EMPIRICAL ASSESSMENT OF THE IMPACT ON TRADE OF PRODUCT SPECIFIC PREFERENTIAL RULES OF ORIGIN

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Thesis submitted to the University of Nottingham for the Degree of Doctor of Philosophy

May 2011

Abstract

This thesis addresses the issue of rules of origin and their impact on trade flows. Four objectives are sought: i) to provide further evidence on the impact on trade of product-specific preferential rules of origin; ii) to develop a restrictiveness index based on empirical findings; iii) to open the path for the impact of the rules of origin on particular sectors other than textiles; and iv) to contribute with further evidence on regime-wide provisions.

Literature on rules of origin is reviewed in Chapter 2. While theoretical literature establishes certain conditions under which rules of origin can increase welfare, empirical literature is unanimous about the negative effects they have on trade flows. Two main aspects stem from the review of the empirical literature. First, empirical literature on rules of origin remains still very limited in scope. Second, in order to proxy the stringency of the rules, traditional literature relies on restrictiveness indices based on an *ex-ante* observation rule. This rule depends on the authors' appreciation, which can potentially be incorrect. Chapter 3 provides a broad explanation about the different type of product specific and regime-wide rules of origin.

The framework to assess the impact of specific rules and regime-wide provisions on trade flows is developed in Chapter 4. The analysis is conducted using a gravity model of disaggregated panel data for four reporting countries and 16 FTA partners, controlling for reporter and partner fixed effects. In order to account for different ways of modeling specific rules of origin, four different methods are confronted. Data sources and explanations are also provided in this Chapter.

Each of the methods is estimated for total trade flows, exports and imports, as a way to improve the validity of the estimates. The results, along some issues regarding the proper form of the specification are presented in Chapter 5. The results prove significant for every specification and suggest that regional value content type of rules, as well as self-certification procedures promote trade within the FTAs.

Using the estimates from the previous chapter, an *ex-post* restrictiveness index is constructed in Chapter 6. This index is subsequently used to assess the stringency of

the rules of origin by sector and by agreement stringency levels. One of the main differences of this index with past indices is the relatively high level of leniency it assigns to regional value content rules. The validity of the *ex-post* index is checked by estimating the impact of rules of origin on North-South trade as well as on agricultural, industrial and textile imports, finding support on the results.

After analyzing the state of play of rules of origin in today's world, policy recommendations are provided in Chapter 7. There is a practical unanimity on the need to reform the rules of origin as they currently stand. The possibility to choose across-the-board between a regional value content rule and current rules, coupled with self-certification procedures appears to address the concerns of researchers, industry and policy makers.

Acknowledgments

I would like to thank my supervisors Oliver Morrissey and Wyn Morgan for their guidance, support and mostly, their patience throughout many years.

I am also grateful to other supervisors I have had in the past, notably Robert Hine, who gave me the opportunity to join this programme; similarly, Alexander Hijzen, who followed my early years of work.

Most especially wish to thanks my family, who has been helping in every possible way throughout the entire process.

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List of Acronyms

Acronyms Specific to Rules of Origin

&	Equivalent to "in addition of"
ALT	Alternative between rules
CC	Change in Chapter
CCex	Exception to Change in Chapter
CTC	Change in Tariff Classification
CTCex	Exception to Change in Tariff Classification
CTH	Change in Tariff Heading
CTHex	Exception to Change in Tariff Heading
CTI	Change in Tariff Item
CTS	Change in Tariff Subheading
CTSex	Exception to Change in Tariff Subheading
COMB	Combination of rules
EXC	Exception to any type of Change in Tariff Classification
MC	Import Content
OR	Equivalent to "either... or"
RoO	Rules of Origin (unless specified, refers to product-specific rules of origin)
RVC	Regional Value Content
RVCEU	Regional Value Content-PANEURO type
TT	Technical Test
WO	Wholly Obtained

General Acronyms

AGOA	African Growth and Opportunity Act
ASEAN	Association of Southeast Asian Nations
CAFTA	Central America Free Trade Area
CARIFORUM	Caribbean Forum
CBP	Customs and Border Protection
CES	Constant Elasticity of Substitution
CGE	Computable General Equilibrium
CIF	Cost, insurance, freight
COMESA	Common Market of Eastern and Southern Africa
CRS	Constant Returns to Scale
CU	Customs Union
ECOWAS	Economic Community of Western African States
EFTA	European Free Trade Association
EIA	Economic Integration Agreement
EPA	Economic Partnership Agreement
EU	European Union
EURO-MED	European-Mediterranean Countries
FDI	Foreign Direct Investment
FE	Fixed Effects
FOB	Free on board
FTA	Free Trade Agreement
GATT	General Agreement on Trade and Tariffs
GCC	Gulf Cooperation Council

GDP	Gross Domestic Product
GLS	Generalized Least Squares
HS	Harmonized System
HWP	Harmonized Work Programme
IIT	Intra-Industry Trade
IRS	Increasing Returns to Scale
ITC	International Trade Center
LAIA	Latin American Integration Association
LSDV	Least Squares Dummy Variable
MERCOSUR	Mercado Común del Sur, in Spanish - Southern Common Market
MFN	Most Favored Nation
NAFTA	North American Free Trade Area
OLS	Ordinary Least Squares
ORRC	Other Restrictive Regulations of Commerce
PANEURO	Paneuropean System of Rules of Origin
PS	Partial Scope Agreement
RE	Random Effects
RTA	Regional Trade Agreement
SADC	Southern African Development Community
SAFTA	South Asian Free Trade Area
SEP-4	Trans-Pacific Strategic Economic Partnership
SITC	Standard International Trade Classification
SPS	Sanitary and PhitoSanitary Measures
TBT	Technical Barriers to Trade
TDCA	Trade and Development Cooperation Agreement EU-South Africa
USTR	United States Trade Representative
WLS	Weighted Least Squares
WTO	World Trade Organization

Chapter 1. Introduction

1.1. Background, Motivation and Aims

Assessing the origin of trade flows is key in world trade. Governments need to compile accurate import statistics to analyze the origin of their imports to properly shape their trade policy. Also, products from different countries may be subject to different measures like tariff-quotas, safeguard measures or different duties. Determining the origin of goods is a complex operation, more so in today's globalized world where different stages of production of a good may take place in several countries. In order to address this question, countries establish a definition of origin. The set of definitions, or rules, that establish the origin of goods are known as rules of origin (RoO).

There are many ways of defining origin and historically, each government has had a different approach. LaNasa (1995) notes how a first proposal to regulate RoO under the General Agreement on Trade and Tariffs (GATT) was refused by a group of countries on the basis that "origin was inescapably bound up with national economic policies, which are unavoidably different in different countries". As a result, RoO vary widely from one country to another. This can be a potential problem for producers, as their exports may be recognized to originate in one country or another depending on the rules of the importing territory, and hence face varying conditions. Multilaterally, the potential problem posed by the rules of origin started to gain prominence as it became evident that the EU was using the rules with discriminatory purposes (Forrester, 1994).[1] A first attempt to legislate this aspect of trade relations came in 1982, when GATT members started studying this issue.[2] This early attempt barely achieved any progress. Later, the Uruguay Round resulted in a more serious effort to intensify work in this regard with the signature of the World Trade Organization (WTO)

[1] Throughout this thesis, the denomination of European Union (EU) is used to refer to the group of countries that were first part of the European Economic Community, then European Communities and now the European Union.
[2] http://www.wto.org/spanish/tratop_s/roi_s/roi_info_s.htm

Agreement on Rules of Origin. One of the main objectives of the Agreement on Rules of Origin is to harmonize multilateral rules of origin for all products. Several deadlines have been missed since the Uruguay Round and progress to harmonize multilateral remains slow. According to the outgoing Chair of the Committee on Rules of Origin, by 2010 harmonization had only been achieved on 55 percent of the products.[3]

In a world where most trade takes place under the same conditions for every country as it was intended to be under the Most Favored Nation (MFN) provision of the GATT, the importance of determining origin would not be as crucial, as imports would receive the same treatment independently of their origin.[4] This is not so when trade is conducted under a preferential basis as RoO serve to determine whether the good qualifies for preferential treatment. With the spectacular increase in the number of FTAs in the past 20 years, RoO have gained increased relevance.[5]

In a Free Trade Area (FTA), RoO are originally intended to avoid *trade deflection*. This phenomenon consists of channeling exports from third countries into the FTA through the member with lowest tariff. These products are subsequently re-exported to the remaining countries of the agreement at the preferential within-FTA tariff, avoiding the payment of higher duties in those countries. The country with the highest tariff then experiences an unintended decrease in its tariff revenues. Since FTAs are designed to promote trade between two (or more) partners and not to boost imports from third country competitors, governments devote important efforts in the negotiations to determine what is considered to be originating in the partner countries.[6] As a consequence, the extent to which imports can benefit from preferential treatment depends chiefly on the definition of origin, i.e. on the rules of origin. If origin is drafted in a restrictive manner, RoO can undermine the effects of trade liberalization between the partners of an FTA by setting requirements that are too costly to comply with by the exporters, hence bypassing the benefits of the FTA (Anson et al., 2005).

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[3] http://www.wto.org/english/news_e/news10_e/roi_25mar10_e.htm

[4] Other than the uses mentioned above, at the multilateral level, rules of origin also gain some relevance for labelling issues. See WTO (2007b) for a description of WTO disputes on this matter.

[5] See Appendix 1.1 for a list of RTAs in force.

[6] For instance, MERCOSUR-EU negotiations to sign an FTA are currently in their 20th round due to a number of outstanding issues. According to Thorstenten (2008), a Brazilian trade representative, rules of origin was the "big issue".

In view of this, RoO have the potential to transform from an uncontroversial technical neutral device to implement necessary trade policies (LaNasa, 1995) to instruments adapted to serve protectionist interests (Palmeter, 1987). As Cadot et al (2004) note, RoO should be seen as an economically sensitive issue rather than a technical one.

In fact, if the "prize" offered by the preferential treatment is substantial, i.e. a considerable margin of preference in a large market, stringent RoO may cause a producer to change its source of inputs from a cheaper source to a more expensive regional source (Ju and Krishna, 1998). This potential to distort trade is an intrinsic characteristic of RoO. It follows that the rules can be shaped so as to protect powerful industries in certain countries, hence acting as a counter-liberalization factor (Deardorff, 2004).

An additional concern comes when the RoO embodied in two agreements differ widely as producers may be forced to choose between their destination market. In the presence of an ever increasing number of RTAs, exporters are faced with the complexity of having to fulfill the criteria of different rules of origin which may be divergent, not only in their substance but also in their procedural requirements.[7] Take the case of a South African exporter of soups and broths and preparations thereof (Harmonized System (HS) ex 2104). Under the EU-South Africa Trade and Development Cooperation Agreement (TDCA), he cannot prepare soups from prepared or preserved tomatoes and other vegetables (HS 2002 and HS 2005). In parallel, for the same product, the Southern African Development Community (SADC) FTA prescribes that the value of non-originating materials does not exceed 60% of the ex-works price of the product, although nothing prevents him from using prepared or preserved tomatoes. In such situation, the exporter may have to face the decision of choosing between both markets and losing the preferential market access offered by the agreements.

Nowadays, protocols of rules of origin have turned into lengthy and complex legal documents. Products are conferred origin in accordance to the specific rule assigned to each of them in these protocols; the kind of rules that apply specifically to one product are called product specific rules of origin.[8] They can be broadly classified into four main "families":

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[7] RTAs is the WTO terminology for reciprocal agreements liberalizing part or all trade among the parties. RTAs can be Free Trade Areas, Customs Unions or Partial Scope Agreements.

[8] As an indication of the complexity of these documents, US agreements typically amount to around 2,000 product-specific rules of origin.

wholly obtained, change in tariff classification, regional value content and technical test rules; each of them with distinctive advantages and disadvantages.

In addition to the product specific rules of origin, protocols usually include provisions that apply to the agreement as a whole, covering disciplines such as certification procedures, the extent to which countries can accumulate materials/processes with other countries, or tolerance rules allowing the presence of a maximum value of non-originating materials. These disciplines are referred to as regime-wide provisions.

In view of this complexity, and their intended initial neutral nature, rules of origin did not attract much attention from the public (LaNasa, 1995). However, since the early 90s, a new literature spawned. Three factors contributed decisively to this development in the literature. First, increasing internationalization of production; as Forrester (1994) points out, original rules in the EU were designed as if production took place in one single country. In an evermore globalized world, defining origin became a much more complex process.[9]

Second, the intense increase in FTA numbers after the uncertainty created by the outcome of the Uruguay Round; in 1991 there were 50 active RTAs in the world; by 2000 that number had increased to 200, according to WTO Secretariat figures.[10] Rules of origin are intrinsically more sensitive in FTAs than multilaterally as they become the device which decides if preferences are granted. Third, Harilal and Beena (2003) highlight how, following several successful GATT rounds of negotiations, countries had lost by the mid 1990s much of their power to conduct trade policy by the use of tariffs. In order to retain control over trade policy, they needed to restore to non-traditional mechanisms. Indeed, literature on RoO started to develop during the Uruguay Round (1986-1994).[11] However, the definite push that turned attention to this topic was the signature of the North American Free Trade Area (NAFTA) and the protectionist use of RoO by the US.[12] As Ju and Krishna (1995) note, attention around FTAs developed especially after the signature of NAFTA. However, early

[9] See Palmeter (1987) for a description of pre-NAFTA rules of origin in the US.
[10] www.wto.org/english/tratop_e/region_e/regfac_e.htm
[11] See Hoekman (1993), Krueger (1993), Krishna and Krueger (1995) or Vermulst (1992) for early work on RoO.
[12] See Estevadeordal (2000), Cadot et al. (2002), Anson et al. (2005) for studies concentrating on the effects of NAFTA RoO.

work concentrated mainly on policy issues and theoretical work and it was in the early years of this century when empirical literature started developing.[13]

In spite of this recent trend, there are still relatively few studies assessing the impact of rules. In particular, four main gaps have been identified. First, attempts to measure the restrictiveness of rules of origin are based on "restrictiveness indices" that, by assigning one degree of restrictiveness to each particular rule, proxy the overall restrictiveness of an agreement. These indices are potentially incorrect, as the value assigned to each type of rule is given according to the author's expectation; thus, they are highly subjective. Second, to my knowledge, the precise effect of the different product-specific rules of origin has only been evaluated in two studies, remaining much scope for additional assessment.[14] Third, the impact of the rules on sectoral trade has limited to textiles, bypassing every other sector. Lastly, regime-wide provisions have only been modeled in a handful of examples.

The aim to close the gap in these aspects of the literature represents the main motivation of this thesis. As a consequence, it pursues four main objectives: i) to provide further evidence on the impact on trade of product-specific preferential rules of origin; ii) to develop an index of restrictiveness of the rules based on empirical findings; iii) to open the path for the impact of the rules of origin on particular sectors other than textiles; and iv) to contribute with further evidence on regime-wide provisions.

