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**US BILATERAL REGIONAL AGREEMENTS:
THE NEGATIVE WELFARE EFFECTS OF
MULTIPLICITY IN COUNTRY OF ORIGIN
RULES: A NEW METHODOLOGY**

by

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I. INTRODUCTION

The US along with the EU have generated dozens of bilateral FTAs across the globe. All of these trading arrangements have detailed agreements on rules of origin (ROOs). Those rules are required in order to ensure that there is no subversion or deflection of the perceived benefits of the FTAs. These rules have their greatest impact on a firm's cost structure when applied to intermediates good trade. Determination of the origin of a final good becomes more complicated where imported intermediates are used.

There is a relatively small theoretical literature on the impact of ROOs on trade patterns. This literature hypothesizes that these rules can easily be used to restrict/suppress trade between countries, or to divert trade away from more efficient to less efficient suppliers. On the face of it this is perhaps surprising since rules of origin are typically formulated in the context of a process of trade liberalization and are thus needed to prevent trade deflection. However, it arises because rules of origin focus on the geographical sourcing of intermediate the sourcing of intermediates from the cheapest suppliers may well be restricted.

The conventional paradigm has been that a country entering into an FTA can avoid the potential trade-diversion losses if its and its partners' pre-membership tariffs are very low or zero. In most cases this is not the case, so trade diversion is a likely outcome.

The intent of this paper is to present a formal methodology for estimating rules of origin requirements. Section II of the paper presents the concept of the ROO. Earlier attempts to capture the costs of ROO are presented in Section III. Our suggested methodology relying on the tariff equivalents literature is presented in Section IV.



Concluding remarks are presented in Section V.

II. THE CONCEPT

In the context of preferential trading arrangements rules of origin (ROO) are an important element in determining the final welfare gains associated with the bilateral trade relationship. In the case of a free trade agreement the rules prevent imports from non-member countries from entering the free trade area via the country with the lowest external tariff. In the context of US free trade agreement with Latin America (NAFTA and CAFTA) the rules serve to ensure that third countries which are not members of these FTAs do not take advantage of the zero duty associated with the FTAs.¹

ROOs in the context of an FTA are designed, in theory, to minimize trade deflection. Trade deflection occurs when a company undertakes minimal processing or assembly in a preference-receiving country to take advantage of preferences. Thus, preferential rules establish criteria to ensure that a product is sufficiently transformed in a preference-receiving country or trading area to justify allowing it to benefit from the preference. However, prevention of trade deflection sometimes appears to be no more than a pretext for using preferential rules of origin as a barrier to trade and as an incentive for foreign investment.

¹ In any FTA negotiation, one of the critical issues concerns "rules of origin" (ROO). The ROOs specify a criterion, or criteria, under which commodities imported by an FTA partner will be deemed to have originated from within the FTA and thus be eligible for duty-free treatment. Without a ROO, each imported commodity would enter through the country with the lowest tariff on each commodity. If the rule were simply that some value should have been added in the country of origin, anything - the addition of a label, the final assembly or even the painting of a product - would qualify an item for duty-free entry to the other country.



By varying the extent of the required transformation and allowing different degrees of "cumulation" on a regional, donor or global basis, preference-granting countries use preferential rules of origin to control the degree of preference given to different recipient countries. In those cases where the rules of origin are more restrictive than necessary to prevent trade deflection, they give producers an incentive to increase the intermediate and final manufacturing, processing and assembly within the preferential area at the expense of facilities in other countries that would otherwise have a comparative advantage. This distortion of manufacturing and purchasing decisions results in inefficient allocation of global resources.

The effectiveness of overly restrictive rules of origin in diverting trade and investment will depend on how companies assess the difficulty of complying with the rule, the size of the market affected, the degree of technical skill needed to comply with the rule, the level of education of the workforce, and the "penalty" for failing to comply with the preferential agreement. Multinational corporations will have greater incentives to locate manufacturing and assembly operations within an area if the "penalty" for not complying with the preferential rule is substantial, such as the loss of significant tariff preferences or of access to an important market, rather than if the penalty is minimal, such as a low tariff on goods sold to a small market. Alternatively, if the preference or tariff is minimal, the market small, or the goods destined for several countries, the firm may just ignore the preferential agreement.

Often the overly restrictive rules of origin found in FTAs are not designed to protect producers of final goods but, rather, to increase the investment in the production and assembly of intermediate goods and to protect and enhance the position of



intermediate producers. Because rules of origin are applied only to imported goods, if the good is produced and sold domestically, no origin determination is necessary. Therefore, if one member's market is much larger than the others', firms have an incentive to locate factories in the country where most of the final goods are to be sold, evading the rules of origin. This protection of intermediate producers results in inefficient diversion of trade and investment and is the focus of nonmember resentment of preferential trading agreements. Furthermore, over time, the domestic intermediate producers may be replaced, or crowded out of the market, by foreign producers that relocate to the protected area. Of course, foreign parts will have to be imported in compliance with nonpreferential trade law, including applicable tariffs.

Typically one or more of four criteria are used in determining the originating status of a good: (a) requirements in terms of domestic content is the favorite ROO. Content is a legal term of art and can be defined in terms of value added or in terms of weight or other physical characteristic. In addition, the required share of value added can be defined in terms of cost or price. Specifically, whether or not the value of the imported intermediate exceeds a certain percentage (often 40 per cent but has been known to be as low as 15 percent for certain countries) of the final good price; The value-added test defines the degree of transformation required to confer origin on the good in terms of the minimum percentage of its value that must come from the originating country or the maximum amount of its value that may come from the use of imported parts and materials." If the floor is not reached or the ceiling exceeded, the last production process will not confer origin. While the value-added method is often praised

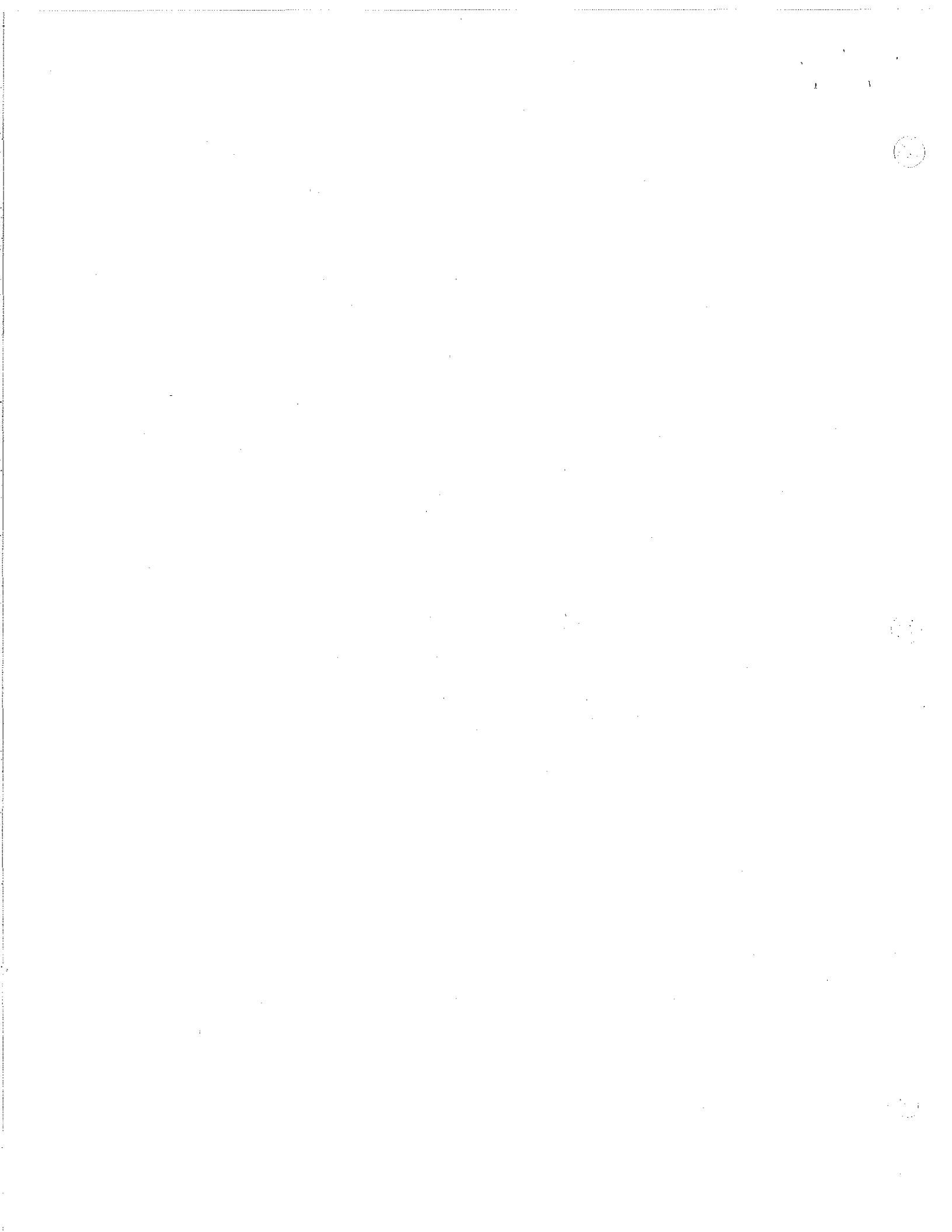


for its simplicity and precision,' in practice it is unsatisfactory because it generates substantial compliance costs and uncertainty for companies.

