56%	**2.09%**	**79.44%**
RVC	169	90.57%	**4.68%**	**3.84%**	4.64%	**0.80%**	**67.31%**
TECH	46	92.00%	**9.17%**	**11.39%**	3.17%	**-8.22%**	**43.80%**
CC+TECH	254	99.88%	**12.18%**	**14.86%**	4.23%	**-10.63%**	**36.11%**
TECH+RVC	4	100.00%	**13.86%**	**15.23%**	13.11%	**-2.12%**	**69.17%**
INTERMEDIATE GOOD							
Correspond to	*obs.*	*Cumul.*	$\hat{c}_i^{OLS}$	$\hat{c}_i^{TOBIT}$	τ_i	$\tau_i - \hat{c}_i^{TOBIT}$	u_i
others (CH, CSI, or no RoO)	345	32.92%	**0.00%**	**0.00%**	4.69%	**4.69%**	**74.54%**
CC	612	91.32%	**1.99%**	**2.35%**	4.83%	**2.48%**	**72.55%**
RVC	91	100.00%	**9.38%**	**4.49%**	5.11%	**0.63%**	**83.73%**
FINAL GOOD							
Correspond to	*obs.*	*Cumul.*	$\hat{c}_i^{OLS}$	$\hat{c}_i^{TOBIT}$	τ_i	$\tau_i - \hat{c}_i^{TOBIT}$	u_i
others (CH, CSI, or no RoO)	1200	55.12%	**0.00%**	**0.00%**	2.08%	**2.08%**	**45.82%**
CC	597	82.54%	**3.83%**	**3.68%**	4.45%	**0.77%**	**61.94%**
RVC	78	86.13%	**5.48%**	**4.61%**	6.09%	**1.48%**	**74.45%**
TECH	44	88.15%	**10.94%**	**11.17%**	3.12%	**-8.05%**	**41.41%**
CC+TECH	254	99.82%	**14.77%**	**14.85%**	13.11%	**-1.74%**	**69.17%**
TECH+RVC	4	100.00%	**16.42%**	**15.77%**	4.23%	**-11.54%**	**36.11%**

APPENDIX A.5: ROBUSTNESS CHECKS

A.5.1. OLS and Probit vs. two-limit Tobit on the Total Sample

DETERMINANTS OF UTILIZATION RATES

u_i	0%< u_i <100%	u_i =0% & u_i =100%
	OLS	**Probit**
$\tilde{\tau}_i$	0.8591**	8.2660**
	(0.03)	(0.60)
CC_i	-0.0310**	-0. 4059**
	(0.01)	(0.05)
$TECH_i$	-0.1060**	-0. 9690**
	(0.02)	(0.07)
RVC_i	-0.0055	-0. 3919**
	(0.03)	(0.12)
Obs.	*1410*	*1793*
R^2-adj	*0.58*	
Pseudo-R^2		*0.61*

Dummies for section and stage of production are included but not reported in order to save space
OLS: coefficients estimate with Ordinary Least Squared with White correction.
PROBIT: NOT the coefficients estimate with the Probit Model but the changes in the probability for an infinitesimal change in each explanatory variables.
Standard deviations in parenthesis.
** and * respectively significant at the 5% and 10% level.

Hence, for the total sample we obtain:

- ✓ For 0%< u_i <100% (1410 obs.):
  $\hat{c}_i^{OLS} = 0.036 * CC_i + 0.123 * TECH_i + 0.000 * RVC_i$
- ✓ For u_i =0% & u_i =100% (1793 obs.):
  $\hat{c}_i^{PROBIT} = 0.049 * CC_i + 0.117 * TECH_i + 0.047 * RVC_i$

COSTS AND PREFERENCE RATES

	Obs	$\tilde{\tau}_i$	$\hat{c}_i$
0%< u_i <100% (**OLS**)	1410	5.92%	3.62%
u_i =0% (**Probit**)	954	0.38%	2.12%
u_i =100% (**Probit**)	861	6.32%	3.72%

A.5.2. COSTS ESTIMATES WITH THE ESTEVADEORDAL INDEX OF ROO

DETERMINANTS OF UTILIZATION RATES ON TOTAL SAMPLE

u_i	Tobit
$\tilde{\tau}_i$	4.4864**
	(0.19)
r_i	-0. 0285*
	(0.01)
Obs.	*3225*
Log likelihood	*-3033.6*

Dummies for section and stage of production are included but not reported in order to save space
r_i = the Estevadeordal (2000) index of RoO ($1<r_i<7$, a higher value indicating a more restrictive RoO, see text).
TOBIT: coefficients estimate with the Two-Limit Tobit Model .
Standard deviations in parenthesis.
** and * respectively significant at the 5% and 10% level.

Hence, for the total sample we obtain: $\hat{c}_i^{TOBIT} = 0.0064 * r_i$

COSTS AND PREFERENCE RATES

	Obs	$\tilde{\tau}_i$	$\hat{c}_i^{TOBIT}$
0%< u_i <100%	1410	5.92%	3.23%
u_i =0%	954	0.38%	2.91%
u_i =100%	861	6.32%	3.34%