1.2. Methodology

This thesis attempts to provide an estimate of the impact on trade of product specific rules of origin and regime-wide provisions. With these estimates, it is then possible to construct an *ex-post* index of restrictiveness of the different types of RoO. A commonly used device to analyze different trade-related policies in the last years has been the gravity model, which has shown to represent a good fit for estimating trade flows.[15] In its basic form, the gravity model predicts bilateral trade as a function of two countries' mass and distance. The economic mass of the countries reflects potential supply and demand whereas distance

[13] Estevadeordal and Suominen (2003), Augier *et al* (2004) or Anson et al (2005) are among these.
[14] See Cadot et al (2002) and Cadot et al (2006)
[15] Cheng and Wall (2004) overview a wide range of issues analyzed through gravity modeling.

reflects resistance to trade. In its logarithmic form, which is usually used, it takes the following form:

$$T_{ij} = \alpha_0 + \beta_1 Y_i + \beta_2 Y_j + \beta_3 d_{ij} + \varepsilon_{ijt} \tag{1.1}$$

where T_{ij} is trade between countries i and j, Y_i and Y_j represent the economic size of the countries, usually measured by their GDP, and d_{ij}, represents the geographical distance between both countries. Since economic mass and distance cannot be alone considered to explain bilateral trade flows, the gravity model has been completed by a myriad of factors that are thought to influence bilateral trade. Some of them, such as common language, common border or belonging to the same FTA, have become customary in gravity equations. Equation (1.1) is then augmented to include them, as follows:

$$T_{ij} = \alpha_0 + \beta_1 Y_i + \beta_2 Y_j + \beta_3 d_{ij} + \beta_4 \sum_{i=1}^{I} \sum_{j=1}^{J} D_{ij} + \varepsilon_{ijt} \tag{1.2}$$

where D_{ij} are the dummy variables that capture the co-existence of certain factors between the countries of interest. It follows that virtually any policy variable, like it is the case of the different types of RoO can be then plugged into the equation.

One of the key motivations of this thesis is to evaluate the impact of product specific RoO. Therefore, it becomes mandatory to use disaggregated trade data. In addition, in order to ensure the general applicability of the findings, the methodology needs to cover a representative amount of trade. For this reason, trade data accounts for exports and imports between North-North, South-South and North-South countries. Lastly, researchers deriving the theoretical foundations of the gravity model have found that the model may be subject to misspecification bias unless heterogeneity is accounted for (Feenstra, 2002). Thus, the gravity model used is constructed under these premises. A prominent way to account for unobserved country specific factors is through the use of fixed effects. These are plugged into a panel data of four reporting countries and 17 reporting countries over four years.

The model presents a number of notable characteristics. First, total exports and total imports to/from the world are used as size variables instead of Gross Domestic Product (GDP). A similar way of specifying size variables is found in Cadot and de Melo (2007). Second, due to

collinearity issues, reporter countries are grouped into two groups, developed and developing, rather than allowing the presence of different fixed effects for each country. Lastly, rules of origin are modeled in four different ways.

The first method allows for all possible interactions between rules. It adds a dummy variable for each type of rule as well as for every time there is a combination or alternative between the rules. The second method consists of taking away all the combinations, alternatives and exceptions from the sample. In this fashion, it is possible to isolate the effects of each type of rule.

The third method is an extension of the second. It groups the rules into families (Change in Chapter (CC), Change in Tariff Heading (CTH) and Change in Tariff Subheading (CTS) under Change in Tariff Classification (CTC)) so as to assess the impact of the main families of rules. Finally, the fourth method individualizes each type of possible combination/alternative/exception between the rules. It accounts for 37 different possible rules; each of them assigned a different dummy variable. The last relevant variable relates to the processes of certification used in FTAs, accounting for the difference between self-certification and public certification.

Estimation of the model is done using Generalized Least Squares in order to correct for autocorrelation and heteroscedasticity of the data. A further transformation consists of using logarithms, in order to solve normality problems in the residuals.

Each product specific rule of origin is observed to have a different impact on trade. The restrictiveness index is subsequently obtained from the sum of the coefficients of each of the product specific variables from these regressions. The resulting index assigns a different value for each type of rule and for each combination therein. This index is then used to assess the restrictiveness of the rules of origin in each agreement and to proxy the stringency of the rules.

1.3. Structure

This thesis is organized as follows: Chapter 2 reviews the literature on rules of origin, both from a theoretical and an empirical point of view. Chapter 3 provides an extensive

description of the types of rules of origin and regime-wide provisions present in origin protocols; each type of rule is followed by an illustrative example. Chapter 4 represents the core of this thesis: it justifies and builds the gravity model used to perform the analysis, assessing the questions related to economic theory. The second part of this chapter describes and explains the sources of the data and provides a series of descriptive and summary statistics. Chapter 5 provides a series of econometric considerations for the proper form of the estimation model. The chapter is completed with the presentation of the results from the various estimations performed. Chapter 6 builds on the findings of the previous chapter to develop the restrictiveness index. Subsequently, the index is compared to other indices present in the literature and used as a proxy of the stringency of the rules of origin to estimate their impact on North-South trade as well as on textiles, industrial products and agriculture. Chapter 7 discusses current issues related to rules of origin, both from a legal and an economic point of view, and provides policy recommendations on the basis of the findings of this thesis. Lastly, Chapter 8 presents a summary of the main aspects, the main contributions of the thesis and suggestions for future research.

Chapter 2. Literature Review

The economic study of RoO did not start until the mid 1990s, and has remained limited in scope thereafter. The late and sluggish development of RoO analysis is partly explained by three overarching reasons. First, as Krishna and Krueger (1995) note, until the mid 1990s there was a lack of general interest about the role of the implementation of trade restrictions. Instead, economists focused on the incentives provided by trade agreements, leaving little scope to policy measures like RoO. According to LaNasa (1995), there was a perceived misconception about the essentially technical character of RoO. Second, until the expansion of FTAs in the mid 1990s, trade was mainly multilateral, with all trading partners facing the same RoO. With the spread of FTAs, countries started to confront different and discriminatory RoO, prompting interest in their effects. In particular, the North American Free Trade Area (NAFTA), as in many other areas of trade, was the spark that caused economists to turn their attention to its components.[16] The third reason is the reduction of Most Favored Nation (MFN) tariffs. After the Uruguay Round, tariffs were drastically reduced, leaving little margin of maneuver to governments on this respect. In view of this new scenario, other trade policies like trade defense mechanisms, or RoO gained more importance.

Whichever the limitations, the study of RoO has developed in recent years, both in theory and practice. Theoretical literature has mainly concentrated on explaining if and how RoO hamper trade and their consequences; empirical literature, by its part, has focused on establishing the impact of the rules on trade flows, and can be broadly divided in two type of analysis: *ex ante* and *ex post*. The reminder of this Chapter presents the most relevant findings in these two fields of study.

[16] Estevadeordal (2000), Cadot el *al.* (2002) and Anson et *al.* (2005) are examples of empirical studies on NAFTA's RoO.

2.1. Theoretical Literature

Theoretical literature on RoO has been centered around the impact of RoO on prices, production, trade flows, and welfare. The general structure of most studies in this area follows an approach which consists on calculating those variables at pre-Free Trade Area (FTA) equilibrium and then assessing the distortion brought in by the inclusion of the RoO. Since the rules have the potential to impact different layers of the production chain in vertically integrated production structures, many studies look at the effects on both the intermediate and the final goods markets.

By and large, the assumptions used in most studies are fairly similar. Most of them grow from partial equilibrium models, in perfect competition, with constant returns to scale and perfect substitutes goods. Attempts to depart from the core locus of analysis include Duttagupta and Panagariya (2003), who construct a general equilibrium model to look into the political economy of RoOs; Krishna and Krueger (1995), who look at the different effects for welfare that the presence of a monopolist of intermediate goods brings about; or Francois (2005), who develops a model under product differentiation. The way to specify the form of the RoO varies in the studies, although all of them share the election of a Regional Value Content (RVC) (or MC) type of rule for the analysis.[17] The reason for this election resides on the complexity to model both Technical Test (TT) and Change in Tariff Classification (CTC). Being regional value content rules the main type under consideration, it seems natural that the literature on RoO found its inspiration on the local content literature of the early 1980s.

Literature on local content protection provided a theoretical basis to the policies that favored local inputs in manufacture. One of the most prominent works in this field of economic policy was that of Grossman (1981), who developed the framework for the analysis of this issue used in subsequent work on RoO. The focus of this study lies on the resource reallocation – mainly on the intermediate good market – created by the imposition of a local content requirement.[18] The author defines three different types of content requirement: content protection in physical terms, content protection in value added terms and preference content. Physical content protection is defined as the requirement to include a minimum

[17] MC refers to import content. For the economic purpose of this work, it will be equalled to RVC.

[18] According to Grossman (1981) , content protection schemes usually require the obligation to incorporate on the final good a certain level of local value added or local materials. Failure to meet such requirement implies the payment of high tariffs on all imported intermediates.

amount of domestic intermediate in the production of the final good; value added content requires a share of domestic value added embodied in the final price of the product; and preference content deals with the tariff incentive granted to developing countries provided they comply with a minimum content requirement in the exporting country, i.e. a rule of origin except it does not contemplate sourcing from the country granting the preference. Grossman develops a partial equilibrium model under the assumptions of perfect competition and small economy, where domestic and foreign inputs are perfect substitutes, as well as the factors of production (labor and intermediates).

The author investigates the effects of local content requirements on prices and output of intermediate goods through the examination of the pre and post policy equilibriums. For the physical content protection case, the firm maximizes the following equation:

$$\max PF(L, M + M^*) - P_m M - P^*_m (1 + \bar{t}_m) M^* - wL \qquad (2.1)$$

subject to $\bar{t} = 0$ when the content requirement k is fulfilled (i.e. if $M^* < (1-k)(M + M^*)$ and $\bar{t} = t_m$ when it is not. L represents labor, M and M^* domestic and foreign intermediates with P and P^* being their prices, w wage and $\bar{t}_m$ a tariff equivalent. From this setting the author derives that the firm will choose to under fulfill the content requirement when the price paid for the foreign input $P^*_m (1 + t_m)$ is lower than the average-weighted price of foreign and domestic inputs $kP_m + (1-k)P^*_m$.[19] It follows that when the firm decides not to comply with the content requirement, the demand for domestic inputs is zero unless $P_m = P^*_m (1 + t_m)$. Through these observations and the supply equilibrium condition for the domestic input $P_m(M) = C'(M)$, the author obtains his main conclusions:

1. Implementing a physical content requirement results in an increase of the domestic intermediate at first but for high levels of domestic content the result is ambiguous. The logic behind this observation is that the producer will choose to substitute foreign inputs for domestic to meet the ratio but

[19] The average weighted price is taken by combining the first-order conditions of the profit maximization equation with respect to the imported and the domestic input.

will also substitute both inputs for labor, in account of the more expensive average input price.

2. The effect on the value added for the industry is ambiguous. The predominant effect will depend on the elasticity of the domestic input production to its output price and the elasticity of final good production to changes in intermediate prices. If they are elastic, it will drive up domestic cost considerably causing a cutback in final output.

The author also establishes the effect on a content protection policy on the price of the domestic input. He rearranges the first order conditions of the domestic intermediates into:

$$PF_2 = \{1 + \frac{(P_m - P_m*)(1-k)}{kP_m + (1-k)P_m*}\} = P_m \tag{2.2}$$

from where it can be seen that an increase in the domestic content requirement *k* brings along a reduction in the domestic price of the intermediate, hence acting as a tariff on foreign input and a subsidy for final good producers.

The author continues the analysis by looking into variations of this model. The first one is to contemplate value-added, rather than physical content policies. The main difference is that the domestic share can now be included in any of the domestic factors of production, not necessarily exclusively in the inputs. This translates into a different restriction that states that $\bar{t}_m = 0$ if $P*_m M* \leq (1-j)PF(L, M + M*)$, where *j* represents the ratio of local value added. The main divergence with the previous analysis is that there need not be one input price limit at which the firm chooses to meet the requirement. This is possible if there is enough value added on the inputs alone, without having to purchase domestic intermediates. A related consequence is that the price at which the producer will choose to satisfy the content requirement is no longer independent from the production of the final good.[20] Another effect is that the subsidy effect referred to above also extends to labor, i.e. across all factors of production. Grossman also extended his study to several goods and different market structures to conclude that the effects of a local content protection policy are difficult to predict.

[20] Grossman (1981) does not clarify in what way it is related in this case, stating only that it will depend on the substitution possibilities in final output production.

Finally, Grossman (1981) discusses the effects of content preference policies on exporting markets. The observations reveal that under the circumstances that the supply for intermediates is such that the content requirement is almost attained, there may be offsetting effects. As the demand for intermediates goes up (as a response by the final good producers opt to increase the domestic intermediate to benefit from the programme), the price of the final output may also increase, which will bring along an increase in the supply of the final good. This, however does not exclude the possibility of a lower output of the final good as a response to the higher price, thus missing the objective of the policy.

Another important contribution to the theory of local content was that of Mussa (1984) who changes specifications in the production function in Grossman (1981) to dispute the results therein. In particular, he uses a homogeneous, linear, neo-classical production function which allows for an increasing difficulty in input substitutability as opposed to the perfect substitutability assumed by Grossman (1981). Basing the analysis on the relative output price of domestic to imported intermediates, the author finds that an increase in the content requirement will benefit the supplier of the domestic producer. A crucial aspect is that in order to comply with the domestic content requirement, the final good producer must receive a penalty in case of not doing so. This penalty, he argues, normally comes in the form of a tariff in case of non-compliance. This tariff only affects production at low levels of domestic input, i.e. when the requirement is not satisfied. By increasing the cost of foreign inputs only after a certain level, the penalty does not affect final good output price as long as the requirement is satisfied.[21] This property of local content schemes makes them preferable, according to the author, to tariffs, which increase the average price of the final product irrespective of the compliance or not with the requirement. Finally, he extends his model to other types of market structures to find that a domestic content requirement does not alter the conditions when a monopoly exists in the final good market and a monopsony in the domestic input market unless the requirement causes the monopoly and the monopsony to exist.

Based on a similar approach as the one used in local content literature, theoretical considerations about RoO also centered the attention on the chain effects induced by an artificial restriction on the "normal" input combination of producers. In a very simplistic

[21] Mussa (1984) explains that under compliance above a certain level of domestic input, the suboptimal combination of factors does not minimize costs but does not alter the final price.

way, RoO alter the choice of the producers because in order to enjoy duty free treatment, they have to comply with the restriction laid down in the rules. In principle, the producer will no longer be able to produce under the optimal combination of inputs, which would raise the costs of production. This is shown in Figure 2.1, taken from Krishna (2005).