The uncertainty derives from the fact that the test ignores exchange rate risk and fluctuations in the price of raw materials and intermediate goods. The status of goods can change daily as the currency values or the price of raw materials or intermediate goods fluctuates, unless the firm is able to obtain a binding advance ruling from the customs authorities. Additionally, the attribution of origin of identical goods may vary with each importing country, depending on the exchange rate between the importing country's currency and that of the processing country. Furthermore, because the value-added test is a bright-line test, it often results in seemingly arbitrary results for borderline cases. For example, if the rules require 50 percent local value added to confer origin, a good with 49 percent local value added will be denied origin, resulting in a difference of only 1 percent local value added between it and a good considered to originate there.

As with any defined test of origin, the value-added test is subject to industry capture during its formative stage. For example, American automobile manufacturers pressured the negotiators of the NAFTA into accepting special overly restrictive rules of origin for automobiles that require them to have higher regional value content than most other goods under the Agreement.² Furthermore, purportedly to prevent roll-up, NAFTA requires the producer to improve the accuracy of the calculation by tracing the value of imported automotive parts throughout the production chain, which imposes substantial additional compliance costs and administrative burdens on the manufacturer. The

² NAFTA requires a regional value content equal to or greater than 62.5% for light trucks and passenger vehicles using the net cost method. Art. 401 (b) of the NAFTA requires just a specified change in tariff classification for most goods, and for footwear the requirement must be that specified tariff classification change and that it have a regional value content equal to or greater than 55% under the net cost method.



combination of requiring higher regional value content and the tracing provisions forces automotive companies to manufacture the drive trains and engines within the free trade area if they want the vehicles to qualify for preferential treatment, or, if they want to limit the applicability of the rules of origin, to locate their assembly plant in the largest target market, i.e., the United States. To comply with a value-added rule requiring tracing, a manufacturer of a complex product would need a highly sophisticated inventory and accounting system to ensure that particular goods contain specific local components at specific values.

(b) The Requirement of the last substantial transformation. This rule captures the heart of the meaning of rules of origin in a simple, concise way. For a product to be from a particular state or trading area, it must be substantially transformed there into a "new and different article . . . having a distinctive name, character or use."³ To prevent a product from having multiple countries of origin, the rule attributes the good to the country where it last underwent 'substantial transformation.' To satisfy ROO requirements a product must change its tariff heading in an extremely specific manner. In this process an FTA member may be able to orchestrate a purely protectionist outcome for a domestic subsector. This is no different than the specificity associated with a detailed harmonized classification system which can be made to correlate with different growing seasons.⁴

³ See *Anheuser-Busch Ass'n v. United States*, 207 U.S. 556, 562 (1908) (quoting *Hartranft v. Wiegmann*, 121 U.S. 609, 615 (1887) (explaining that a good is substantially transformed when it is "manufactured into a new and different article, having a distinctive name, character or use from that" of the original article or good).

⁴ An interesting example of US protection of its tomato catsup producers is contained in the ROO under NAFTA whereby substantial transformation from chapter 21 is allowed, excluding transformation from tomato paste which falls under chapter 20. This form of blatant protectionism is obvious, given Mexico's comparative advantage in growing tomatoes and its derivative paste and US production of tomato catsup.



(c) The specified process test of origin, also referred to as a technical test, prescribes certain production processes that may (positive test) or may not (negative test) confer originating status. The obvious question is can one develop a satisfactory test of origin for each of the enormous array of products on the international market and to update these rules as new products and technological advances in production are made. A process test for defining origin would be highly susceptible to capture by industry lobbying groups; since the test would be framed in technical terms, its content would be hidden from public view, and the drafters and administrators of the rule would therefore have to rely on industry for information. For example, the European Commission's Regulation 288/89 stated that origin is conferred on an integrated circuit whenever it undergoes diffusion, even though diffusion is followed by assembly and testing, processes that are more labor intensive and may add more value than diffusion. This product-specific technical rule allegedly was adopted because EC producers of integrated circuits performed the diffusion in Europe and then had the testing and assembly done in third countries, while Japanese producers of integrated circuits had them tested and assembled in Europe. Therefore, this regulation conferred EC origin on goods produced by EC manufacturers while denying EC origin to goods produced by Japanese manufacturers, thereby allowing the European companies to trade their integrated circuits on better terms than the Japanese. In the case of textile and apparel industry which lobbied for the inclusion of restrictive process location requirements referred to as 'triple transformation' was implemented to determine origin.

(d) Changes in Tariff Classification which is used in the 'substantial transformation' test is a further concrete ROO test. This method specifies the change in

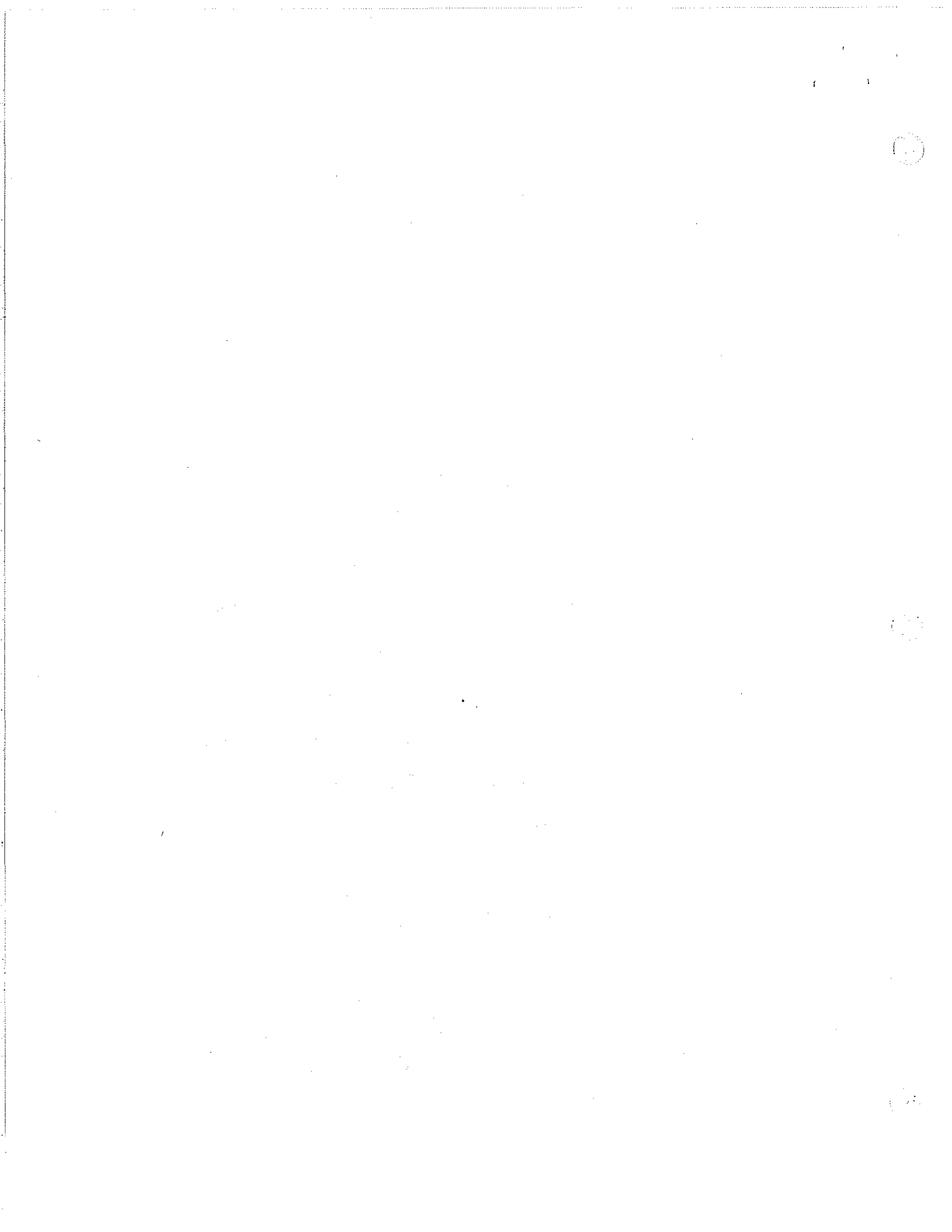


tariff classification required to confer origin on a good under the Harmonized Commodity Description and Coding System (Harmonized System). The Harmonized System has been adopted for customs tariffs and trade statistical purposes by countries representing 90 percent of world trade, making it one of the most basic and widely applied laws in international trade. It provides a uniform, hierarchical nomenclature to be used in defining origin determinations for all products in international trade.⁵ The rules of origin thus specify which of these, or combination of these, applied to each given product.

While rules of origin (ROOs) are formulated as part of the FTA negotiation, with the intent to lead to liberalization there are nevertheless several reasons why a given set of ROOs may result in substantially less liberalization than implied by the preferences which have been granted. First, there are the transaction costs associated with ensuring that ROOs are adhered to. The size of the transaction costs are usually related to the various stages of production that accompany the product. The usual assumption of a single parent in today's complicated outsourcing environment is hardly maintained.