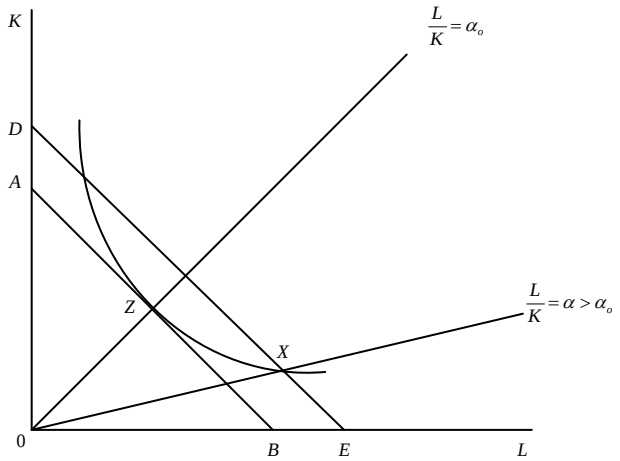

Figure 2.1. Alteration of the Input Mix after Imposing RoO

Assuming that *K* is foreign input and L, local, the slope of the rays from the origin represents the combination of non-member and member inputs in the production of the good. Before the FTA, or in the absence of RoO, the tangent between the iso-quant and iso-cost curves of the firm is found at Z. The slope of the ray from the origin through Z gives the proportion of non-member and member inputs used in production. If a RoO is set, the choice is tipped towards a greater use of the member input, and only combinations above the iso-quant are possible, at a higher iso-cost curve. This point is represented by X, where the new combination of inputs, with higher local input is used. Note that the greater the exigency to use member inputs, the higher the cost in which the firm incurs.

These different effects have been proven more or less formally in a wide range of studies. The common point of these studies is that rules of origin distort markets. In general, they are found to be welfare reducing, although several authors have shown under what conditions, RoO may actually increase market access and/or welfare. The reminder of this section looks at examples of both cases.

The first study that looked into the negative effects of RoO was Krueger (1993). The author differentiates the welfare effects on CUs and FTAs because FTAs can have additional trade

diverting effects by "exporting protection" via RoO.[22] CUs and FTAs will both bring about trade diverting effects via the substitution of the more efficient world producer by the higher cost producer in the Customs Union (CU)/FTA. But in addition to that, restrictive RoO will reinforce this shift to the less efficient producer by encouraging producers in the FTA partners to buy from them in order to comply with the RoO, an effect that would not occur in CUs due to the common external tariff. It is the advantage of the most efficient of the partners (but less efficient than the rest of the world) to set restrictive rules of origin so as to ensure protection to that market. In the semi-formal explanation, the author relates compliance with the RoO to the effective protection granted on the final good. In particular, producers of the final good will choose to source from the less competitive (compared to rest of the world) intermediate producer in the partner country if:

$$\frac{1+t_{us}^{c}-(1+t_{us}^{x})\,fy}{1-y}>0\,, \tag{2.3}$$

where t_{us}^{c} and t_{us}^{x} are the tariffs on clothing (final good) and textiles (intermediate) in the US, f is the share of intermediate purchased in the US in the final good and y is the value of textiles purchased per unit of clothing. This formula represents the criterion for positive effective rate of protection in the US. In fact, as long as the effective rate of protection in the partner country is higher than in the home country it would always pay local producers to buy from other FTA members rather than from lower cost producers from rest of the world (provided there is a need to buy from the partner country to comply with the RoO). According to Krueger (1993), RoO become then very powerful protectionist policies for intermediate good producers.

Another example of how RoO can result in a reduction of output is presented by Krishna and Krueger (1995), who analyze an imperfect competition model (where FTA partner is a monopolist), based on the work of Hollander, in which they assume Constant Returns to Scale (CRS) as well as fixed coefficients in production. They show that under a cost based RoO, and being local and foreign inputs perfect substitutes, there would be a raise of marginal costs for the monopolist, thereby decreasing its output, although for low levels of

[22] If an FTA sets stringent RoO, it may become profitable to source intermediate goods from the same market that will later be the export market. The intermediate good producer (which is the final good export market) will have an incentive to set stringent rules.

restriction, it will still be worthwhile for the monopolist to accept the restriction. There would be increased costs for the monopolist, which would in turn translate into a fall of output for the FTA.

However, an overview of the literature reveals that under certain conditions, RoO may also increase trade and improve welfare, as well as having very different effects on different markets. Figure 2, taken from Krishna (2005), shows one situation in which RoO can result in increased welfare.

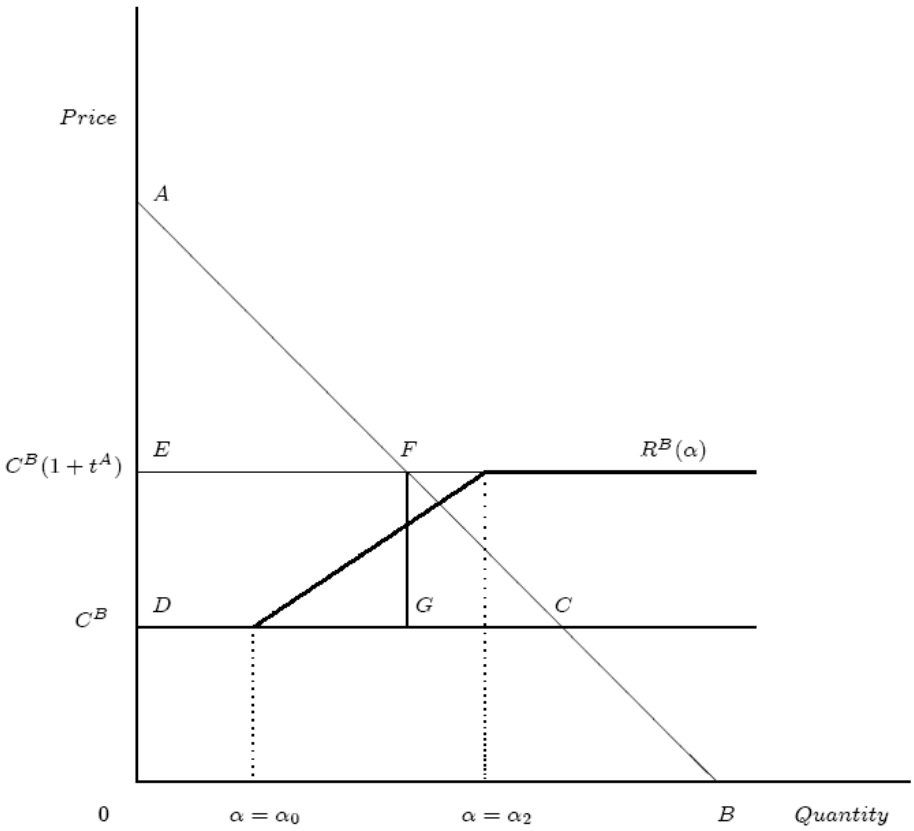

Figure 2.2. Increased Welfare with RoO

Consider an FTA between A and B where the price in B of the final good equals world price and the unit cost of production ($P^B = P^* = C^B$), and where there is no local production in A, which has the higher tariff of the two countries. The pre-FTA level is given at F. When the FTA is created and RoO integrated, there is a considerable gain of welfare at α_0 (along the RoO restrictiveness curve). For low levels of restriction α (below α_o), the unrestricted costs of producing in B equal the restricted costs $R^B(\alpha)$. In such case, A would now consume all its final good from B. In the absence of RoO, and in the absence of transport costs, B would

trans-ship all the world production to A, although not necessarily increasing its own production. As for A, for low levels of restriction, there is no impact whether they exist or not, as the price in A does not rise. Consumer surplus increases as price falls from $C^B(1+t^A)$ to C^B and tariff revenue falls, but less (EFCD>EFGD). As the rule becomes more restrictive, consumer surplus decreases through the increase of prices and eventually, towards α_2, welfare must be lower than prior to the FTA. Beyond α_2, the RoO are not met and there is no preferential treatment, hence no change in welfare.

This finding has been modeled formally in a number of studies. Assuming perfect competition model, constant returns to scale and small country conditions Krishna and Krueger (1995) show that under a certain level of restrictiveness of RoO, in a perfect competition model with CRS, US' (the importer) tariffs become effectively zero as all the imports are produced in Mexico (which has zero tariff for all inputs and world price for that import) after the formation of an FTA. Trade patterns can be greatly affected; investment flows are likely to come into Mexico and; welfare, which is not monotonic in the restrictiveness of RoO, increases for low levels of restrictiveness. However, Krishna and Krueger (1995) show how different specifications in their model may result in important changes in the results. They point out the difference between the short and the long run. In the long run, all the effects highlighted above are likely to materialize. In the short-run, this is not the case as investment flows will take some time to flow into Mexico and Mexico would only be able to absorb part of US demand. Also, CRS will take some time to materialize, which means that Mexico's increased production would bring about an increase in marginal costs, choking off supply. If there is no change in world price, the US price remains unchanged and there is a loss in welfare due to a loss in tariff revenue in the US. If there were no RoO and no transport costs, production in Mexico would not be affected and there would be a welfare gain in the US (since prices would immediately go down, which would outweigh the loss of tariff revenue).

Another different specification refers to the way in which the RoO is spelled, establishing the difference between a price-based versus a cost-based restriction.[23] The decision to comply or not with the RoO will be determined by whether the restriction lies below the tariff inclusive

[23] In the cost based definition, the restriction requires a minimum amount of local input over total input. In the price based, the restriction requires that the price minus the foreign input exceeds a certain level.

import price in the US. For low levels of restriction, in the long run there is no difference with low levels of restriction in the cost-based case. However, in the short-run the price-based rule allows for more gains to Mexican producers based on the observation that the restricted cost function in a price based scheme is decreasing as price in the US rises.[24] In the short run, the profit made by companies is higher in this case than in the cost based scenario, where the restricted cost function is simply a function of the restriction.

Falvey and Reed (2002) present another way in which RoO may benefit the importing country through the change in the terms of trade induced by RoO in a country that only imports the final good. In their partial equilibrium model, they consider three countries, of which two are perfectly competitive exporters and one an importer (which has monopsony power). Production of the final good requires an intermediate and value added. Finally, the good is not consumed in the exporting country. The results of their model depend on the increasing unit costs in the supply of all inputs, although only in the short run. The authors calculate the welfare effect of a change in total imports in a set up where intermediates are complemented by non-tradable value added. The authors derive the optimal tariff and note that while a uniform tariff raises welfare, the fact that each exporting country has different supply functions suggests further gains if tariffs are made discriminatory. The optimal discriminatory tariff becomes:

$$t^0 = \frac{v_2^{'} t_1^0 + v_1^{'} t_2^0}{V'} \tag{2.4}$$

where t_j^0 is the optimal discriminatory tariff to goods from each exporting country and $v_j^{'}$ is the change in value added for different quantities of the final good in the exporting countries.[25] The authors then define a RoO as a requirement to set a minimum ratio of intermediate on total output from that country. This restriction alters the initial choice of the producers between intermediate and value added. If an increase in the ratio of the intermediate to value added raises output it implies that there will be a reduction in the average cost. This may occur because the firms in the exporting countries choose a combination at which prices from the two sources are equated, rather than their marginal

[24] The higher the price, the easier it becomes to comply with the restriction.
[25] The value added in the exporting country is related to the importer's welfare through the observation that it is part of the price paid for the final good in the importing country.

costs. This results in an equilibrium where the price equals the average cost, which may be higher than necessary for a given level of output. If the RoO changes the combination of inputs so as to decrease the average cost, there will be a fall in price and hence, an increase in welfare. It follows that an "optimal" RoO can be set taking into account intermediate input elasticities, yielding an optimal tariff which also raises welfare as in the case of no RoO.

A basic characteristic of RoO is that they may affect different products in vertically integrated markets, thereby giving rise to different effects in each markets. Ju and Krishna (1998) study the effect on firm behavior and prices for both the intermediate and the final good, as well as the consequences on the market equilibrium and outcome for both goods markets, when RoO are taken into consideration in the creation of an FTA.

The authors set up a model with both intermediate and final goods, with two countries plus rest of the world. Both countries produce both goods but only one country exports the final good to the other. They use a CRS setting in the short-run, not allowing for investment, which could imply one country not having the capacity to fulfill the other country's demand. Through the derivation of the profit maximization problem for the perfectly competitive firms, the authors look at the effects of RoO on prices, for both countries and for both goods. They find that firms in the exporting country specialize their production towards one market or another. At the same time, firms choosing to produce for the local market have a fixed level of profits, while those exporting have profits which are increasing in the price of the final good in the importing market and decreasing in the price of the FTA made intermediate as well as the level of restriction.

Under this sequence, the authors show that prices of imported inputs do not change after the formation of the FTA. Domestic prices for inputs do change, as they equalize in both FTA partners and needs not be equal than the imported price as the domestic inputs can be used to comply with the RoO. Prices of the final good also change, with the importing country (the more expensive prior to the FTA) falling if the exporting country is large enough to satisfy its demand and remaining unchanged if the exporting country is small. The equilibrium price leaves exporting firms indifferent between exporting or selling at home because the higher price paid in the partner's market is compensated with the cost of complying with the RoO. The authors then continue to show the impact on market access. They defend that for loose RoO, intermediate imports will increase whereas final good

imports will decrease, because final good production in the exporting country is inversely related to the restrictiveness of the RoO. For loose rules, cheaper production of the final good, hence more output, which crowds out imports of the final good but increases imports of the intermediate. It must be noted that this point can only hold if there are no tariffs in the exporting country for the imported input, as it would otherwise provide an incentive to use local inputs rather than imported. The effect on the final good market can be seen as trade diversion. However, the authors recall that there is no more production taking place for the local market, which increases imports of the final good to the exporting country, this is, trade substitution. Since production decreases with the restrictiveness of the RoO, for levels of restrictiveness above a certain threshold, there are less exports than what would have been produced locally, so trade diversion is reversed. In order to observe the market access effect on the FTA and in both countries, the authors resort to the derived demand and input price effects, which act together with the level of restriction of the RoO to determine the results. By reducing the tariff of a good, demand increases but local supply decreases. Since there are RoO that require the use of local supply, demand for the final good is reduced and the derived demand effect reduces demand for the intermediate. The input price effect consists in a reduction of the input price due to lower tariffs increases supply, which causes supply of the final good to increase, hence reducing imports of the final good.

Rodriguez (2001) furthers the analysis of the impact on intermediate and final good markets deriving a modified version of the multistage model developed by Dixit and Grossman (1982). His model consists of a three country set up where each country intervenes in a different production stage, by increasing labor intensity and over the continuous interval [0,1]. The good goes along the production chain from country 1 to 2 and from there to country 3, where the final good is finished. As such, tariffs on intermediates are dragged along this process, and subsequently increase the price. The producer's cost minimization problem is given by the following equation:

$$Min_{i_{12}i_{23}}(1+\bar{t}_3)(1+t_2)\int_0^{i_{12}} f^1(i)di + (1+\bar{t}_3)\int_{i_{12}}^{i_{23}} f^2(i)di + \int_{i_{23}}^{1} f^3(di) \qquad (2.5)$$

where t_i are the respective tariffs in each country and $f^i(i)$ are the respective unit cost functions. The key of this model lies on the fact that the margins of comparative advantage

vary endogenously. As the price conditions change in one country (because of the formation of an FTA), production stages vary marginally to one country or another.

Under this setting, the author finds that non-binding RoO, i.e. those that do not require a change in the source of the intermediate, create trade for both FTA members, compared to a pre-FTA world.[26] This trade creation represents a more efficient combination of processes within the pre-FTA setup. At the same time, there is no change in the production undertaken in the non-member, so there is no trade diversion. Further, such a RoO would also reduce prices in all three countries for the final good. The logic of this lies on the fact that when tariffs disappear between two countries, and there is no cost associated with the compliance of the RoO, this cheaper price is carried along to other countries. However, when restrictive RoO are considered, the results vary considerably. First there is what the author calls the *trade regression* effect, which is the inefficient relocation of production across FTA members.[27] In addition, trade diversion also exists with the non-member as a result of a shift in the margin of comparative advantage between the non-member and the member with the closest production structure. Also, production costs and prices increase with the level of restrictiveness in the FTA.

Based on the work of Rodriguez (2001), Lloyd (2002) looks into possible ways of improving RoO specification for developing countries. This model adapts the one presented by Rodriguez (2001) of a continuum of stages to show that a RoO on value added would be more efficient than an "all-or-nothing" RoO. This RoO would be equal to the MFN rate minus the value added included in the free trade area, which could eventually be 100 percent, hence eliminating the tariff. Such a RoO would be preferable for developing countries under a preferential scheme, as it would encourage reaching higher degrees of processing in the developing country. The model changes that of Rodriguez (2001) by assuming different costs of production in different countries. Using an "all-or-nothing" RoO on goods from the developing country raises the costs of those goods that do not comply with the requirement, protecting production in the developed country for higher degrees of processing. On the contrary, a value added RoO encourages production in the developing country reverting to a free trade situation.

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[26] It must be noted that the pre-FTA world is not free trade but contemplates MFN tariffs for all members.
[27] As opposed to trade diversion which is the inefficient relocation of trade between members and non-members.

Cadot *et al.* (2002) add to the observation of the effects of RoO on intermediate and final goods drawing a model that highlights the relationship between RoO and effective-protection formulae. They build on a two-country model, where only one country produces the intermediate good. This good is only consumed by the other country and, with perfect substitutability between foreign and domestic intermediates and decreasing returns to scale, they show that the *benefit* from using the preferential regime is:

$$b = p_F * t_F - \alpha a p_I * \rho_I , \tag{2.6}$$

where α is the restriction imposed by the RoO, and takes the form of a percentage of the quantity of the intermediate good from the FTA that must be used in the production of the final good; a is the input-output coefficient; and ρ_I the ad valorem equivalent of the premium on the home-made intermediate good generated by the RoO. Whenever the restriction is 100 percent ($\alpha = 1$), this formula comes down to an effective protection expression. When instead of a tariff elimination under the preferential treatment there is a tariff reduction at a rate τ_F, the previous formula becomes:

$$b = p_F * (\frac{t_F - \tau_F}{1 + \tau_F}) - a\alpha(p_I - p_I*) \tag{2.7}$$

It follows that b is decreasing in τ_F and increasing in α. If $b = 0$[28], then $\frac{d\alpha}{d\tau} < 0$, which means that deeper preferences are associated with a higher restriction. This result suggests a degree of substitutability between tariffs and RoO, although the authors do not explore the conditions to choose one mechanism or another. However, this question is partly answered in Anson *et al.* (2005) who use the findings of Cadot *et al.* (2002) to conclude that the effects of a RoO would be two:

1. Final-goods producers would shift their purchases of intermediates to intra-FTA intermediates
2. If final goods are imperfect substitutes by origin, consumers will shift towards intra-FTA from the rest of the world trade if *b>0*. If this shift is

[28] When FTA participants are "just indifferent between signing or not"

not too strong, the share of intermediate trade in total intra-FTA trade is expected to rise.

Further evidence of how RoO can impact differently both the intermediate and the final good is presented by Francois (2005) who develops a model in which he includes the use of a set of global equilibrium prices for the examination of trade between different pairs of countries under various RoO. The demand for regional varieties of the intermediate good results in a function of the degree of substitutability between the varieties and of the price for the final good. The restrictions imposed by the rules are introduced as increased trading costs when the countries enter an FTA. This yields an elasticity representation of the impact of rules-induced price increases on the use of intermediates for FTA partner-destined final goods from where the author derives the intermediate input demand. A number of results stem from this system:

1. The volume of trade in final goods will fall between FTA partners
2. Import demand for final goods shifts away towards third-country suppliers, whereas demand for intermediate goods shifts to FTA partner suppliers
3. The level of intermediate trade may or not increase. On one hand intermediate trade increases as a result of the RoO but on the other hand, the fall in final good production drives down demand.
4. Intermediate goods will represent a larger share of total intra-FTA trade.

Finally, the political economy of RoO is modeled in Duttagupta and Panagariya (2003) who concentrate on the importance of RoO for accepting or not an FTA. Departing from the widely accepted premise that RoO grant additional protection when tariffs disappear, the authors show that FTAs that are not acceptable to certain economic groups become acceptable only after the imposition of RoOs. In doing so, they analyze the welfare effects of FTAs, with and without RoO. They build their model using a general equilibrium setting. However, when exploring welfare effects, they revert to partial equilibrium. Their model has three goods (0, 1, 2 and m), where m is the input, 1 and 2 are final and 0 is the numeraire under perfect competition and CRS. They derive the demand function from the first-order conditions of a utility function using quasi-linear preferences. With regards the production

function, they introduce a "two-step" chain, whereby there is a first-step component "V" that is complemented by m to produce 1. Each country imports and exports one good. Tariffs are determined endogenously and fall to zero in both countries for the input "m" and positive tariffs for the final goods. In their setting, tariffs are inversely proportional to the elasticity of import demand and the government's weight in social welfare. Also, tariffs are directly proportional to the ratio of domestic output of good the final good to its imports. The determination of tariffs is important because it presumes that a final good exporter would be in favor of the FTA as it has free imports and protected market for output whereas input exporters have nothing to gain.

In this context, they analyze the welfare effects of RoO for trade diverting and trade creating FTAs. They show how preference in the final good entails the imposition of RoO on the input, which will bring about trade diversion in this good as producers of the final good will need to use inputs from the FTA. This, in turn, entails the creation of a captive market for intermediate good producers. However, because producing the final good becomes more expensive, trade diversion is reversed in the final good market. With weakly binding rules, the gain in the final good outweighs the loss in the input. By the contrary, strict rules reverse this situation.

However, if the preference is purely trade creating such that the post-FTA price is at its free trade level, the imposition of RoO is unambiguously harmful. In this case, there is no trade diversion in the final good market to be reversed, and the RoO still cause trade diversion in the input market. An FTA that was rejected (by both consumers and producers) is now accepted in the presence of RoO (because of the producers' surplus), even though the FTA as a whole loses out with RoO.

2.2. Empirical Literature

By and large, empirical literature has concentrated on the impact of RoO on trade. The intrinsic complexity of RoO, with a myriad of provisions affecting one same product, together with the innumerable different regimes has complicated traditional empirical analysis, leading economists to look for alternative ways of assessing the impact of RoO. In particular, assessments of the impact caused by RoO can be grouped into two main categories: development of (*ex ante*) indices of restrictiveness and *ex post* analysis.

The *ex ante* literature scrutinizes RoO protocols and assigns values to each type of RoO, as well as to the different regime wide provisions. By its part, *ex post* literature focuses on the analysis of existing trade-related data and the impact of RoO on its variations. Each method, as it is explained below, has its pros and cons.

2.2.1 Development of *ex-ante* Restrictiveness Indices

A considerable part of the *ex ante* literature builds on a restrictiveness index first developed by Estevadeordal (2000). This index, inspired in work previously done by Garay and Estevadeordal (1996), results from a need to compare RoO regimes. It is created by assigning values to each type of product specific RoO and then averaging these values to result in one figure that indicates the overall restrictiveness of a RoO regime. Each observation can take a value between 1 and 7 (1 being the least restrictive, 7 the most) depending on the restrictiveness associated to each specific rule. In the many instances in which several rules can be combined for one product – either complementing or supplementing each other – the author contemplates combinations of the rules, increasing the level of restrictiveness the more complicated he considers them to be. The least restrictive is a change in the tariff item (8-digit) level, whereas the most restrictive is a change in the section level combined with a technical test rule. Combinations like percentage rule and change in tariff subheading fall half way in restriction, according to this index. The index is then calculated as follows:

Table 2.1. Calculation of Estevadeordal (2000) restrictiveness index

y = 1	If y* ≤ CTI
y = 2	If CTI < y* < CTS
y = 3	If CTS < y* ≤ CTS & RVC
y = 4	If CTS & RVC < y* ≤ CTH
y = 5	If CTH < y* ≤ CTH & RVC
y = 6	If CTH & RVC < y* ≤ CTC (Section)
y = 7	If CTC (Section) < y* ≤ CTC (Section) & TT

The way to allocate these values follows an *observation rule* that has an intrinsic degree of subjectivity. It sets the level of restrictiveness based on the author's consideration of what is more or less restrictive and assigning same levels of restrictiveness to rules that may or not have the same restrictiveness.

Although the index pioneered by Estevadeordal (2000) has the shortcomings outlined above, its construction has the advantage of allowing for the possibility of averaging the values for each product (either trade-weighted or not) over the entire tariff universe to obtain a figure that can be presented as the sectoral or overall restrictiveness of the RoO regime.[29] Also, it has been subsequently modified to further refine the classification of rules. Suominen (2004), cited in Estevadeordal et *al.* (2007) modifies the index so as to allow for different values of restrictiveness depending on the percentage level or for the case in which no CTC is required.[30] Anson *et al* (2005) introduces more variations into the same 1 to 7 scale, assigning values to combinations of specific rules not previously calibrated by Estevadeordal (2000). Very similarly, Cadot *et al* (2006) follows the same logic to further complete the index, and provides a very exhaustive classification, again based in the same scale. Evidencing the complexity of RoO, this index contemplates 34 different categories of product specific rules.

[29] Examples of this are Estevadeordal and Suominen (2004) to compare EU's and NAFTA RoO regimes or Estevadeordal and Suominen. (2006) to compare regimes worldwide.

[30] This is prominent in the European family of RoO. The specific rule of origin reads in these cases: "Change from materials of any heading", not adding any further restriction.

Table 2.2. Calculation of Cadot et al (2006) restrictiveness index

	y*=NC
r=1 (R1)	y*=WO
	y*=R2+allow (*)
	y*=CTS
r=2 (R2)	y*=TT
	y*=EXC
	y*=R1+R2
r=3 (R3)	y*=R2+R2
	y*=CTH+allow (*)
	y*=CTH
r=4 (R4)	y*=RVC1
	y*=RVC1+Oth.Req
	y*=CTH+R2+allow (*)
	y*=RVC2
	y*=RVC2+Oth.Req
	y*=RVC1+R1 (or R2)
r=5 (R5)	y*=CTH+R1 (or R2)
	y*=CTH+R1 (or R2)+R1 (or R2)
	y*=CTH+RVC1
	y*=CTH+RVC1+R1 (or R2)+allow (*)
	y*=CC or
	y*=RVC2+R1 (or R2)
	y*=CTH+RVC2
r=6 (R6)	y*=CTH+RVC2+R1+allow (*)
	y*=CTH+RVC1+R1 (or R2)
	y*=CTH+VRC1+R1 (or R2)+R1 (or R2)
	y*=RVC1+R1 (or R2)+R1 (or R2)
	y*=RVC2+R1 (or R2)+R1 (or R2)
	y*=CTH+RVC2+R1 (or R2)
	y*=CTH+RVC2+R1 (or R2)+R1 (or R2)
r=7 (R7)	y*=CC+R1 (or R2)
	y*=CC+VC
	y*=CC+R1 (or R2)+R1 (or R2)
	y*=CC+RVC+R1 (or R2)+R1 (or R2)

NC=No change

Note: y* is the latent variable approximated by the observation rule and assignment to the corresponding R value on the left-hand side column; (*) only applies for EU ROO; RVC1 if RVC>40%, RVC2 if RVC<=40%; Oth.Req are NONOR, VC-R.

Another index of a similar nature was developed by Garay and Cornejo (2001), who decompose the index in four components (Change in Tariff Heading (CTH), Exception to Change in Tariff Heading (CTHex), percentage rule and Technical Test (TT)) and look at them independently, allocating values for each of the four categories, each of which having a scale and range independent of the others. For instance, CTH can take values from 1 to 8 depending on the level at which the change is required, whereas the percentage rule takes the value of the percentage required in the rule.[31]

Harris (2007), quoted in Estevadeordal *et al* (2007) constructs another *ex ante* index assigning positive and negative points to each rule which allows for the combination of complementary and/or supplementary rules. The index allocates a positive figure between +2 and +8 to each of the different types of CTC (from least to most restrictive). From there, an additional rule, like RVC adds another positive figure (whose value depends on the level of local content required). On the contrary, an *addition* (positive exceptions that are allowed) subtracts points. The higher the figure, the more restrictive the rule is.

These indices focus entirely on the product specific rules, leaving aside regime-wide rules. This gap was overcome by Estevadeordal and Suominen (2004), who developed a comparable *ex ante* index that looks into the regime-wide provisions which, according to the authors, are trade-facilitating. Hence, it concentrates on the inclusion or not of diagonal cumulation, full cumulation, drawback, self-certification and tolerance rules (and the different values at which it can be set), taking values between 1 (least facilitating) to 5 (most facilitating).

In an attempt to combine in one *ex ante* figure the impact of both product specific and regime-wide RoO, Gretton and Gali (2005) propose a further contribution. The logic of their index diverges from the ones discussed above as they assign weights to the different aspects of a RoO protocol and then they multiply each weight by a factor of restrictiveness. There are three main categories, the first one proxying product specific rules. It is assigned a weight of 0.6 on the overall index, of which 0.2 correspond to each of the main categories of product specific rules (CTC, percentage rules and TT). The more restrictive the CTC is, the higher the factor will be. At the same time, if the rule is complemented by a RVC, there is a further

[31] For instance, a RVC requiring 40 percent would take the value of 40 in the column corresponding to the percentage rule in this index.

increase in the index. The second category refers to regime-wide RoO, and it has a weight of 0.25. If for instance the regime contemplates cumulation, its corresponding weight takes a value of zero. The third category looks at other aspects like diversity of rules faced by each country, i.e. whether members are part to several FTAs with different rules. The overall figure can take a value between 0 (least restrictive) and 1 (most).

These indices and their extensions have been used as standalone measures to assess the level of restrictiveness of RoO regimes or have been introduced into econometric models as exogenous variables. Estevadeordal et *al* (2007) justify their appropriateness as measures of restrictiveness because these methods are "particularly useful for endogenizing and comparing RoO regimes", since they can focus on their characteristics rather than their effects. At the same time, they recognize the short-comings of these approaches, namely the fact that they obviate the "input-output" structure of the concerned product to really assess the impact of the RoO. Without knowing the actual impact of each rule, it cannot be ascertained that a rule is more restrictive than other. With this observation in mind, these indices may suffice to describe and compare RoO regimes, but any comment about their restrictiveness must be taken with extreme caution, as at their very core they rely on the author's discretion to assign stringency values.

2.2.2 Ex post literature

RoO and their connection to trade flows and other variables have been the focus of attention of several empirical studies. In general terms, the study of RoO has been centered on one main question: their impact on trade flows.[32] In later years, more refinement has facilitated the study of particular policies, such as cumulation.[33] However, work has also considered RoO as one of the driving factors for other issues other than the main "impact-on-trade" question. For instance, the International Trade Center (ITC) (2001) explores the relation between RoO and export credit insurance; Estevadeordal *et al.* (2006) focus on the impact of RoO as a determinant of Foreign Direct Investment (FDI) flows, analyzing the relationship between NAFTA RoO restrictiveness and FDI flows in Mexico; Ishikawa *et al.* (2007) explored the firm's profits in the presence of RoO.