The specific terms of an ROO in an FTA agreement is important in determining the economic effects of the ROO. The incentives provided to producers hoping to export to their trading partners obviously vary with the exact terms of the ROO as well as with the structure of pre-FTA tariffs. If factor content excluding labor is counted in establishing the required minimum ROO there would be a real incentive to substitute

⁵ The HS is divided into twenty-one sections, each representing a broad industrial grouping; ninety-six chapters, each representing a more narrow industrial sector; and 1,241 headings, each representing a narrow industrial section. The headings in a chapter are generally ordered by increasing degrees of processing. Therefore, because a change in the level of classification of a product at the heading level often suffices to confer its origin on the country where that change last occurred, this way of determining origin is also called the change-in-tariff-heading method.



materials for labor in the production process. If domestic labor, not capital, is the primary factor determining ROO the incentive to substitute labor for capital is obvious.⁶

More fundamentally, the underlying restrictiveness of a given ROO is likely to impact upon trade (Krueger, 1993, Krishna and Krueger, 1995; Krishna, 2003; Falvey and Reed, 2002; Burfisher, Robinson and Thierfelder, 2004; and Hoekman, 1993). Consider an FTA between the US and Costa Rica where the rules of origin specify that the final good is deemed as originating from Costa Rica if the value of non-originating intermediates does not exceed 40 percent of the value of the final good. Suppose that prior to the FTA Costa Rica imports intermediate goods from the EU comprising 50 percent of the value of the final good subsequently exported to the EU. Unless the Costa Rican firm changes its source of supply of intermediates or raises the final price of the good exported, it will not be able to benefit from the tariff-free access to the US market. If it changes its source of supply it can either source more (or all) of the intermediate from domestic sources or from the US. In the case of the former we have trade suppression, and in the case of the latter trade diversion. Each of these involves using a higher cost intermediate than was the case prior to the application of the free trade agreement, which would therefore also raise the price of the final good.

Krueger provides a simple example of the firm specific choices. Consider the case of a producer in country 1 deciding on her choice of purchasing an input (j) from FTA partner 2 or a non-partner supplier for its final product (i). Conventional wisdom would have Country 1's producer of i choose a fraction (f) of inputs purchased from country 2 in order to maximize the following profit function:

⁶ Under the U.S.-Canada FTA, the United States used the percentage of domestic value added as its criterion for duty-exempt eligibility but counted only labor costs, and not any imputed capital costs.



$$\pi_1^i = p_2^i - p_2^j f y - p_w^j (1-f)y \quad (1)$$

where p is price for input (j) or output (i); the subscripts 1, 2 designate the partners of the FTA and (w) designate the non-FTA source for j ; y is the value of j purchased per dollar of i at international prices. It is assumed that $y < 1$. Introducing t to represent tariffs and r to represent ROOs as a proportion of the price of i , we can develop the conventional gaps in FTA member's prices. For the tariff gap we have the following where w represent world market prices.

$p_1^j = (1+t_1^j)p_w^j$; we can have two possible outcomes:

$$p_1^i = 1 \quad \text{if } p_1^i - p_w^i(1-f)y < r$$

$$p_1^i = 1+t_1^i \quad \text{if } p_1^i - p_w^i(1-f)y \geq r$$

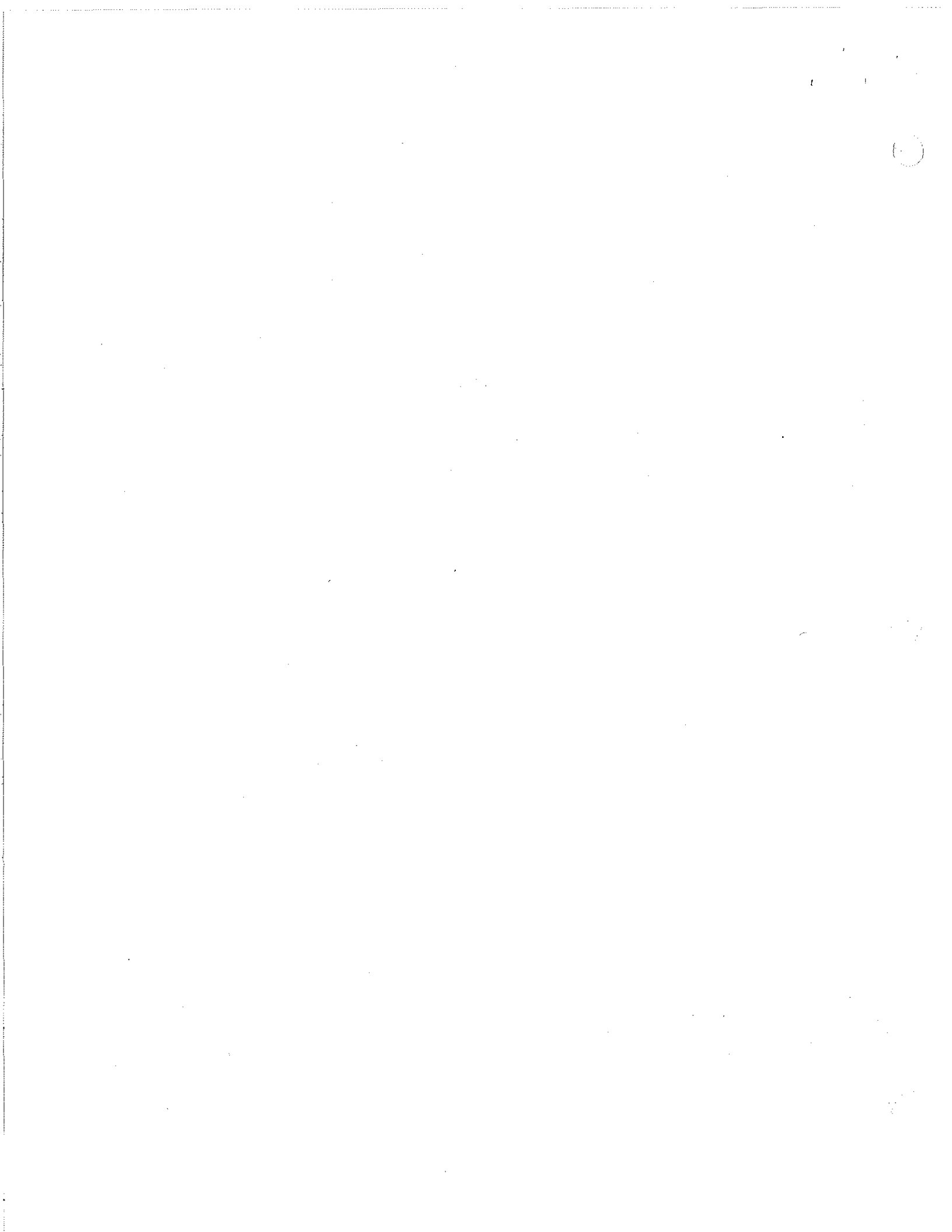
The world price for i can be set as a numeraire and set equal to one. Producers in an FTA member country will consequently choose to satisfy the ROO whenever:

$$1+t_1^i - (1+t_1^j)fy > (1-f)y \quad (2)$$

Dividing this expression leads to the conventional effective protection criteria for country 1.

$$\frac{(1+t_1^i) - (1+t_1^j)fy}{1-y} > 0$$

The higher the effective rate of protection in Country 1 for a given commodity, the more it will pay the other FTA members to source their intermediate inputs (j) from Country 1 despite the other members lower foreign (tariff-inclusive) prices. As the other FTA members increase their exports to Country 1 one can presume that their export prices would fall while their marginal costs of local production would rise. In the long-

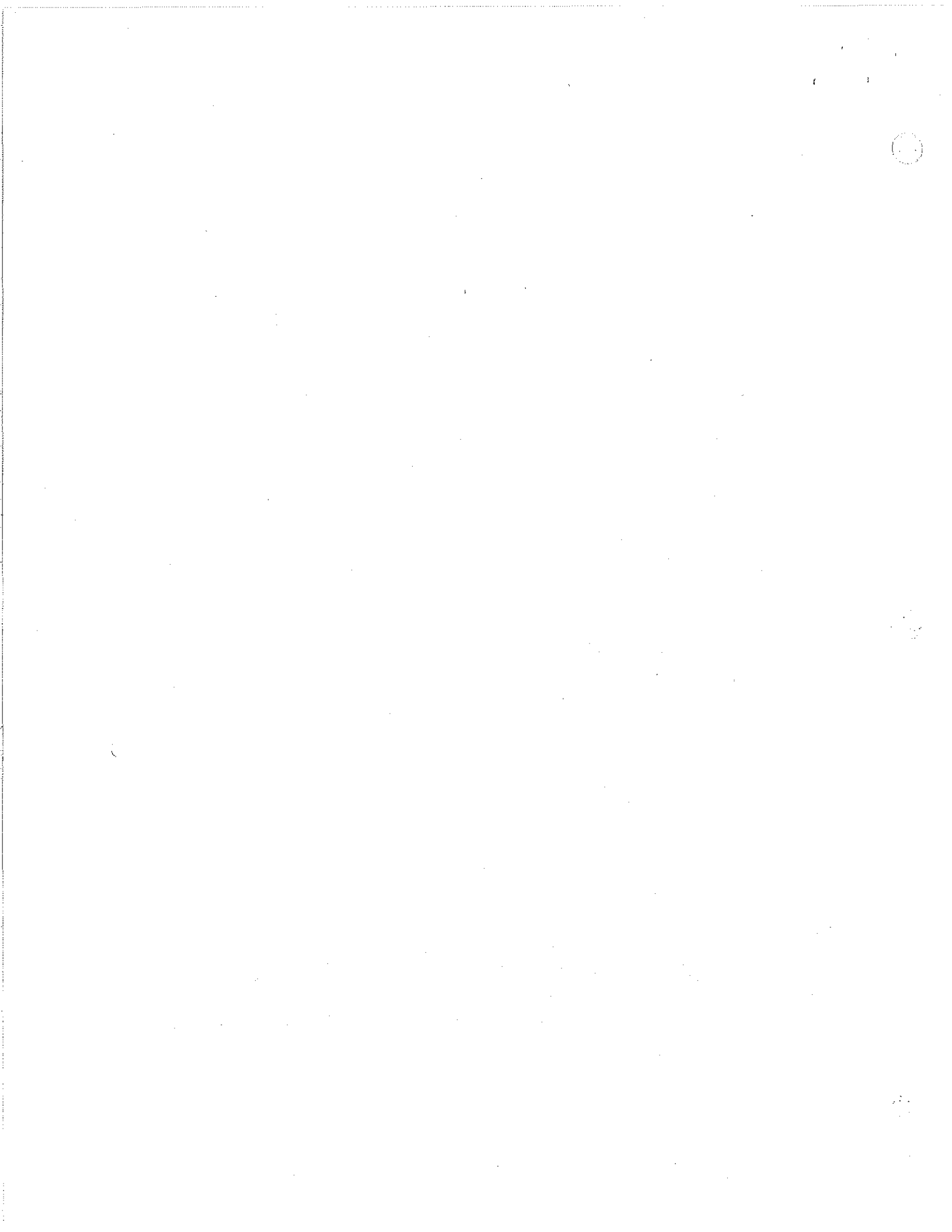


run an equilibrium would be reached where the ex-ante profits are eliminated. In general, one would expect that producers of a final good in an FTA would find it advantageous to purchase higher-cost (protected) inputs from other FTA members than to purchase from lower cost non-FTA sources whenever: 1) the effective rate of protection in the partner country was greater than in the home country; and 2) the rule of origin would not be satisfied without such purchases.