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[32] Estevadeordal (2000), Cadot *et al.* (2002, 2006), Portugal-Perez (2008), among others are examples of this trend. These studies are further discussed below.
[33] Estevadeordal and Suominen (2004bis) and Augier *et al.* (2004) fall in this category.

With regards to the techniques used, the empirical study of RoO has been dominated by the use of econometric modeling, in particular through the use of gravity modeling and other *ad hoc* formulations.[34] Although much smaller in number, examples of other techniques are also present. For instance, Mattoo *et al* (2003) estimate the growth in Malagasy and Mauritian exports under the African Growth Opportunity Act (AGOA) building a partial equilibrium model that depend on tariff equivalents of the export quotas, tariffs on imports in the US, supply and the cost of complying with the RoO. The latter depends by its part on the cost of switching purchases of inputs and transport. Their results suggest that the absence of RoO could increase exports by eight percent for Mauritius and at least 19 percent for Madagascar. The remainder of this section provides details about the key empirical studies on RoO.

Estevadeordal (2000) builds a model to explain the linkages between tariff negotiations and RoO in NAFTA. He uses the index explained in the previous section, which he introduces as a function of "observable" variables used to obtain a prediction of the restrictiveness index. He estimates the following equation:

$$ROO-RI = f_1(MFN-DIF, IIT-ME-US, IIT-ME-RoW, IIT-US-RoW), \qquad (2.8)$$

where *ROO-RI* is the restrictiveness index and takes the values assigned following the observation rule described above, *MFN-DIF* is the MFN differential between Mexico and the US, *IIT-ME-US* is the intra-industry trade between Mexico and the US in the years 1990-1992 and the remainder two variables are the respective measure for Mexico and the US and the rest of world. The ordered probit estimation allows the author to obtain a continuous indicator for the restrictiveness index, which is then introduced in the following equation as an endogenous variable to explain the years of liberalization, which proxy the degree of liberalization:

$$YE-ME-US = f_2(ROO-RI, YE-US-ME, PRE-MAR-ME, IMP-RAT-ME, EXP-RAT-ME) \quad , \qquad (2.9)$$

[34] Other than econometric analysis, Appiah (1999), quoted in Georges (2007) undertook the first Computable General Equilibrium (CGE) study to find that RoO could deduct up to 2.8 percentage points from the income gains of NAFTA. Georges (2007) provides a further overview of other examples with CGE. Other non-econometric studies include Brenton and Manchin (2003)who look at EU's imports from preferential partners and, providing descriptive evidence, they argue that RoO account for their very low utilization rates (as low as 31 percent for GSP in 1999).

where *YE-ME-US* are the years of liberalization of Mexico to the US under NAFTA, *YE-US-ME* is the equivalent for the US, *PRE-MAR-ME* is the initial preferential margin of Mexico *vis à vis* the US, *IMP-RAT-ME* are Mexican imports from the US relative to total Mexico's trade and *EXP-RAT-ME* the equivalent for exports. The estimation is done using cross-section techniques averaging data for the period 1990-1992.

The results of the first estimation confirm the author's prediction that the higher the spread between members' tariffs, the more restrictive the RoO become. This is interpreted as the role of RoO in preventing trade deflection. The second equation, estimated using standard Ordinary Least Squares (OLS) techniques, confirms the hypothesis that RoO are an important element in determining the depth and speed of liberalization as both variables are significantly positively correlated. As a consequence, the author sees RoO as well as preferential tariffs as primary policy instruments in market access negotiations in FTAs.

Estevadeordal's (2000) index and variations in the same spirit have been used as control variables in econometric analysis, whether to assess the impact on trade of RoO themselves or to compare them with other policies. For instance Cadot *et al.* (2002) assess the cost impact for Mexican exports complying with NAFTA's rules of origin in two ways: i) using a revealed-preference mechanism, using data on NAFTA utilization rates; and ii) using an index of RoO restrictiveness constructed by Estevadeordal (2000) only on NAFTA, using data at the 6-digit level. In the second method they compare the positive (expected) effect of tariff preference with the effect (negative) of RoO and find out that have a similar effect. Under perfect substitutability of intermediate goods (whether domestic or imported), they draw a model where they relate tariff preferences and rules of origin restrictiveness. They argue tat except for those products where there is 100 percent utilization rate and those with zero percent, tariff preferences may be offset by rules of origin, in fact they may be exact with opposite sign. If this is true, Mexican exports to the US should be largely unaffected by NAFTA, as RoO is just another way of disguising tariff protection. Further, Mexico's exports to the US should not differ widely from exports to other markets, provided the tariff faced by Mexico in other partners does not differ much from the one faced in the US. They assess this hypothesis using Mexican exports as weights in Weighted Least Squares (WLS) estimation,[35] and regressing them on a RoO restrictiveness index and exports to the rest of the world.

[35] Because it can be thought that RoO determine the dependant variable (exports) as they affect its price, although this may not be necessary and hence, OLS estimates need not be biased.

Subsequently, they compare the predicted values of Mexican exports in three different cases: as NAFTA stands today under current tariff preferences and RoO; one without tariff preferences and RoO; and another one without RoO. The results of the first scenario can be interpreted as the impact of the total "NAFTA package" on Mexican exports; the second, the combined effect of RoO and preferences and the third, as the impact of RoO. When they perform this experiment using the coefficients obtained when using Estevadeordal's index, Mexican exports would increase by 35.5 percent if RoO were set at an overall restrictiveness level of 2.[36]

Another use of Estevadeordal (2000) index is found in Anson et *al* (2005), who calculate the impact of RoO on exports through the following gravity model:

$$\ln M_{ij} = \alpha_0 + \delta_i + \delta_j + \alpha_1 \ln(Y_i Y_j) + \alpha_2 \ln(DIST_{ij}) + \alpha_{3k} DUM_{ij}^k + \alpha_4 PTA_{ij} + \alpha_5 CU_{ij} + \beta \ln(1 + ROO_{ij}) + \mu_{ij} \quad (2.10)$$

where δ_{ij} are the country and year fixed effects, DUM_{ij}^k the vector of dummies capturing the typical gravity variables (language, colony, etc.), PTA_{ij} and CU_{ij} variables that take the value of 1 if any pair of countries belong to the same FTA or customs union and $\ln(ROO_{ij} + 1)$ the restrictiveness index, somewhat modified from Estevadeordal (2000). They run a regression on 149 countries and 15,280 observations, both with and without fixed effects and find that the restrictiveness index has a negative impact on the FTAs but lower than the positive impact of the FTA itself. Subsequently, the authors confirm the negative impact of RoO on exports regressing Mexican exports to the US on tariff preferences, RoO restrictiveness and exports to the rest of the world. Although this model is recognized by the authors to lack a solid economic foundation, they find evidence that RoO decrease exports by 33.8 percent.

The authors further explore the impact of RoO by developing a model that looks at utilization rates, rather than exports, in the same spirit as Cadot *et al* (2002). Tariff preferences give a lower bound on the costs of RoO. For utilization rates of 100 percent, RoO costs can be assumed to be not greater than the tariff preference. For utilization rates of 0 percent, RoO costs can be assumed to be not lower than the tariff preference, i.e. if costs were lower than the tariff preference, there would be some utilization. For those utilization rates

[36] Estevadeordal (2000) index ranges from 1 to 7.

between 0 and 100 percent, they break down the costs by finding the distortive cost and they assume the remaining cost as the administrative cost associated to the RoO. Their results show that administrative costs linked to RoO account for around 2 percent ad-valorerm, which represents 47 percent of the preference margin enjoyed by Mexican exporters. Cadot et *al.* (2006) use a similar approach to break down the costs associated to RoO. They do this by assuming that that is the cost incurred in by firms in sectors that are close to 100 percent utilization rate (>90 percent) and have a restrictiveness index below at 2 or below (out of 7). They find that the administrative costs associated to RoO are 3.4 percent for the Pan-European System of Rules of Origin (PANEURO) and 1.8 percent for NAFTA.

Estevadeordal and Suominen (2004bis) undertake a study over a very large sample of countries (155) to assess the trade effects of aggregate imports of RoO. They do so in a number of ways, always relying on gravity modeling and using the restrictiveness index as proxy to capture RoO. First, they look at aggregate trade and, in addition to the restrictiveness index, they introduce the facilitation index as described in the previous section. Their model takes the following specification:[37]

$$V_{ij} = \beta_0 + \beta_1 GDP_i + \beta_2 GDP_j + \beta_3 GDPPC_i + \beta_4 GDPPC_j + \beta_5 DIST_{ij} + \beta_6 BORDER_{ij} + \beta_7 COMLANG_{ij} + \beta_8 COL_{ij} + \beta_9 COMCOL_{ij} + \beta_{10} PTA_{ij} + \beta_{11} ROORI_{ij} + \beta_{12} FACIL_{ij} + \varepsilon' \quad (2.11)$$

where they add many of the gravity variables plus $ROORI_{ij}$ and $FACIL_{ij}$, which are the average measures of the product specific and facilitation restrictiveness indices for each regime. The results obtained show that introducing the restrictiveness variable in the regression highly increases the positive impact of the PTA variable, while the restrictiveness coefficient is negative by a similar amount. This leads the authors to confirm the negative effect of restrictive RoO on trade. Additionally, the facilitation index shows a positive impact on flows (coefficient of 0.182). In their view, "the combined effect of regime-wide variables that instill flexibility to the application of product-specific RoO serves to boost trade". The positive figure of the facilitation index prompts the authors to decompose it to further explore its components. When they do so, the facilitation index, is replaced by

[37] All the non-dummy variables are taken in logs. They regress this model for the years 1981-2001 using panel data estimation techniques with year, importing and partner country dummies. Another example of this type of regression can be found in Wagner, Head and Ries (2002)

$CUMUDIAG_{ij}$, $CUMUFULL_{ij}$, $DRAWBACK_{ij}$, $SELFCERT_{ij}$ and $DEMINIMIS_{ij}$. The first four variables are dummies that take the value of one when that policy exists in the protocols; the latter takes the value of the *de mninims* allowed in the protocol (i.e. between 0 and 15). All the five variables are positive and significant, although diagonal cumulation only at the 10 percent level.

Augier *et al* (2004) further the study of cumulation. In particular, they undertake an impact study of the PANEURO system of diagonal cumulation on textile exports from the Southern Mediterranean countries. To this purpose they serve themselves of a modified gravity model as follows:

$$\ln(X_{ij}) = \alpha_0 + \alpha_1 \ln(Q_i) + \alpha_2 \ln(E_j) + \alpha_3 \ln(RUV_{ij}) + \alpha_4 \ln(tariff_{ij}) + \alpha_5 \ln(Dist_{ij}) + \alpha_6 PTA_{ij} + \alpha_7 Border_{ij} + \alpha_8 Language_{ij} + \alpha_9 Quota_{ij} + \alpha_{10} ROO_{ij}, \quad (2.12)$$

where Q_i represents total textile production in the exporting country; E_j total apparent textile consumption in the importing country;[38] RUV_{ij} are the relative unit values used to proxy prices; $tariff_{ij}$ gives the bilateral MFN or preferential average between countries; $Dist_{ij}$, $Border_{ij}$, $Language_{ij}$ and $Quota_{ij}$ are usual gravity dummies; and ROO_{ij} is the variable that models cumulation. It takes the value of 1 when the exporting country has an FTA with the EU but no cumulation, zero otherwise.[39] In addition to the countries taking part in the Barcelona process, the authors include five other selected countries. The cross-section equation is estimated using Tobit methodology for years 1995 and 1999. Their results suggest that the lack of diagonal cumulation trade lowered by as much as 73 percent in 1995 and 81 percent in 1999. In a follow up study, Augier *et al* (2005) confirm these results by performing a study that looks at the same question but using panel data estimation and dividing their sample into aggregate, intermediate and manufacture trade. They use the difference in difference approach using three different control groups and find that the lack

[38] This variable is constructed by deducting exports from the sum of total production plus imports in the importing country.
[39] This definition implies that not having an FTA with the EU and having one with cumulation both take the same value.

of cumulation could impede trade by 25 percent to 70 percent between EU spokes, depending on the time period and trade flow considered.

Some studies have tried to fine-tune the estimation of the impact of RoO by looking at different sectors or different types of product-specific RoO. Estevadeordal and Suominen (2004bis) perform an exercise by replacing the analysis of aggregate trade to sectoral trade on intermediates. For this purpose, they choose chemicals, machinery, television and radio transmitters, textiles and vehicles and study the impact of the restrictiveness and facilitation variables described above. Interestingly, both variables show positive and significant impact. The result of the facilitation index variable parallels their previous result for aggregate trade but the one for the product specific restrictiveness index differs completely, showing now positive figures. The authors argument that this finding is in line with the theory, that suggests that RoO boast trade in intermediates. Furthermore, the authors combine both variables with time dummies and show that the impact of each of them increases over time, which could be evidence of the experience that exporters adapt over time to deal with the RoO.

Trying to disentangle the effects of the different types of RoO has become another avenue of research in recent times. Three examples of such attempts are Portugal-Pérez (2008), Cadot *et al.* (2002), and Cadot *et al.* (2006). These three papers are of special relevance considering the purpose of the present study.

Portugal-Pérez (2008) undertakes a study of the impact of regional value content rules and technical test rules on African textile exports to the US and the EU for the years between 1996 and 2004. The author augments the usual gravity model by introducing a dummy variable for RVC and another one for TT. He uses Tobit estimation to account for truncated data; he explores 236 varieties of apparel for 22 exporting countries at the Harmonized System (HS) 6-digit level, yielding 33 408 observations. The model takes the following specification:

$$\ln(1+X_{i,t}^{j,k}) = \beta_0 + \beta_1(R_{i,t}^{j,k}) + \beta_2(VC_{i,t}^{j,k}) + \beta_3(t_{i,t}^{k,mfn}) + \beta_4(t_{i,t}^{j,k,pref}) + \beta_5 \ln(Y_t^k) + \beta_6 D_i^{Madag-02} \sum_{j\in J}\sum_{k\in K}\delta_{j,k}(D_i^j x D_i^k) + \varepsilon_{i,t}^{j,k} \quad , \tag{2.13}$$

where $R_{i,t}^{j,k}$ is the dummy variable that controls for AGOA eligibility; $VC_{i,t}^{j,k}$ is the dummy that controls for EU's special treatment for non-knitted apparel;[40] $t_{i,t}^{j,k,pref}$ and $t_{i,t}^{k,mfn}$ are the respective preferential and MFN tariffs; Y_t^k is the exporter's Gross Domestic Product (GDP); $D_i^j x D_i^k$ is the country pair fixed effects;[41] and $D_i^{Madag-02}$ controls for Madagascar's special circumstances in 2002.

The author finds that the presence of an alternative RVC rule is associated with an increase of 45 percent of exports. This is justified by the author by the fact that this rule is presented in the EU's system as an alternative to the double transformation rule, which many African countries cannot meet. Even more strikingly, the single transformation rule under AGOA is reported to increase exports in 303 percent.

Cadot et al (2002) decompose the restrictiveness index used in the model presented above into several dummies that represent different RoO types. They explain Mexican exports using WLS cross-section estimation for the year 2000 at the 6-digit level. The equation takes the following form:

$$XUS_i = \alpha_o + \alpha_i * XROW_i + \alpha_2 * \ln PREF_i + \alpha_3 * R_i + \alpha_4 * CHAP * FOOD + \alpha_5 * CHAP * TEXTILE + \sum_k \alpha_k * D_{ki} \tag{2.14}$$

R_i is the vector of five different dummies that take the value of one if the corresponding RoO takes one of the following forms: CTH, CTS, Exception to Change in Tariff Item (CTI), Exception to Change in Tariff Classification (CTCex) , RVC. The variables *CHAP*FOOD* and *CHAP*TEXTILE* are manipulations due to wrong results of the Change in Chapter (CC) dummy. D_{ki} is a vector of dummy variables for each HS Chapter. All the coefficients appear with the expected negative sign and significant. When they use the results of this regression on the projection exercise described above, they show that the type of rule that has a greater negative impact on Mexican exports is a CC, followed by a CTH. The remaining variables would also increase exports if relaxed except the Exception to Change in Tariff Classification

[40] This rule foresees an alternative RVC allowing apparel non-qualifying for cumulation, provided that its value does not exceed 40 percent (in some cases 47.5 percent) when exporting on a preferential basis to the EU.
[41] The author notes that exporter and importer specific fixed effects cannot be added due to multicollinearity.

(CTCex), which has a positive impact on exports.[42] Using the same model for Mexican exports to the US, Cadot *et al* (2006) provide new estimates for each type of rule. Their model adds by introducing the TT type of rule to the vector of dummies. Also, they enlarge the period of study, considering years 1994 to 2001 and use panel data techniques. Their specification also controls for time effects and fixed effects at the section level. As before, it is done by WLS. Table 3 compares the results obtained by both studies. The difference in magnitude of the coefficients is explained by the fact that Cadot *et al.* (2002) does not take logs for exports.

Table 2.3. Comparison of estimates for different types of RoO

	Cadot et al (2002)	**Cadot et al (2006)**
Variable	**Coefficient (t-statistic)**	
XROW	3.63 (97.6)	0.577 (0.006)
PREF	26.09 (15.31)	1.887 (0.193)
CTI	-2197.41 (-3.04)	NA
CTS	-308.36 (-2.18)	-0.773 (0.112)
CTH	-658.84 (-6.00)	-0.751 (0.115)
*CC*FOOD*	-387.68 (-1.05)	-1.095 (0.131)
*CC*TEXTILE*	-533.09 (-1.02)	
CTCex	230.67 (3.84)	0.506 (0.036)
RVC	-985.41 (-19.70)	-0.432 (0.032)
TT	NA	1.000 (0.055)

Both studies show some interesting results. First, CTC are always associated with negative impacts although their magnitude is not necessarily consistent with the predictions. While a CC requires in principle the most restrictive change, in Cadot *et al*. (2002), it is the second

[42] The coefficient on the CTI variable is the one with largest negative impact but has a low effect on trade simulations as it affects only low-volume tariff lines.

least restrictive, although this may be biased by the different specification of this variable. A CTI reveals to be the most restrictive type of RoO in Cadot et al. (2002), and CTS, the least, which is inconsistent with the predictions. In Cadot et al (2006), the order of restrictiveness is more coherent with theory, with CTS and CTH showing practically the same impact. An RVC rule has a negative impact in both cases, although in neither study it has the largest nor the smallest coefficient. Exceptions to the CTC increase trade according to both studies. However, a note of caution must be added here. Most RoO protocols have two kinds of exceptions, "negative" and "positive".[43] The former is supposed to add further restrictions to the rule, while the latter relaxes it. Hence, they should have opposite impacts. To my knowledge, neither of these studies makes a distinction between both types. Finally, the positive impact of the TT RoO is striking in Cadot *et al* (2006). The authors argue that this may be caused by the fact that TT is in most cases associated with a CTC. However, this would not provide the necessary explanation, as no CTC type of rule is positive. A TT has been criticized by its *ad hoc* opaque nature, according to Brenton and Manchin (2003) technical requirements are "more specific and more restrictive than CTH". Yet, in view of this result it may be the case that it is actually carved to adapt to the production structures already in place, resulting in a lenient type of rule.

2.3. Conclusion

Literature on RoO can be broadly divided in theoretical and empirical. None of them was developed until the mid 1990s and has remained limited in scope thereafter.

Theoretical literature was largely influenced by the literature on local content protection started by Grossman (1981) and Mussa (1984). Most studies on this regard explore the impact of RoO on prices, production, trade flows, welfare and on the chain effects on intermediate and final goods. Most studies start their analysis by focusing on the alteration that the imposition of a RoO brings to the optimal combination of inputs of the pre-FTA equilibrium. From here, the overview of the economic literature on RoO reveals that these instruments can be powerful policy mechanisms in affecting a wide range of trade related aspects. In particular, there are five main observations. First, RoO tend to cause harmful effects on welfare although, under certain conditions, they can actually improve it; second, RoO are

[43] See Sections II.3.3.4 and II.3.3.5 for a discussion on this question.

more likely to result in positive effects when compared to pre-FTA scenarios that contemplate tariffs rather than free trade; third, intermediate goods are likely to experience increased demand at the expense of final good producers; fourth, as the restrictiveness of the RoO increases, so does the probability that they produce harmful effects and; fifth, the details of each particular situation matter.

Empirical literature on RoO can be divided into *ex-ante* and *ex-post* literature. The former scrutinizes RoO protocols and assigns values to each type of RoO, as well as to the different regime wide provisions. This current of the literature was developed under the need to compare origin regimes across trade agreements and concentrates largely on the development of *ex-ante* indices of RoO restrictiveness. By its part, *ex post* literature focuses on the impact of RoO on different trade-related variables, such as trade volumes, tariff preferences or the cost of compliance with RoO. A majority of the work done uses the restrictiveness indices developed *ex-ante* as exogenous independent variables that explain the trade variable under scrutiny. Additionally, there are a handful of studies that code RoO in different ways so as to assess the estimated impact on trade volumes, although these studies are usually quite limited in scope.

From the review of the empirical literature there are two main findings that become relevant in the present context. First, there is unanimity in that RoO impede trade when taken as a package. To my knowledge, no study has shown positive trade effects of RoO when looking at a representative selection of trade flows.[44] However, the second main finding is that when RoO are disaggregated into their different components, some of them that can actually increase trade. This is the case of some regime-wide trade facilitating measures, and some concrete types of product-specific RoO. The potential for further research to explore this latter finding is encouraged by the fact that only a handful of studies have looked at these questions.

[44] Estevadeordal and Suominen (2004bis) concentrate on selected intermediates.

Chapter 3. Types of Rules of Origin

3.1. Preferential vs. non-preferential RoO

A first distinction of RoO families must be done between preferential and multilateral, or non-preferential, RoO. Often, the general public is mistaken by thinking that the types of rules used in these two groups are different, while they are not. The distinction between preferential and non-preferential comes on their use. The first group is used in preferential trade, i.e. FTAs, while the second is used in multilateral trade.[45]

Non-preferential RoO do not discriminate origin between World Trade Organization (WTO) members, which represent a vast majority of today's world; therefore, their impact in altering trade flows is minimal. As LaNasa (1995) observes, rules of origin have a distortive effect in so far they are used in a discriminatory way. Therefore, this study concentrates entirely on preferential RoO.

3.2. Product specific vs. regime-wide RoO

RoO protocols are complex texts full of technicalities that lay down the conditions which a product must satisfy in order to be considered originating. In pre-NAFTA liberalization agreements, such as LAIA, it was not uncommon to set one same rule to confer origin for the entire protocol. In modern FTAs this is not the case and RoO protocols contain a different rule for each product, defined at the chapter, heading or subheading level, as the case may be. These individual rules are called product-specific RoO.

In addition to the product-specific rules, protocols contain a number of clauses that apply to all products. These clauses refer to the procedural requirements needed to demonstrate origin, accumulative production in other countries or *de minimis* rules, among others. These clauses are known as regime-wide RoO.

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[45] See Chapter 7 for details about non-preferential rules of origin.

Both product-specific and regime-wide RoO are presented and analyzed in this thesis since both types may have an impact on trade flows depending on their structure. The fact that both product-specific and regime-wide rules coexist when conferring origin to a product makes it difficult to oversee either of them.

3.3. Product-specific rules

Since RoO are definitions of what is considered to be originating and each country can have its own definition for each good, the range of product-specific rules is potentially unlimited. While there are some similarities among the types of product-specific rules used across the world, there are also several differences, and combinations of them, further complicating the picture.

As a broad first division, goods can be conferred originating status if they have been wholly obtained or if they have been substantially transformed in the partner country. The remaining part of this section describes both types of rules, as well as their different variations.

3.3.1 Wholly obtained rules (WO)

This type of rule applies to primary goods and products made solely thereof that have been obtained directly within the territory of the country in question.

Definition of wholly obtained: EU-Caribbean Forum (CARIFORUM) Economic Partnership Agreement (Protocol I, Article 6)

1. The following shall be considered as wholly obtained in the territory of the CARIFORUM States or in the territory of the EU Party: (a) mineral products extracted from their soil or from their seabed; (b) fruit and vegetable products harvested there; (c) live animals born and raised there; (d) products from live animals raised there; (e) (i) products obtained by hunting or fishing conducted there; (ii) products of aquaculture, including mariculture, where the fish are born and raised there; (f) products of sea fishing and other products taken from the sea outside the territorial waters of the EU Party or of a CARIFORUM State by their vessels; (g) products made aboard their factory ships exclusively from products referred to in (f); (h) used articles collected there fit only for the recovery of raw materials, including used tires fit only for retreading or for use as waste; (i) waste and scrap resulting from manufacturing operations conducted there; (j) products extracted from marine soil or subsoil outside their territorial waters provided that they have sole rights to work that soil or subsoil; (k) goods produced there exclusively from the products specified in (a) to (j).

Example 1: EU-CARIFORUM Economic Partnership Agreement (EPA) Protocol I

HS heading No.	**Description of product**	**Working or processing carried out on non-originating materials that confers originating status**
Chapter 01	Live animals	All the animals of Chapter 1 used must be wholly obtained

Although most countries keep a similar definition for wholly obtained rules, there are some variations, as in the case of fish obtained in international waters. Most of the countries would consider it to be wholly obtained if it has been caught by a vessel of the country, but the definition of vessel from a country may vary. For the EU the nationality of a vessel is determined by several conditions, like the percentage of nationals onboard; for the US, nationality is determined by the flag they carry. Products that are obtained as a combination of wholly obtained products in the territory of the parties are also given originating status automatically.

3.3.2 Substantial transformation

When the materials used in the manufacture of a product are not originating, or when originating and non-originating materials are combined, it is required to "substantially transform" those materials to confer origin in order to the final product. These are the rules that normally gain most of the attention since they are the ones in which there is more scope to impose stringent criteria. There are three main ways to define substantial transformation:

3.3.2.1. Change in tariff classification

A change in tariff classification (CTC) of the product's components is a very common way to assess whether the product has undergone substantial transformation in a country. Normally this rule demands all the materials used in the production of a good to have changed by the end of the production process the tariff classification they had when were imported into the country that will subsequently export within the Free Trade Area (FTA).

This rule is normally based on the Harmonized Commodity Description and Coding Systems, or Harmonized System (HS). This system is internationally harmonized up to the 6-digit level. Countries' coding systems, although based on the HS, go beyond, even to the 12-digit level. Since there are several levels of classification, ranging from sections to the 12-digit level, a CTC may acquire different forms, depending on the level at which the change of tariff classification is required for that product. In practice, preferential rules are negotiated ranging from change in chapters (2—digit level) to change in subheadings (6-digit level). The

level from which the materials are required to change is what determines the type of CTC. Consequently, different types of CTC are:[46]

- Change of Chapter (CC): When the rule requires the materials to change to the level at which the rule is presented from any other chapter

Example 2: United States–Central America–Dominican Republic FTA (CAFTA-DR)

HS heading No.	**Description of product**	**Working or processing carried out on non-originating materials that confers originating status**
09.01	Coffee, whether or not roasted or decaffeinated; coffee husks and skins; coffee substitutes containing coffee in any proportion	A change to heading 09.01 from any other chapter.
2005.10	Homogenized vegetables, prepared or preserved (excluding by vinegar)	A change to subheading 2005.10 from any other chapter.

- Change of Tariff Heading (CTH): When the rule requires the materials to change to the level at which the rule is presented from any other heading.

Example 3: EU-CARIFORUM EPA, Protocol I

HS heading No.	**Description of product**	**Working or processing carried out on non-originating materials that confers originating status**
ex 2008	- Peanut butter; mixtures based on cereals; palm hearts; maize (corn)	Manufacture in which all the materials used are classified within a heading other than that of the product
2009	Fruit juices (including grape must) and vegetable juices, unfermented and not containing added spirit, whether or not containing added sugar or other sweetening matter, containing 20% or less by weight of added sugar or other sweetening matter	Manufacture in which all the materials used are classified within a heading other than that of the product

[46] WTO, Committee on Rules of Origin. G/R/WO/56, 25 May 2000.

- Change of Tariff Subheading (CTS): When the rule requires the materials to change to the level at which the rule is presented from any other subheading.[47]

Example 4: Chile-Korea Free Trade Agreement

HS heading No.	**Description of product**	**Working or processing carried out on non-originating materials that confers originating status**
3204	Synthetic organic coloring matter, whether or not chemically defined; preparations; synthetic organic products of a kind used as fluorescent brightening agents, whether or not chemically defined	A change to heading 3204 from any other subheading
6812.20	Yarn and thread, of asbestos	A change to subheading 6812.20 from any other subheading

As it can be seen in the examples, the key element to determine into what category of CTC the rule falls is the level from which the materials must transform, and not the level at which the rule is described. A CC implies a change in the first two digits between the input and the final good, a CTH a change in the third and fourth digits and a CTS in the fifth and sixth digits. Taking the example of a producer of pineapple and orange juice (mixtures of juices, HS 2009.90), the implications of the different types of rules would be:

[47] A Change of Tariff Heading-Split (CTHS, (when the rule requires the materials to change to the level at which the rule is presented from any other split heading) and Change of Tariff Subheading-Split (CTSHS, when the rule requires the materials to change to the level at which the rule is presented from any other split subheading) are being discussed at the WTO multilateral negotiations but are not used in preferential agreements.

Example 5

HS heading No.	Description of product	Type of Rule	Implication
2009.90	Mixtures of juices	CC	All the materials must originate from chapters other than 20
		CTH	All the materials must originate from headings other than 2009 (whether or not from chapter 20)
		CTS	All the materials must originate from materials other than subheading peanut butter (2009.41) (whether or not from heading 2009 or chapter 20)

According to the CTH rule laid down in the EU-CARIFORUM EPA, pineapple and orange juice producers can manufacture juice from imported prepared pineapple (HS 2008.20) and prepared orange (HS 2008.30) as they belong to a different heading, HS 2008. Both the prepared pineapple and the prepared orange would undergo a CTH to become juice, which would then acquire originating status. However, the rule does not allow producers to mix pineapple juice (HS 2009.41) and orange juice (HS 2009.11), as both juices separately belong to the same heading as mixtures of juices (HS 2009). If the rule was a CC, it would force producers to manufacture the juice from locally produced prepared pineapple and orange, as the materials would not undergo the corresponding change in chapter (both prepared pineapple and pineapple juice belong to Chapter 20). On the other hand, if the rule was a CTS, it would allow producers to manufacture the juice from imported pineapple juice and orange juice directly, as the materials used would suffer a change in subheading (from HS 2009.11 and HS 2009.41 to HS 2009.90).