The discussion thus far suggests that ROO are not just technical details of an FTA but are in fact surrogates for protectionist instruments that are no longer available under multilateral trade rules. In that way they act very much like TBTs, in a world where traditional instruments of protection are increasingly constrained. The difficulty associated with making this case is that it is primarily an empirical issue. Earlier empirical analysis, has been slow to develop because of the complexity of ROOs and because the necessary data on preference utilization rates are only now becoming available and are difficult to interpret.

III. EMPIRICAL MEASURES

Virtually all FTAs have a system of ROO which are both product specific at the tariff line and 'system general' for the specific bilateral or regional FTA. To understand the difficulty of measuring the NTB nature of these regimes we start with the NAFTA as a point of departure. System general rules for a NAFTA like agreement usually includes (i) a de minimis (or tolerance) criterion which stipulates a maximum percentage of non-



originating materials that can be used without affecting the origin of the final product, (ii) cumulation⁷, (iii) roll-up,⁸ (iv) duty-drawback⁹, and (v) certification method.

Table 1: System Wide ROOs in NAFTA, Chile, GSP					
FTA	De-minimis or tolerance rules	Roll Up	Cumulation	Drawback	Certification
NAFTA	7(except agricultural & industrial products; 7% of weight in Chs 50-63)	Yes	Bilateral	No after 7 years	Self
US-Chile	10 (except in Agricultural & processed agricultural products)	Yes	Bilateral	Not mentioned	Self
US -GSP	10 (10% of weight in Chs 50-63)	Not mentioned	Bilateral, limited diagonal	Not mentioned	Self
Source: Estevadeordal and Suominen Estevadeordal, A. and K. Suominen "Rules of Origin: A World Map and Trade Effects", in Cadot, O., A. Estevadeordal, A. Suwa-Eisenmann and T. Verdier (eds), <i>The Origin of Goods</i> , Oxford and New York: Oxford University Press. (forthcoming).					

⁷ "Cumulation" is a term of art referring to an exception allowing FTA producers to import non-originating materials from other FTA member countries without affecting the final product's originating status. "Bilateral cumulation" is most common and applies to trade between two partners in a FTA. It stipulates that producers in country A can use inputs from country B without affecting the final good's originating status provided that the inputs are themselves originating (that is provided that they themselves satisfy the area's ROOs). "Diagonal cumulation" (applicable to the EU), specifies that countries tied by the same FTA can use materials that originate in any member country as if the materials were originating in the country where the processing is undertaken. "Full cumulation", refers to all stages of processing or transformation of a product within the FTA, can be counted as qualifying content regardless of whether the processing is sufficient to confer originating status to the materials themselves.

⁸ The concept of "roll-up" refers to the principle which allows non-originating materials which have acquired origin by meeting specific processing requirements to maintain this origin when used as input in a subsequent transformation.

⁹ "Duty drawbacks" are refunds to exporters of tariffs paid on imported intermediate inputs. US FTAs mandate the elimination of duty-drawback schemes for exports to partner countries, on the ground that a duty drawback claimed by a producer in A to export to B would put that producer at a competitive advantage compared to domestic producers in B given that the A producer already benefits from the elimination of intra-bloc tariffs.

Table 1 presents a glimpse into the complexity of ROO for the entire FTA. For the US, there are differences between NAFTA, Chile and its GSP program. These differences get more complicated as we add more FTAs. At the tariff line, Product-specific rules (PSRO) are based on two broad criteria -- the 'wholly obtained' and 'substantial transformation' norms.

The 'wholly obtained' criterion is self evident. It applies mainly to products which have been entirely grown, extracted from the soil or harvested within the country of export, or manufactured there from any of these products. It applies when one can identify a single parent, an event that is getting more and more rare. With subcontracting activities in place in most countries the second criterion of 'substantial transformation', is applicable. This criterion is fact specific and far more difficult to interpret. It can but is not limited to the following alternatives, noted above (which can be used as stand-alone or in combination with each other) :

- Change of Tariff Classification (CTC), requiring the product to belong to a tariff classification different from that of its imported inputs. The change of tariff classification can be expressed at various levels of aggregation: from broader to narrower, chapter (HS 2 digits), heading (HS 4 digits), subheading (HS 6 digits), or item (HS 8 digits). Changes of classification expressed at broader levels of aggregation are, in principle, more constraining.
- Regional Value Content (VC) requirement, requiring the product either to acquire a minimum percentage of local value added in the exporting country or not to exceed a maximum percentage of foreign (non-originating) materials.
- Technical Requirement (TECH), requiring the product to undergo certain manufacturing operations in the exporting country or prohibiting the use of certain inputs.



- Exceptions (EXC) can be attached to a particular CTC, which prohibits the use of non-originating materials from a certain subheading, heading, or chapter.
- Allowances, on the contrary, permit the use of non-originating materials from certain classifications.

Using these requirements, Estevadeordal (2000) proposed developing an index based on the observed ROO in order to summarize the restrictiveness of a given PSRO. His ordinal index computed at the tariff line level, ranged from one (least restrictive) to seven (most restrictive). His observation rule was based on the following two assumptions. The first is that the restrictiveness of a change of tariff classification (CTC) can be ranked in terms of its restrictiveness on the basis of the following observation: a change of classification at the chapter level (CC) has to be more difficult to satisfy than a change at the heading (CH) level; likewise, a change at the heading level has to be stricter than at the subheading (CS) level, and a change at the subheading level more stringent than at the tariff line or item level (CI). This implies that the following observation rule (larger values corresponding to more restrictiveness) :

$$\Delta CC > \Delta CH > \Delta CS > \Delta CI$$

Cadot, et. al. (2006) present a summary table for NAFTA of restrictiveness of these requirements. The data is reproduced in Table 2. The results are strictly descriptive with no correlation to tariff or price data. They suggest comparing these restrictiveness indexes against a tariff preference margin calculated at the tariff line. The tariff preference is the conventional FTA preference, which is declining over time.

$$\tau_i = \frac{t_i^{MFN} - t_i^{FTA}}{1 + t_i^{FTA}}$$

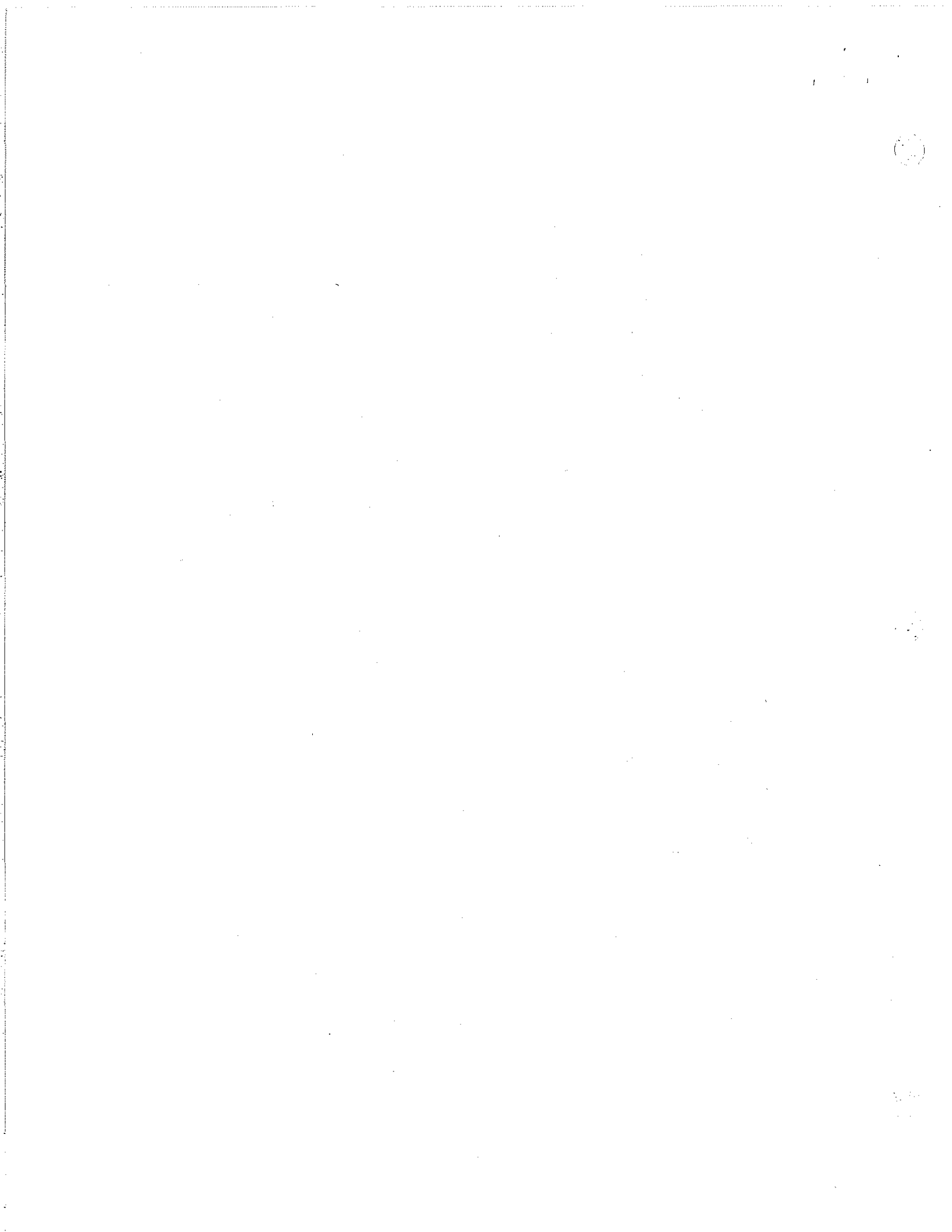


Table 2: Distribution of PSRO under NAFTA						
% of tariff lines	No other requirements or EXC	TECH or TECH+EXC	VC or VC+EXC	TECH+VC or TECH+VC+EXC	Wholly	Subtotal
NO CTC	0.54	0.0	0.0	0.0	0.0	0.54
CI	0.02	0.0	0.02	0.0	0.0	0.04
CS	3.81	0.44	0.1	0.0	0.0	4.35
CH	36.27	0.16	4.12	0.1	0.0	40.65
CC	48.66	5.78	0.0	0.0	0.0	54.44
Total	89.3	6.38	4.24	0.1	0.0	100
Each cell in the table represents the percentage of tariff lines that have the ROO in the corresponding row and in the corresponding column. CTC=change in tariff classification; CC=change in chapter; CH=change in heading; CS=change in subheading; CI=change in item. EXC=exception to change of tariff classification. VC=regional value content. TECH=technical requirement.						
Source: Cadot, et. al. (2006), Table 2.						

It is not obvious how these two indexes can help us understand the reallocation of industrial production, investment flows and choice of subassembly. In the next section we present an alternative methodology which focuses on estimating the tax equivalent of ROOs on a firm's costs.

IV. ALTERNATIVE METHODOLOGY

The system of complicated ROOs has evolved and become more complicated with the NAFTA agreement. Over the past three decades attempts to model the tax equivalents of these ROOs requires the separation of the country specific import market, at a minimum, into at least three markets. The first market is composed of the members of the FTA.¹⁰ The second market, composed predominately of non-member suppliers, constitutes those suppliers free of bilateral constraint. The third market is the domestic producers who are affected by the activities of both constrained and unconstrained suppliers.

¹⁰ One can view these countries as if they are constrained suppliers.



In order to determine the price effects attributable to these bilateral constraints, one needs to model both constrained and unconstrained markets, such that for every actual price-quantity combination observed in the presence of these ROOs, a non-ROO price-quantity combination can be simulated.

Given the nature of this market, ordinary least squares (OLS) regression of import demand on prices and other explanatory variables is inappropriate. Estimation of the demand and supply responses in the unconstrained market must account for changes in prices in the constrained market. In the constrained market, the supply curve is truncated, and the import quantities demanded (M^D) and ROO bound (S^Q) are not necessarily equal to each other: they are related to actual observed imports (M^A) by the equation :

$$M^A = \min (M^D, S^Q)$$

The price in this ROO controlled market will affect the equilibrium in both the uncontrolled import market and the domestic market for comparable domestic products.

A complete disequilibrium model applicable to the industry specific ROO controls would consist of the following set of structural equations:

Import demand:¹¹

$$M_t^D = \alpha_1 P_t + \alpha_2 X_t + \mu_t \quad (3)$$

¹¹ Vectors are denoted with bold characters.



Import supply:

$$M_t^S = Q_t^S \quad (4.1)$$

or

$$M_t^S = \beta_1 P_t + \beta_2 Y_t + \mu_{2t} \quad (4.2)$$

A Walrasian price adjustment mechanism:¹²

$$P_t = P_{t-1} + \gamma_1 (M_t^D - S_t^Q) + \gamma_2 X_t + \mu_{3t} \quad (5)$$

Market clearing mechanism:

$$M_t^A = \min (M_t^D, S_t^Q) \quad (6)$$

where:

M_t^A = observed import transaction at time t,

M_t^D = unobserved import demand at time t,

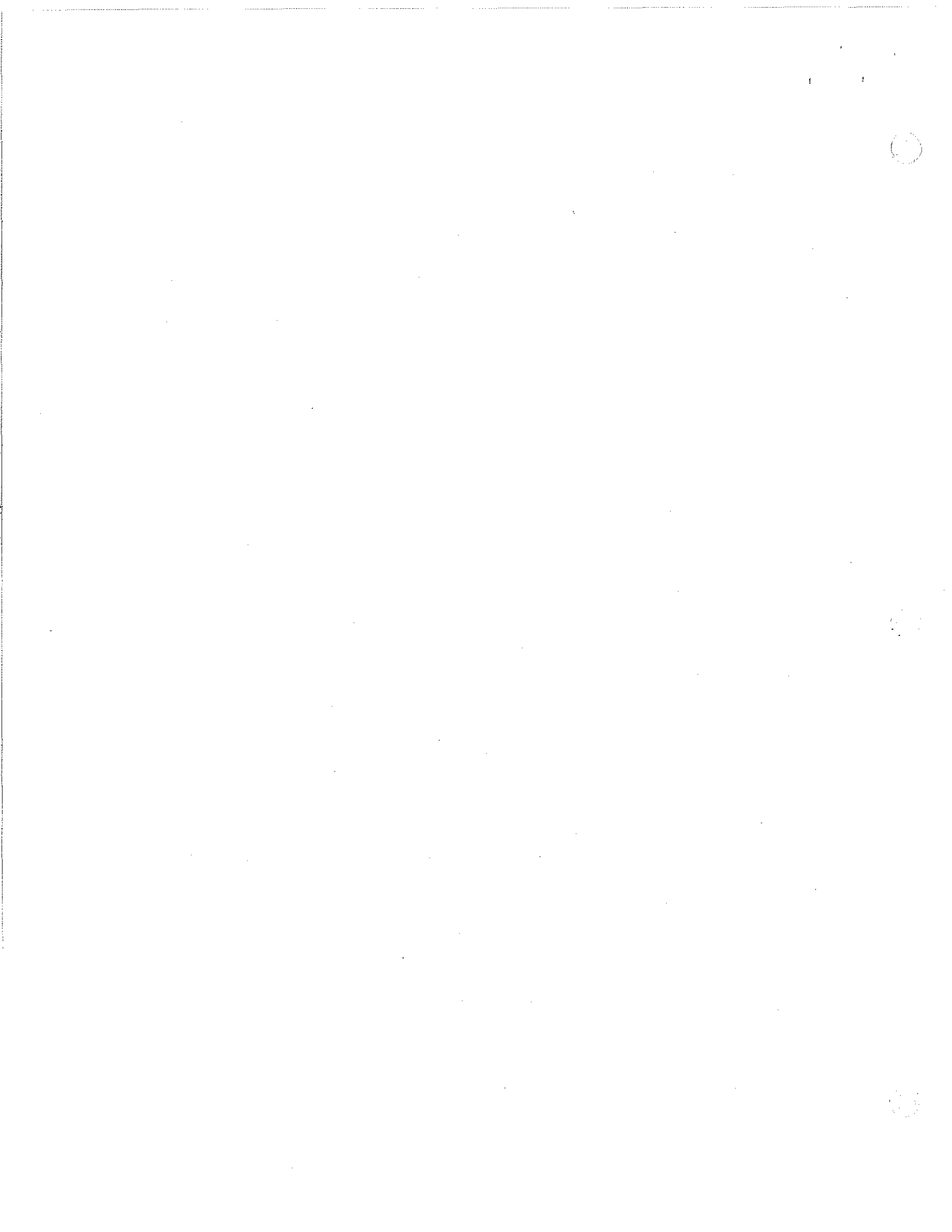
M_t^S = quantity of imports supplied at time t,

S_t^Q = quantity of imports constrained due to FTA ROO agreement,

P_t = set of prices,

X_t and Y_t = set of exogenous explanatory variables, and

¹² In effect, this assumption claims that, ceteris paribus, prices change in proportion to the current excess demand.



α_i = demand elasticities,

β_i = supply elasticities,

γ_i = adjustment coefficients, and

t = time.