As it can be seen in the example above, in the presence of a CC rule, the manufacturer could only import fresh fruit; a CTH would also allow the producer to obtain the juice from imported prepared fruit; and a CTS would increase his options to produce his juice from already made juices. Hence, the higher the level from which the rule requires to transform the materials, the more restrictive it becomes.

CTC rules are widely used in today's FTAs. This type of rule is preferred in the Harmonization Work Programme on non-preferential RoO foreseen in the WTO Agreement on Rules of Origin.[48] The are three main reasons for this predilection. First, its transparent nature, as it is very straightforward to determine if a change in classification has taken place. The second reason is that it relies on the HS, which is widely used and known by customs officials around the world. The combination of these two factors makes it very simple to asses if origin can be granted or not. The third reason resides on its hierarchical nature as postulated by LaNasa (1995). The farther into the chapter the heading is, the more processing has been involved; thus a change in the tariff heading should imply a sufficient degree of transformation on the product.

On the other hand, the CTC requires a thorough knowledge by the part of the producer, which may have difficulty in identifying the correct material and termination for the final product when exporting to a certain country. A second disadvantage of the CTC is its conception as a coding system and not as a manufacturing guide, which means that some manufacturing processes do not entail a change in tariff classification while in other occasions a minor operation may. This question has proven to be the more critical downside of using the CTC, as shown by the discussions taken place in the WTO Committee on Rules of Origin (CRO).[49] In these negotiations, there have been a number of cases where countries have disagreed on the applicability of a CTC rule. One classical example is that of coffee. Not considering coffee husks and skins, the HS assigns only four subheadings to this commodity (HS 0901.11, HS 0901.12, HS 0901.21 and HS 0901.22). These four headings code coffee in roasted or not, decaffeinated or not. In practice, this means that any operation other than roasting and decaffeinating does not entail any change of tariff classification. As a result, operations such as crushing, grounding or mixing cannot confer origin if a CTC rule is set. On the other hand, roasting does confer origin, and traditional coffee producing countries argue that it should not since roasting Kenyan coffee in the EU would render the coffee is European.

[48] Article 9 of the Agreement sets the procedures to develop harmonized specific criteria for goods. When defining substantial transformation, the Agreement calls members to use a change in tariff classification as a basis for conferring origin. Although percentage rules and technical rules are also accepted, these are seen as supplementary criteria.
[49] The CRO discusses non-preferential RoO but the technicalities inherent to them are the same as for preferential rules.

3.3.2.2. Percentage rules

This type of rule sets a requirement of local content in the value of the final good. There are two ways in which these rules are expressed: setting a minimum percentage of originating value or establishing a maximum limit of non-originating value in the final good. The first type is usually referred to as regional value content (RVC) rule, and the second, as import content (MC) rule. The RVC rule can be expressed in two different ways: the "build-up" method, which considers the value of the originating materials, and the build-down method, which subtracts the value of the non-originating materials from the value of the product. This method is akin to the MC rule in that it takes into account the value of the non-locally produced elements, although it differs in the way of expressing it. The RVC "build-down" method takes the value of these materials from the final good, and sets a minimum threshold; the MC rule adds this value and lays down a maximum limit. The formulae used to calculate these percentages are as follows:

1) RVC "build-up" method

$$RVC = \frac{VOM}{V} x100 \tag{3.1}$$

2) RVC "build-down" method

$$RVC = \frac{V - VNM}{V} x100 \tag{3.2}$$

3) MC

$$MC = \frac{VNM}{V} x100\,, \tag{3.3}$$

where V is the value of the final good, VOM the value of the originating materials and VNM the value of the non-originating materials. These terms differ depending on the country. For instance, the EU uses the ex-works price of the product as its V, whereas the US uses the "adjusted value", which is the value calculated in accordance to the WTO Customs

Valuation Agreement – primarily the transaction value – adjusted, if necessary to exclude any costs incidental to international shipment, i.e. resulting in the Free on Board (FOB) price. In both cases, this price includes all the technical costs associated to the product, such as labor, as well as the profit.

With respect to the value of the materials, in the EU the reference price is the customs value, calculated in accordance with the Agreement on Customs Valuation, adjusted to include international transport. In the US, the price used is the same as for the final good (the adjusted value). Since the ex-works price of the product is lower than the FOB price (as it does not include internal transport) and the value of the non-originating materials is higher (as it includes international transport) in the EU than in the US, the resulting figure of non-originating value in the EU will be higher than in the US according to each one's formulae. The percentage of regional value content normally depends on the circumstances. It changes from product to product within the same agreement and also within different agreements. According to Estevadeordal and Suominen (2006), its range normally oscillates between 40 percent and 50 percent of regional value (or 60 percent and 50 percent of non-originating materials) but values below and over those figures are not uncommon.

Example 6: MC, Southern African Development Community (SADC) FTA

HS heading No.	**Description of product**	**Working or processing carried out on non-originating materials that confers originating status**
Chapter 94	Furniture; bedding, mattresses, 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.	Manufacture in which the value of the materials used does not exceed 60 % of the ex-works price of the product.

Example 7: RVC, Trans-Pacific SEP

HS heading No.	Description of product	Working or processing carried out on non-originating materials that confers originating status
1902	Pasta, whether or not cooked or stuffed (with meat or other substances) or otherwise prepared	A change of heading is not required provided there is a regional value content of not less than 45 percent.

As an illustration, a manufacturer of upholstered chairs from South Africa would fall under Example 1 above. If he produced $2 chairs made of imported wood and foam, where 1.2$ was the cost of importing the wood, $0.2 the cost of importing the chair, labor and overheads accounted for $0.4 and profit for $0.2, his calculation to comply with the MC rule would be:

$$MC = \frac{1.4}{2} x100 = 70\% \ ,$$

not complying with the 60 percent limit. If he found a regional producer of foam, the *VNM* would decrease to $1.2, reaching the specified maximum (60percent). However, from the formula it can be seen that shifting to regional producers would not be the only way to fulfill the criteria. If he were to increase labor costs or profits by at least 0.33$, *V* would increase enough to reduce the weight of the non-originating materials to the required 60% of the good. This example reveals one of the negative aspects of using this sort of rule. By basing its compliance on the local value added to the final good, it penalizes low-cost, labor intensive producers, creating a problem for developing economies. Using the same reasoning, a paradoxical situation may occur whereby the inefficient high-cost producer can achieve access to the partner's market whereas the more efficient producer is left out. Another complication of this system is that it depends on external factors that are beyond its control, such as exchange rates or commodity prices. If the price of the non-originating materials increases, it may impede the final good to obtain originating status. An additional issue is that it is difficult for customs authorities to ascertain the exact percentage of locally added value, as is includes all costs related to production, such as patents or purchase of assets that

are difficult to account. This is complicated by the fact that countries have different definitions for each of the elements of the formula, further setting hurdles to international transactions.

On the positive side, a percentage rule is probably the type of rule that better grasps the very purpose of the rules of origin, i.e. ensuring that a certain degree of processing takes place regionally. Another advantage relates to the fact that since producers know the elements and costs of their materials used, they could take the appropriate measures to restructure their production in a way such to comply with the rule. A final positive aspect is that it sets a transparent threshold that producers can aim at.

3.3.2.3. Technical Test rules

The complexity and variety of RoO cause difficulties to classify them into types. CTC and percentage rules can be easily categorized but there several variations that are broadly combined into the third group of rules that determine substantial transformation. These are called technical test rules (TT). In essence, these are the rules that require any particular action to take place on the final good in order to confer originating status. Rules that require (or prohibit) a particular process to be undertaken fall in this category and so do the rules that require (or prohibit) the final good to source from a specific input.

Example 8: TT – specific operation, ASEAN-Korea FTA

HS heading No.	**Description of product**	**Working or processing carried out on non-originating materials that confers originating status**
5309	Woven fabrics of flax	Printing or dyeing accompanied by at least two preparatory or finishing operations

Example 9: TT – specific input, SADC FTA

HS heading No.	Description of product	Working or processing carried out on non-originating materials that confers originating status
ex Chapter 62	Articles of apparel and clothing accessories, not knitted or crocheted; except for:	Manufacture from yarn

The rule described in example 2 is widely used in textiles. It has been called yarn forward (or fabric forward if it requires to be manufactured from fabric) because it requires that the materials used are not at a later stage of processing than yarn. These rules are very common in textiles. When designed, these rules take into account the different stages of production in textiles: fiber to yarn, yarn to fabric, fabric to apparel. These rules require the product to undergo a certain number of transformations processes in the same country to become originating. Depending on the number of transformations needed, they can be single, double or triple transformation. The more jumps the final good has to satisfy, the more stringent the rule is.

The design of TT rules does not have any preconceived standards with regards to its design, which makes them the most flexible type of rule. They can be adapted to the circumstances of each production process and lay down the specific elements needed for a good to become originating in each situation. However, this flexibility becomes too burdensome to describe the innumerable production stages of all the goods. At the same time, TT rules better serve protectionist interests, as industry lobbyists, who are the ones that best know their production patterns, can mislead authorities in their conception (LaNasa, 1995). Another drawback of this system is that in a world of technological improvements, it would have to be constantly readapted. Finally, it becomes very complicating for importing authorities to verify that the production processes have really taken place in the exporting country (Brenton, P., 2003).

3.3.3 Combinations of Rules

The different groups described above are the main "families" of RoO. However, a closer study of the protocols on rules of origin around the world reveals that it is very frequent to find combinations of the rules described above, whether supplementing or complementing each other. Exceptions to CTC rules are also very common whether to tighten or relax the required change. These combinations and exceptions result in endless possible types of RoO, which may have very subtle variations among them. The administrative complexity that stems is only paralleled by the research difficulty.

3.3.3.1. Supplementary rules

There are many instances in which two different types of rules are laid down together for the same product. Virtually in every case, the choices are a CTC or percentage rule, although other combinations are also possible. They are usually referred to as alternative rules.

Example 10: Trans-Pacific Economic Partnership Agreement (SEP-4)

HS heading No.	**Description of product**	**Working or processing carried out on non-originating materials that confers originating status**
2009.90	Mixtures of juices	A change to subheading 2009.90 from any other subheading; or A change of subheading is not required provided there is a regional value content of not less than 45 percent.

Example 11: Supplementary TT and RVC rules, EU-CARIFORUM EPA

HS heading No.	Description of product	Working or processing carried out on non-originating materials that confers originating status or	
2711	Petroleum gases and other gaseous hydrocarbons	Operations of refining and/or one or more specific process(es)[1]	Other operations than those referred to in column (3) in which all the materials used are classified within a heading other than that of the product. However, materials classified within the same heading may be used provided their value does not exceed 50% of the ex-works price of the product

In the examples above, the producers can choose between two options in each case. Whether a CTC and an RVC in Example 1 or a between a TT and an MC in Example 2. Because this situation increases the options of the producer, it represents an additional flexibility of the origin criteria. The more instances these alternatives exist, the more liberal the rules become.

3.3.3.2. Complementary Rules

The opposite situation comes when two different criteria are specified together in the same rule to confer origin, which is only given if both criteria are fulfilled. Meeting two criteria instead of one, adds complexity to the rule.

3.3.3.3. Combinations of supplementary and complementary rules

The complexity of the RoO is enhanced by the fact that it is possible to combine both supplementary and complementary rules (which can, each of them, be a combination of CTC, percentage, TT or WO rules)

Example 12: Combination of supplementary and complementary rules, ASEAN-Korea FTA

HS heading No.	Description of product	Working or processing carried out on non-originating materials that confers originating status
1103.20	Pellets	Change to Subheading 1103.20 from any other Chapter, provided that the materials of Headings 10.03 and 10.06 are Wholly-Obtained or Produced in the territory of any Party; or A regional value content of not less than 40 percent of the FOB value of the good, provided that the materials of Headings 10.03 and 10.06 are Wholly-Obtained or Produced in the territory of any Party

In the example above, the producer can choose between a CC or an RVC (supplementary rules) with the condition that in both cases, all the materials from headings HS 1003 and 1006 are wholly produced (complementary rule)

3.3.3.4. CTC exceptions

A very frequent case is to introduce exceptions to CTC rules (CTCex), which prohibits the utilization of a certain material from a certain digit level that is otherwise permitted by the main rule. This exception can be added at any digit level; the higher the level of exception, the more restrictive the rule becomes.

Example 13: CTCex, North American Free Trade Area (NAFTA)

HS heading No.	Description of product	Working or processing carried out on non-originating materials that confers originating status
4016.93	Gaskets, washers and other seals	A change to subheading 4016.93 from any other heading, except from headings 40.09 through 40.17
2825.70	Molybdenum oxides and hydroxides	A change to subheading 2825.70 from any other subheading, except from subheading 2613.10.

The CTH rule for subheading HS 4016.93 is further restricted by not allowing materials from headings HS 4009 through HS 4017, which reduces the number of materials from which the

producer can source. Again, the higher the level of classification of the exception (chapter, heading and subheading level), the more number of materials that are prohibited, increasing the restrictiveness of the rule.

3.3.3.5. Positive exception

There is another case in which the main CTC rule can have an exception, although in this case used to relax the application of the rule (CTC+). These rules are drafted so as to allow materials of the same family as the ones prohibited by the main rule.

Example 14: CTC+, EU-Egypt FTA

HS heading No.	**Description of product**	**Working or processing carried out on non-originating materials that confers originating status**
Ex Chapter 29	Organic chemicals; except for:	Manufacture from materials of any heading, except that of the product. However, materials of the same heading as the product may be used, provided that their total value does not exceed 20 % of the ex-works price of the product
ex 8211	Knives with cutting blades, serrated or not (including pruning knives), other than knives of heading 8208	Manufacture from materials of any heading, except that of the product. However, knife blades and handles of base metal may be used

In the examples above, although the requirement is a CTH, a change from that particular heading would also confer origin under certain circumstances, even if it belongs to the same heading as the product in question. In the first case, the condition to use materials from the same heading is to comply with an MC requirement. In the second example there is no limitation, but only certain products are allowed freely.

The types of rules described above are the most common in origin protocols. However, rules may be drafted so as to combine in at least 70 different ways.[50]

[50] See Chapter 4 for an illustrative list of different types of rules.

3.4. Regime-wide RoO

The rules described so far affect only the good concerned. Each good has to meet them to become originating. RoO specific rules are always complemented by a series of provisions that apply to the entire universe of products (or to most of them, depending on eventual exceptions). These all-product provisions are known as regime-wide RoO. Any aspect contained in the FTA agreements or origin protocols that affect the determination of origin of the ensemble of products is a regime-wide RoO. They deal with a whole range of issues, from the treatment received by parts or accessories to the penalty received by an exporter submitting a fraudulent proof of origin.