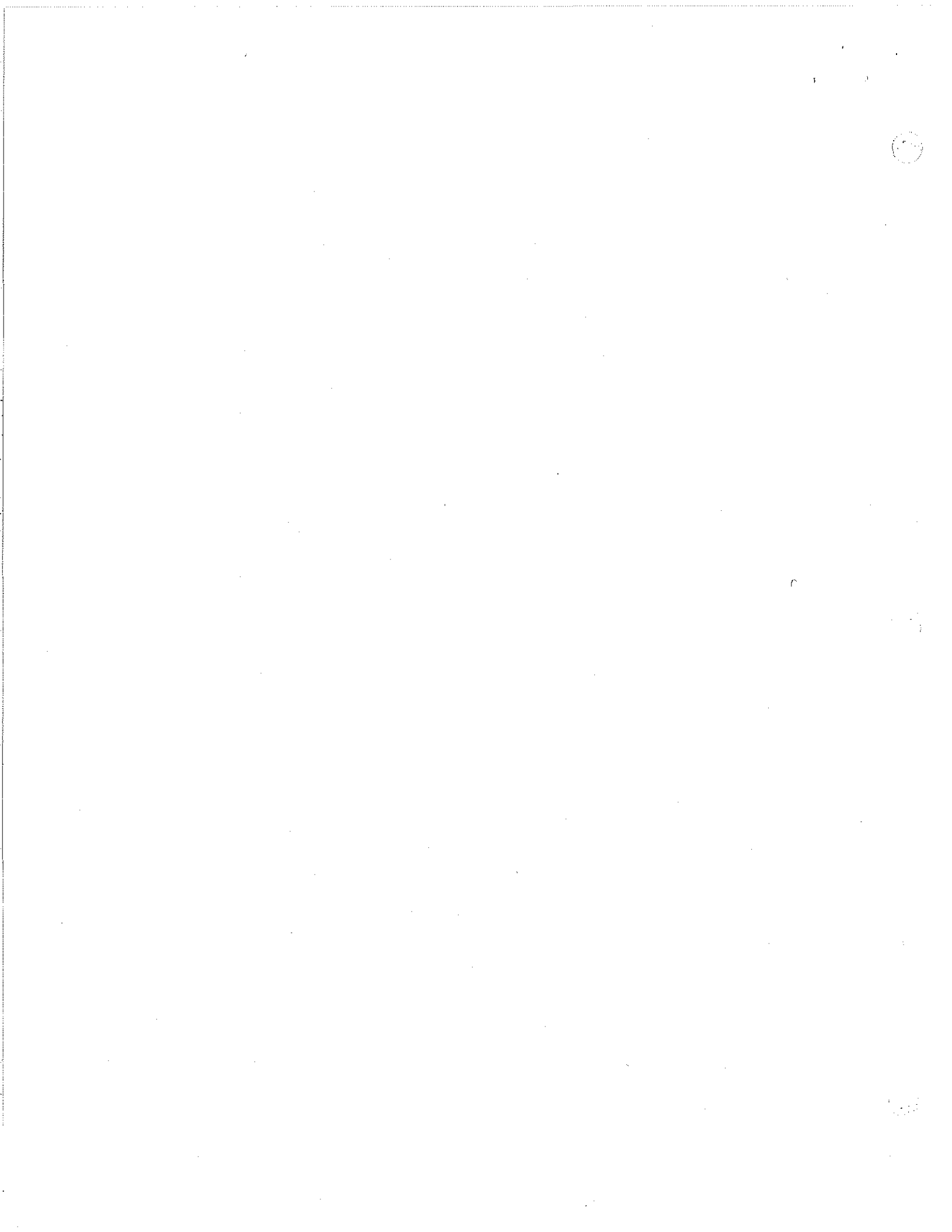
In the controlled market, two possibilities are appropriate. If the supplier fulfills the ROO requirement (eq. 4.1), then an equilibrium will be observed on the vertical segment of the supply curve. On the other hand, an equilibrium could occur at some quantity less than the ROO controlled supply (eq. 4.2). In both cases, while S^Q is observed, M and the true P_t are unobserved. Since P_t is not independent of μ_{1t} , it is not appropriate to estimate α by substituting M of (eq. 3) and S^Q into (eq. 5) and applying the Tobit method.¹³ Furthermore, since the true M is not observed we cannot estimate γ of (eq. 5) directly.

Equations 3, 4, 5 and condition 6 can be utilized to define the conditional joint density functions $g_1(\cdot)$ of M and P_t , given that M is on the demand function and $g_2(\cdot)$ when it is on the supply function. The unconditional joint density of the observed endogenous variables M and P_t is given by:

$$f(M, P_t | X_t, Y_t) = \int_{M^A}^{\infty} g(M_t^A, M_t^S, P_t | X_t, Y_t) dM_t^S + \int_{M^A}^{\infty} g(M_t^A, M_t^D, P_t | X_t, Y_t) dM_t^D$$

The maximum likelihood (ML) estimates of the parameters (α and β) and the variance-covariance matrix Σ are obtained by maximizing the log likelihood function corresponding to the above joint density function. This procedure is, however, a full information ML

¹³ See Maddala (1983a and 1983b).



procedure which is inappropriate in the ROO constrained case where M is not directly observed.

In order to measure the difference between the unobserved equilibrium price with no ROO requirements and the observed transaction price with ROO compliance, the reduced form of M must be substituted into equation (6) where consistent estimators of the reduced form parameters can be obtained by Tobit analysis. Predictions of the unobserved variable M^{14} can then be substituted into equation (5) to directly estimate γ along with the predicted prices without the ROO requirements. It is this price differential which measures the value of the ROO requirements.¹⁵

The structural model outlined in equations (3) through (6) should be estimated as follows:

Import Demand

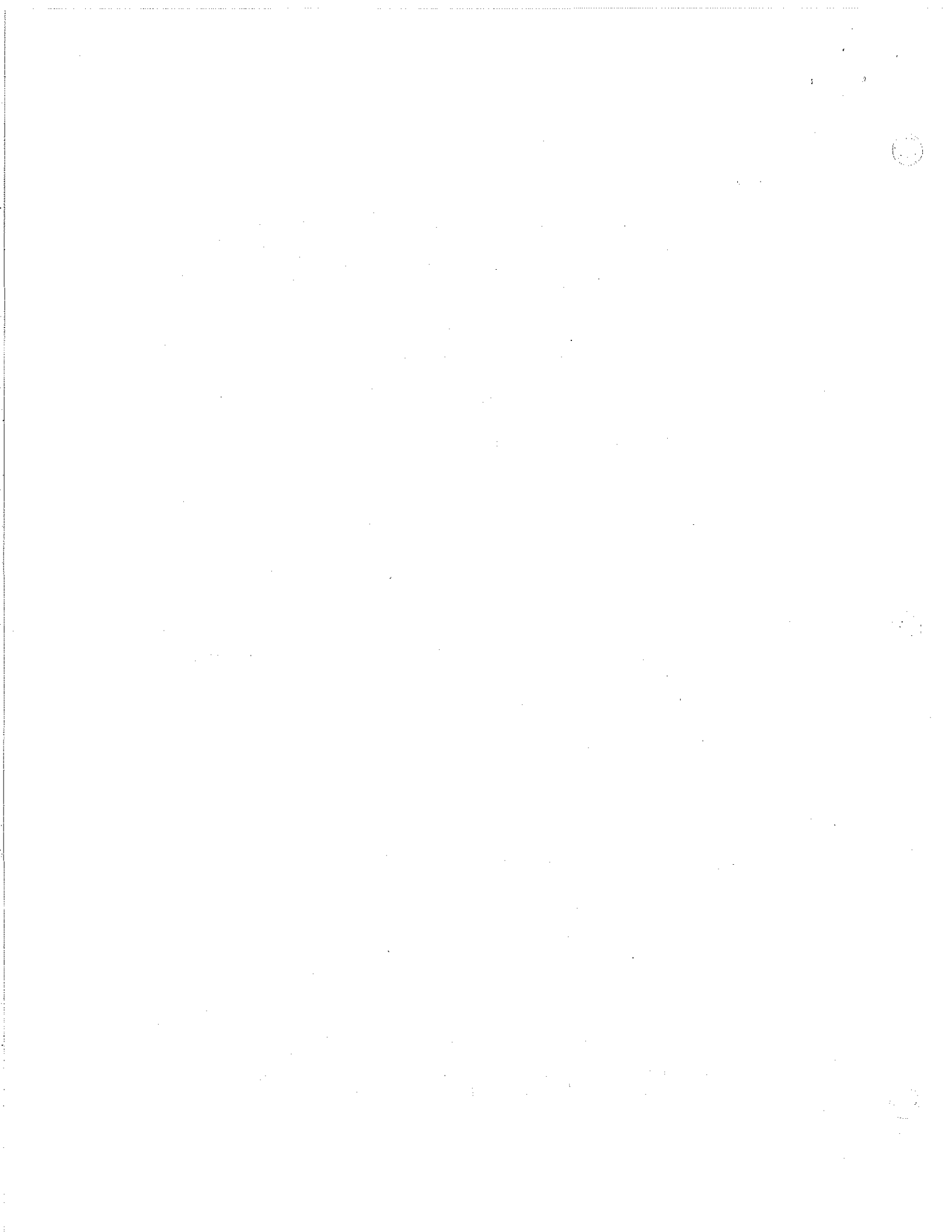
The import demand equation for the two markets (controlled and uncontrolled) is specified as a function of its specific market price, the price of a similar product from the alternative market, the domestic price of a competing good, and a real activity variable, or

$$M_{ij,t}^D = \alpha_0 + \alpha_1 P_{Cj,t} + \alpha_2 P_{Uj,t} + \alpha_3 P_{Dj,t} + \alpha_4 E_t + \mu \quad (7)$$

where M = import demand for commodity j from i (controlled or uncontrolled suppliers) at time period t; $P_{Cj,t}$ = import price from ROO controlled market at time period t; $P_{Uj,t}$ = import price from uncontrolled market at time period t; $P_{Dj,t}$ = domestic price of the

¹⁴ As Hartley (1976) points out, these predicted values are only for the cases where we are on the vertical segment of the supply curve. In all other cases we are already on the demand curve.

¹⁵ The tariff equivalent of the ROO requirements can be measured inclusive or exclusive of the existing tariffs. If the tariff equivalent of the ROO requirements is higher than the tariff preference, members of the FTA will not trade that particular good.



competing product at time t ; E_t = real activity variable at time t ; and μ = random error term. Since there are two differentiated regions, there are two import demand equations that depend on all three prices over time.

This Armington (1969) specification of the import demand equations requires the following set of assumptions. First, it is necessary for these import demand equations to be weakly separable between ROO controlled products and other products which enter the consumer's utility function. In effect, each of our products is treated as a distinct good with imperfect substitutes differentiated by country of origin. Second, Armington's two step process assumes that the marginal rate of substitution for any two products (differentiated by source) are independent of the quantities demanded of third goods entering the consumer's utility function. This assumption of a zero income compensated cross price effect between textile and apparel goods and third goods. It means that a change in the price of this third good will have an impact on the demand for textile and apparel imports, but only when it has an impact on real expenditures. The restrictive nature of this assumption, if violated, may result in a misspecification bias in our estimated import demand equations.¹⁶

While Armington's assumptions may be reasonable for ROO final products, they may present a problem for some of the intermediate products. In the case of intermediate imports, the import demand equations noted by equation (7) are, in fact, derived demand functions. The assumption of independence between the marginal rates of substitution of different classes of intermediate inputs, may represent a problem. In these latter cases the import demand equations will include the prices of all possible substitutes. Omission of

¹⁶ For a discussion of the theoretical implications of the weak separability assumption see Winters (1984).



these prices clearly will cause the import demand equations for the intermediate imports to be misspecified.

Import Supply

The specification for the ROO affected import supply functions must take into account that there are two markets, one controlled and the other uncontrolled. These markets are related in that the price of the controlled product affects the equilibrium price in the uncontrolled market. This uncontrolled market would be characterized by a demand curve given by equation (7) and by the following supply and equilibrium conditions:

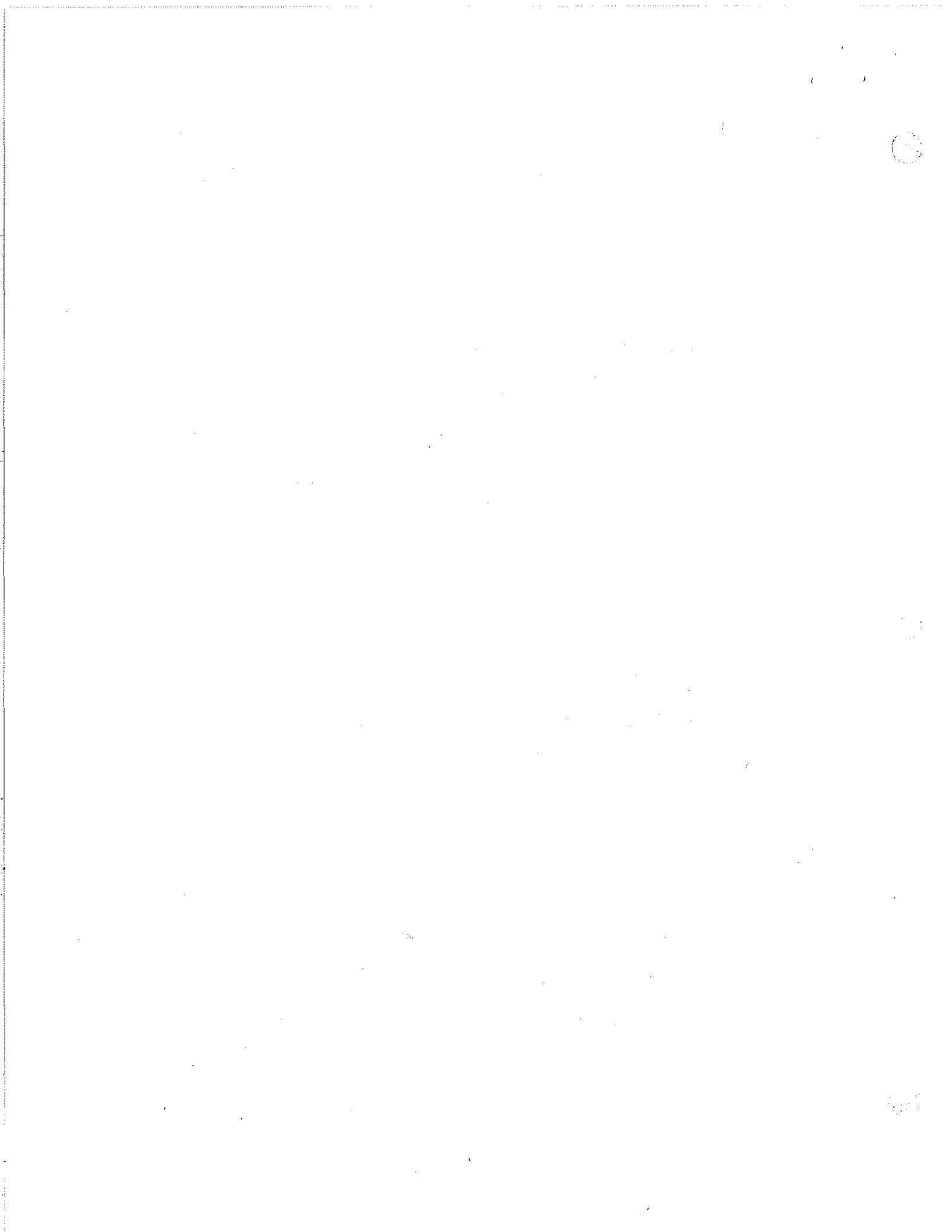
$$M_{ij,t}^S = \beta_0 + \beta_1 P_{uj,t} + \varepsilon \quad (8)$$

$$M_{ij,t}^D = M_{ij,t}^S \quad (9)$$

where ε is normally distributed.

It is assumed that the supply equation for uncontrolled countries (eq. 8) is a function of its product and time specific export price. The solution of an equilibrium price and quantity, however, must take into account the price of substitutes from domestic and controlled suppliers.

The distortionary impact of the quota system is captured in equations (4.1) and (5). The reduced form estimating equations consist of import demand equation (7) and supply equations (10.1) and/or (10.2). The market clearing condition noted earlier as equation (8) can be replaced by conditions (11.1) or (11.2). The added equations for the controlled country scenario are:



$$M_{ij,t}^S = \lambda_0 + \lambda_1 P_{Cj,t} + v \quad (10.1)$$

$$M_{ij,t}^S = S_{ij,t}^Q \quad (10.2)$$

$$M_{ij,t}^A = M_{ij,t}^D = M_{ij,t}^S \quad \text{if } M_{ij,t}^A < S_{ij,t}^Q \quad (11.1)$$

$$M_{ij,t}^A = S_{ij,t}^Q \quad \text{if otherwise} \quad (11.2)$$

where S includes the hypothetical upper bound of added costs of the ROO.

As noted above, the controlled market has two possible sets of price and quantity equilibria. The first case,

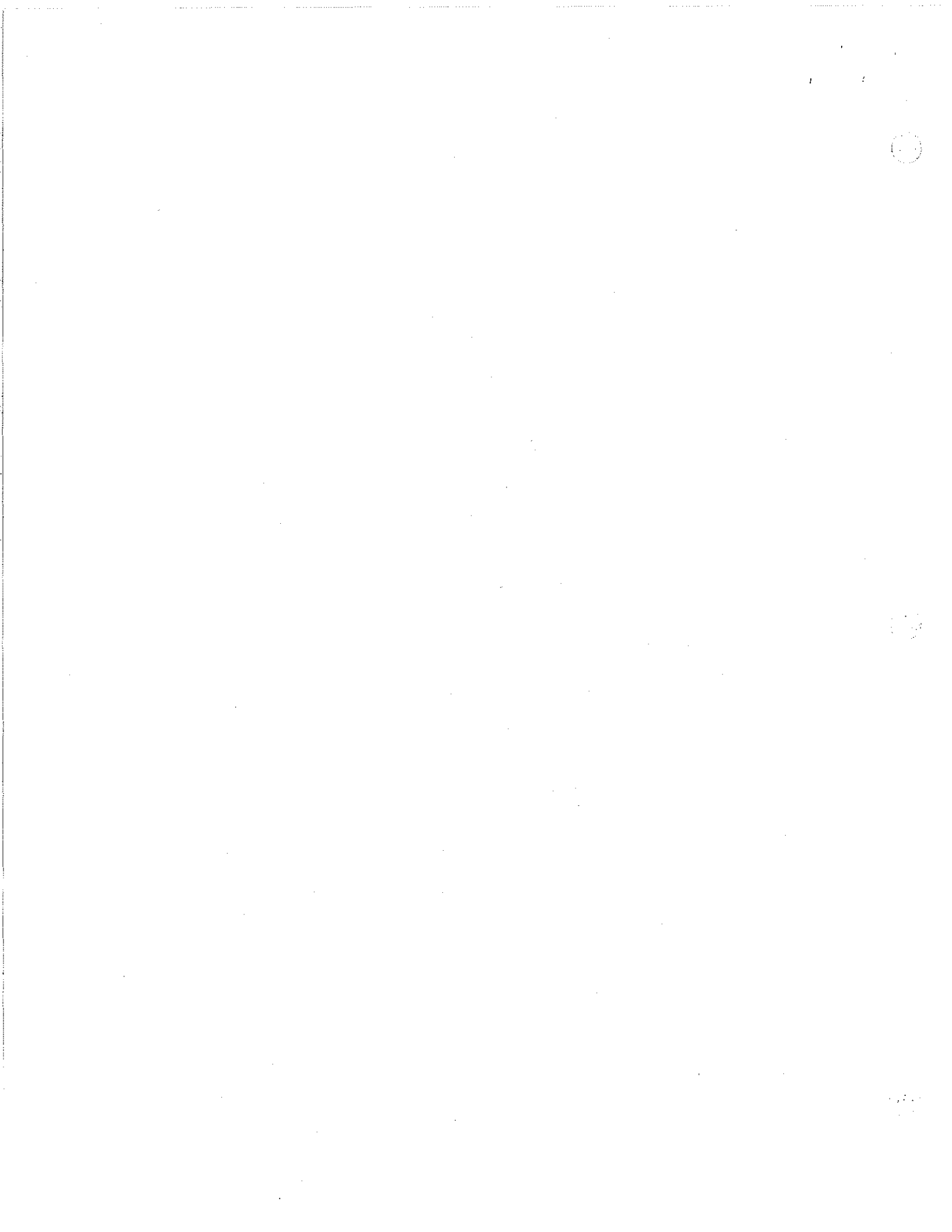
$$M_{ij,t}^A < S_{ij,t}^Q, \text{ we have a simultaneous equation model where both the}$$

quantity transacted and the price are observed endogenous variables. In this case the price and quantity of imports is determined by the intersection of import demand and supply.

The second case,

$$M_{ij,t}^A = S_{ij,t}^Q$$

yields an unobserved excess demand situation where the controlled quantity S is an exogenous variable. In this case the price is an element of the supply constraint, not the demand curve.



The market effects of the ROO requirements can be analyzed by treating the problem as a standard disequilibrium Tobit model.¹⁷ The simplest disequilibrium model, noted above as equations (11.1) and (11.2), can be restated as equation (6):

$$M_t^A = \min (M_t^D, S_t^Q)$$

implying that the actual quantity of imports sold is the minimum of supply and demand. This latter disequilibrium term can be substituted for equations (11.1) and (11.2) above. Furthermore, this disequilibrium caused by the ROO creates an inequality between the actual observed price and the ex-ante market equilibrium price. Thus, a Walrasian price adjustment equation suggested in Fair and Jaffee (1972) can to be added. The price adjustment equation can take the following simple form:

$$\phi P_{Cj,t} = \phi_0 (D_{ij,t}^M - S_{ij,t}^M) + \phi_1 P_{Uj,t} + \phi_2 P_{Dj,t} + \phi_3 E_t + \varepsilon$$

where

$$\phi P_{Cj,t} = P_{Cj,t} - P_{Cj,t-1}$$

The two-stage estimation procedure suggested by Maddala (1983a) and outlined above requires that equation (7) be estimated in its constrained form, as:

$$Z_{ij,t}^* = \alpha_0 S_{ij,t}^Q + \alpha_1 P_{Cj,t} + \alpha_2 P_{Uj,t} + \alpha_3 P_{Dj,t} + \alpha_4 E_t + \nu \quad (7.2)$$

where

$$Z_{ij,t}^* = (M_{ij,t}^D - S_{ij,t}^Q)$$

and ¹⁸

¹⁷ See Maddala and Nelson (1974), Hartley (1976) and Maddala (1983a).



$$Z_{ij,t} = M_{ij,t}^D - S_{ij,t}^Q (= Z_{ij,t}^*) \text{ if } Z_{ij,t}^* < 0$$

$Z_{ij,t} = 0$ if otherwise.

The estimated values of $P_{Cj,t}$ are then substituted into the demand and supply equations in both controlled and uncontrolled markets in order to estimate the relative price and income elasticities absent the ROO distortions. The result of this empirical model consist of a set of ad-valorem tariff equivalents of the ROO, along with a consistent set of unconstrained demand elasticities for both controlled and uncontrolled markets. All are estimated at the 4-digit HS level used to monitor the ROO requirements.

V. ESTIMATING WELFARE LOSSES

This section presents the partial equilibrium methodology for estimating the impact of the dismantling of the ROO requirements on competing domestic U.S. producers. The main controlled competitors' products are denoted as c_1 through c_3 , representing the Central American and Mexican exporters, the Asian exporters, and all other controlled exporters. The uncontrolled exporters are denoted as u and the competing U.S. domestic good as d . Q_u and p_u are the initial quantity and price of the non-controlled competitor, $Q_{c1 \text{ to } c3}$ and $p_{c1 \text{ to } c3}$ are the initial quantity and prices of the three controlled exporters, and Q_d and p_d are the initial quantity and price of the U.S. domestic producers.

We utilize the assumption that, before removal of the tariff equivalent of the ROO, $p_d = p_c = p_u = 1$. If we define $V_{c1 \text{ to } c3}$, V_u and V_d as the dollar value of the respective competitors' exports, and U.S. domestic output, it is then the case that, before tariff

¹⁸ Note that Z is the truncated variable so that $Z_{ij,t} = Z$ if $Z < 0$ and $= 0$ otherwise.



removal, $V_u = Q_u$, $V_{c1 \text{ to } c3} = Q_{c1 \text{ to } c3}$ and $V_d = Q_d$. The proportional change in a variable is denoted by using a hat " \wedge " so that, for example, $z^\wedge = dz/z$.

The full system of equations to be solved will then consist of the following:

$$\hat{Q}_c = \varepsilon_{cc} \hat{p}_c + \varepsilon_{cu} \hat{p}_u + \varepsilon_{cd} \hat{p}_d \quad (12)$$

$$\hat{Q}_u = \varepsilon_{uc} \hat{p}_c + \varepsilon_{uu} \hat{p}_u + \varepsilon_{ud} \hat{p}_d \quad (13)$$

$$\hat{Q}_d = \varepsilon_d \hat{p}_d \quad (14)$$

$$\hat{Q}_d = -\gamma_c \hat{Q}_c - \gamma_u \hat{Q}_u \quad (15)$$

where ε_{ij} is the uncompensated elasticity of demand for good i with respect to price j , and ε_d is the elasticity of supply of good d , γ_i equals (Q_i/Q_d) . The exogenous variables are \hat{p}_c and \hat{p}_u , and the endogenous variables are \hat{Q}_c , \hat{Q}_u , \hat{Q}_d , and \hat{p}_d .

The unit-for-unit substitution assumption implicit in equation 11 is necessary because data on expenditure for domestic textile and apparel are not available for the three-digit textile nomenclature. This assumption will tend to overstate the domestic impact of tariff and quota removal because the unit values of imported textile and apparel products are in most cases lower than their domestic counterparts.

Solving the system yields the following:

$$\hat{p}_d = \frac{-[(\gamma_c \varepsilon_{cc} + \gamma_u \varepsilon_{uc}) \hat{p}_c + (\gamma_c \varepsilon_{cu} + \gamma_u \varepsilon_{uu}) \hat{p}_u]}{(e_d + \gamma_c \varepsilon_{cd} + \gamma_u \varepsilon_{ud})} \quad (16)$$

$$\hat{Q}_d = \frac{-e_d [(\gamma_c \varepsilon_{cc} + \gamma_u \varepsilon_{uc}) \hat{p}_c + (\gamma_c \varepsilon_{cu} + \gamma_u \varepsilon_{uu}) \hat{p}_u]}{(e_d + \gamma_c \varepsilon_{cd} + \gamma_u \varepsilon_{ud})} \quad (17)$$



$$\hat{Q}_c = \frac{[e_d \varepsilon_{cc} + \gamma_u (\varepsilon_{ud} \varepsilon_{cc} - \varepsilon_{cd} \varepsilon_{uc})] \hat{p}_c + [\varepsilon_d \varepsilon_{cu} + \gamma_u (\varepsilon_{ud} \varepsilon_{cu} - \varepsilon_{cd} \varepsilon_{uu})] \hat{p}_u}{(e_d + \gamma_c \varepsilon_{cd} + \gamma_u \varepsilon_{ud})} \quad (18)$$

$$\hat{Q}_u = \frac{[e_d \varepsilon_{uc} + \gamma_c (\varepsilon_{cd} \varepsilon_{uc} - \varepsilon_{ud} \varepsilon_{cc})] \hat{p}_c + [\varepsilon_d \varepsilon_{uu} + \gamma_c (\varepsilon_{cd} \varepsilon_{uu} - \varepsilon_{ud} \varepsilon_{cu})] \hat{p}_u}{(e_d + \gamma_c \varepsilon_{cd} + \gamma_u \varepsilon_{ud})} \quad (19)$$

The areas of the consumer-welfare trapezoids in the three markets are:

$$C_c = \frac{(p_c - p'_c)(Q_c + Q'_c)}{2}$$

$$C_u = \frac{(p_u - p'_u)(Q_u + Q'_u)}{2}, \text{ and}$$

$$C_d = \frac{(p_d - p'_d)(Q_d + Q'_d)}{2}$$

These can be rewritten as:

$$C_c = \frac{-\hat{p}_c p_c (2 + \hat{Q}_c) Q_c}{2} \quad (20)$$

$$C_u = \frac{-\hat{p}_u p_u (2 + \hat{Q}_u) Q_u}{2}, \text{ and} \quad (21)$$

$$C_d = \frac{-\hat{p}_d p_d (2 + \hat{Q}_d) Q_d}{2} \quad (22)$$

The loss of producer welfare in the market for domestic output is exactly equals to the gain in consumer surplus I this market. This amount is an upper bound estimate of the loss in profits:



$$F = \frac{-\hat{p}_d P_d (2 + \hat{Q}_d) Q_d}{2} \quad (23)$$

VI. CONCLUDING REMARKS

What we have shown is that the FTA process has generated a very complex set of ROO costs which cannot be captured by simply ranking the degree of impediments connected with the concept of “substantial transformation.” What has to be estimated is the tariff equivalents of the ROO and compared to the tariff preferences associated with a given FTA. Only then can a firm evaluate whether it conforms to the ROO or violates it.

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