There are a number of regime-wide provisions that have attracted most of the literature on RoO, namely cumulation, de minimis, and to a lesser extent certification procedures, the absorption principle and prohibition of duty drawback.[51] Here, I concentrate on the first four, as the prohibition of duty drawback is an aspect that goes beyond the determination of origin.

3.4.1 Cumulation

Cumulation (or accumulation, as it is called in US FTAs) is the provision that allows materials and/or processes used/undertaken in another partner of the agreement to be considered originating in the country where the final good is produced. Cumulation is considered to be a very important provision in order to integrate the economies of the FTA.[52] The reason is that it allows manufacturers to structure different stages of their production in those countries of the FTA were conditions are best for that particular stage and still satisfy the origin requirements. There are three types of cumulation: bilateral, diagonal and full, described below.

3.4.1.1. Bilateral cumulation

This type of cumulation is the most basic of all. It allows the use of materials originating in an FTA partner to be considered originating when used in the production of a good in

[51] See Cadot et al. (2006), Estevadeordal (2000), Estevadeordal and Suominen (2003), Cornejo and Harris (2007) and Augier et al (2004) for different views on regime-wide provisions.
[52] Augier *et al* (2004)

another partner as if they had originated there.[53] To illustrate bilateral and the other types of cumulation, let us consider the example of a manufacturer of mixture of juices, although in this case, extra sweet juice, and the specific rule contained in the EU-CARIFORUM EPA will be used:

Example 15

HS heading No.	**Description of product**	**Working or processing carried out on non-originating materials that confers originating status**
2009	Fruit juices (including grape must) and vegetable juices, unfermented and not containing added spirit, whether or not containing added sugar or other sweetening matter containing more than 20% by weight of added sugar or other sweetening matter	Manufacture in which: - all the materials used are classified within a heading other than that of the product; - the value of any materials of Chapter 17 used does not exceed 30% of the ex-works price of the product

Example 16:

A manufacturer of juice mix made of pineapple and orange in the EU uses orange juice (HS 2009.41) produced by him and pineapple juice (HS 2009.41) imported from CARIFORUM. The CARIFORUM producer also imports sugar from Cuba. The pineapple juice he produces has an ex-works price of $ 0.50, of which $ 0.15 correspond to sugar.[54] The sweet pineapple juice becomes originating in CARIFORUM because it meets the specific RoO. The orange juice is originating in the EU because it is made of wholly obtained materials. Bilateral cumulation allows the producer of the final good to use originating materials from other

[53] When defining cumulation, the literature on RoO ignores the case of several countries belonging to the same agreement. Bilateral cumulation is considered to happen between two partners of an FTA; diagonal cumulation between countries that have a network of FTAs among them. The case of several countries belonging to the same FTA is largely ignored. Here, I consider bilateral cumulation to cover that case as well.
[54] Sugar is contained in Chapter 17.

countries of the FTA, so when the originating pineapple juice is mixed with the orange juice, the final mixture automatically acquires originating status in the EU.[55]

3.4.1.2. Diagonal cumulation

The provision of diagonal cumulation allows materials from countries belonging to different FTAs to consider originating materials from other countries of the FTA network as long as all the countries have FTAs in place and the same RoO in all of them.

Example 17:

Consider an FTA between Mexico and CARIFORUM with the same specific RoO for HS 2009 as in the EU-CARIFORUM EPA. The EU and Mexico already have an FTA.[56] Consider also that the three blocks have diagonal cumulation provisions among them. As in Example 15, the sweet pineapple juice originating in CARIFORUM is imported into the EU, where it is mixed with originating orange juice. The ex-works price of the final good is $1.00, of which $0.50 are associated to the orange juice. However, there is no need to pass the test of the specific RoO because both juices are originating from the EU-CARIFORUM FTA, which grants the final mix EU origin. Under diagonal cumulation, the manufacturer in the EU can then export the mixture of juices to Mexico under preferential terms.

Example 18:

The CARIFORUM producer now decides to add higher quality sugar in such a way that the resulting ex-works price of his pineapple juice is $0.65, of which sugar accounts for $0.30. The sweet pineapple juice does not meet the specific RoO because sugar accounts for more than 30 percent of the ex-works price of the product. The non-originating pineapple juice is then exported to the EU, where it is mixed with orange juice, which again contributes to the final price with $0.50. The resulting mix does not acquire originating status because the required CTH has not taken place on all the non-originating materials, as mandated by the specific rule (pineapple juices is the same heading as mixture of juices, HS 2009).

[55] There is no need to restore to the specific rule because the final good is considered wholly produced in the EC, as it is made only from materials wholly obtained in the area.

[56] The actual specific RoO for HS 2009 in the EC-Mexico FTA is slightly different, as it is complemented by a percentage requirement for sugar products. In this example, I disregard this variation of the rule for practical purposes.

3.4.1.3. Full cumulation

The most complete case of cumulation is that of full cumulation. Under this provision, FTA members may accumulate not only originating materials but also production processes before passing the origin test. A material that enters the FTA area and is transformed in a country but does not meet the specific RoO can be exported to another country of the FTA (non-preferentially), undergo another stage of production and then become originating.

Example 19:

In the same case as the one described in Example 17 the final mixture of orange and sweet pineapple juice becomes originating and allowed to be exported under preferential terms in both Mexico and CARIFORUM. The reason is that since full cumulation allows to accumulate processes, the final mixture of juices meets the specific RoO in the EU. The ex-works price of the final product is $1.15, of which non-originating sugar accounts for $0.30. The reminding materials of the sweet pineapple juice are originating, so they do not need to undergo the RoO test, i.e. there is no need for the pineapple juice, except the sugar, to meet the specific RoO. Since the orange juice added in the EU dilutes the percentage of the value of the sugar below 30 percent of the ex-works price of the product, the final mixture is now granted EU origin and can be exported under preferential terms to CARIFORUM and Mexico.

As it can be shown from the previous examples, full cumulation facilitates the integration of productive structures by allowing combining processes of non-originating goods and still achieve originating status. This is of particular interest for developing countries where they may not have the structure to substantially transform one good but just add partly to this transformation.

3.4.2 De minimis

The *de minimis* or tolerance is a recurrent provision in most origin protocols that permits final goods that do not meet the specific RoO if the non-originating materials contained therein do not represent more than a certain threshold of the total value of the product. As in the case with the determination of the regional value content, here there are differences between FTAs with regards what price to consider, whether FOB, ex-works, Cost, insurance, freight

(CIF), etc. The lower the price (ex-works<FOB<CIF), the more restrictive the *de minimis* provision becomes, as it is easier for the non-originating materials to surpass the threshold. As Estevadeordal and Suominen (2006) point out, the threshold varies between FTAs but is normally set in the range of 7-10 %. It is also frequent to exempt entire sectors from this rule. For instance in the Pan-European System of Rules of Origin (PANEURO), it does not apply to textiles, for which there is a substitute provision based on the weight instead of value. This tolerance rule does not apply when the value of the non-originating materials would imply that the total value of the non-originating materials would exceed any percentage rule specified for the product in question.

Example 20:

Continuing with the example of the orange and pineapple juice producer, let us now consider that the EU producer of orange juice imports sugar from CARIFORUM and pineapple juice from Brazil and has decided to change the taste into an almost pure orange juice with a slight pineapple touch. The ex-works price of the product is $1.00, of which $0.20 is sugar and $0.15 pineapple juice and the rest is orange juice. The mixture of juices does not become originating in the EU because it has not met the required CTH for the pineapple juice. However, the EU-CARIFORUM EPA tolerance rule states that non-originating materials may nevertheless be used if their total value does not exceed 15 percent of the ex-works price of the product. In this example, it does not, so the mixture of juices can be granted originating status.

3.4.3 Absorption principle

It is common that a non-originating material is combined with another material (originating or not), transforming in an intermediate good that is in turn used in the final good. The absorption principle (or roll-up) allows the intermediate good to be counted as fully originating, not considering the non-originating component it has from the first non-originating material.

The above examples on cumulation assume the existence of the absorption principle. When this provision is allowed, the originating pineapple juice is considered fully originating, and no account is taken for the non-originating sugar contained therein. Once a good is considered originating, it is regarded as a whole. In the absence of the roll-up principle, all

the non-originating materials contained in the product (sugar in this example) would have to pass the test again in the EU.

Example 21:

Consider now a situation in which the pineapple juice manufacturer imports sugar from Cuba in such way that the ex-works price of the pineapple juice is $0.50 and sugar accounts for $0.15. The pineapple juice meets the specific RoO because sugar represents less than 30 percent of the value. This juice is then exported to the EU where the manufacturer combines it with orange juice and another substantial amount of sugar imported from Brazil. The ex-works price of the product is $1.00, of which $0.50 is the pineapple juice, $0.20 the orange juice and $0.30 the Brazilian sugar. The mixture still retains its originating status again because non-originating sugar does not represent more than 30 percent of the final price. In the absence of cumulation, the value of Brazilian sugar would have to be added to the value of Cuban sugar, which would raise the value of non-originating sugar beyond 30 percent of the ex-works price, failing to achieve EU origin.

The three regime-wide provisions described above are generally considered to provide leniency to origin regimes (Estevadeordal and Suominen, 2006), as they add flexibility to the choices that exporters can make.

3.4.4 Certification procedures

A regime-wide discipline that has been attracting some attention in recent times is that of certification.[57] It refers to the different ways an exporter/importer can certify the origin of his product. In essence, there are four types of certification: self-certification, public-private certification, public certification on the side of the exporting country and public certification on the side of the importing country.

Under self-certification, the exporter himself declares that the good is originating without further checks by the authorities. Under public-private certification, the authorities grant some exporters the capacity to make their own declarations, after meeting certain requirements. The less involvement of public authorities, the easier it becomes for

[57] See Cornejo and Harris (2007)

exporters/importers. Of course, in these two cases, authorities still take on random examinations of the consignments, to verify the information. This is indeed a problem that has been raised by Cornejo and Harris (2007). They argue that while private certification is seen as much more efficient, there needs to be enough resources to check the veracity of the declarations, which often involves investigating factories in the country of origin by the authorities. Most South American countries do not have enough resources for such investigations and are thus exposed to fraudulent action.

The remaining two options require the intervention of customs authorities, who must certify the origin of the products themselves. Customs authorities are often perceived as inefficient and corrupt, leading to delays in the certification.

An intermediate approach, which has been used by several Latin American countries is to delegate public certification on private entities that usually have exclusive rights (Estevadeordal and Suominen, 2006)

Certification procedures is not a restrictive or facilitating provision per se, rather, it varies widely according to its drafting. The next two disciplines described below are, on the other hand, trade restrictive *a priori*. While Estevadeordal and Suominen (2004bis) estimate self-certification to have positive effects on trade, Steele (2010) defends it would reduce African exports into the EU. The author argues that European importers would beware African exporters with no experience on self-certification.

3.4.5 Minimal operations

Several origin protocols describe a number of manufacturing operations that are not enough to confer origin even if by undertaking them, the product fulfills the specific rule of origin. They are called insufficient working or processing or list of minimal operations i.e. beyond which the product needs to go. Operations within this category vary from agreement to agreement but typically, they include cutting, printing, washing, painting, etc. In fact, in several protocols, simple mixing, as used in the examples above is included in the list of minimal operations. The more exhaustive this article is, i.e. the more operations it prohibits, the more restrictive it becomes. Another characteristic of this provision is that it prevails over other origin granting provisions. No matter how the good achieves origin (whether a CTC, a percentage rule or in application of the *de minimis* rule), if the operation that granted origin is

included in the list of insufficient working and processing, the good does not obtain origin certification. There is high potential for this article to follow protectionist interests, for the same reasoning as the TT rule described above. Industry representatives are the ones who better know the production chain and can mislead authorities on the inclusion of operations that do not confer origin, remaining highly discretional.

The EU-CARIFORUM EPA includes among its insufficient working and processing: (m) "simple mixing of products, whether or not of different kinds; mixing of sugar with any other material". This would be the case of the examples above so for instance, in example 1 of the *de minimis* rule, under the presence of an article requiring to go beyond minimal operations, origin would have not been conferred because the product only became originating after mixing the juices.

3.4.6 Prohibition of duty drawback

This provision refers to the refusal, in some FTAs, to reimburse to the producers the duties paid by them on those non-originating materials that are contained in goods destined for export. This prohibition has a protectionist bias. By removing the benefit of a duty break on imported materials, it encourages producers of the final good to source from regional materials.. However, Cadot et *al*. (2002) note that duty drawback itself may have a protectionist bias as it reduces the incentive of producers to lobby for lower tariffs on their intermediate goods.

This provision is however not directly related to origin itself although it is usually included in origin protocols.

3.5. Conclusion

Rules of origin are very complex trade policy mechanisms that lay down a series of conditions a product needs to meet in order to be considered originating in a particular geographical area.

A first distinction of RoO families must be done between preferential and multilateral, or non-preferential, RoO. Often, the general public is mistaken by thinking that the types of rules used in these two groups are different, while they are not. The distinction between

them relates then to whether they are used in a multilateral or preferential context. In the context of the present analysis, the focus will concentrate on preferential RoO.

A second clarification between RoO refers to whether a condition applies to the entire spectrum of products or it details the characteristics a specific product must meet. The former are known as regime-wide provisions and although subject to variation, they estipulate the provisions regarding the procedural requirements needed to demonstrate origin, the possibility to accumulate production in other countries or *de minimis* rules, among others. By its part, the rules that apply to a specific product are called product-specific rules of origin, which are traditionally the main focus of study when RoO are considered.

Product-specific rules of origin lay down the conditions a product must meet to become originating. They can be broadly divided into Wholly Obtained (WO) rules and Substantial Transformation criteria. WO rules require a product to be originating in a particular area to achieve originating status. Substantial transformation rules refers to those rules that require the product to undergo "substantial transformation" in order to become originating. They are divided in three main groups: i) Change in Tariff Classification (CTC), when the rule requires the product to change its HS tariff classification to become originating. Depending on the level at which the change is required (chapter, heading or subheading), the change in tariff classification is called change in chapter, change in tariff heading or change in tariff subheading; ii) percentage rules, which require the product incorporate a certain percentage of local content in its total value; and iii) technical test (TT) rules, which set any particular action in order to confer originating status. The WO rules together with the groups of substantial transformation rules are the main four "families" of RoO.

These four families are usually subsequently combined among themselves in origin protocols. One or more rules can be provided as either alternatives or as a supplementary requirement for a good to obtain originating status. A further type of rule relates to exceptions added to the CTC rule, whereby the rule allows an exception to main required change in tariff classification.

Chapter 4. Estimating the Economic Impact of Rules of Origin: Methodology and Data

4.1. Methodology

This thesis attempts to provide an estimate of the impact on trade of product specific rules of origin (RoO) and regime-wide provisions, as well as to construct an *ex-post* restrictiveness index on the basis of the results found in the estimations. Therefore, the driving force behind the choice of methodology is how to assess the *ex-post* trade impact of RoO, as opposed to forecasting. This places econometric analysis above other usual methods, like Computable General Equilibrium (CGE) models.[58] The framework chosen for such analysis is the gravity equation, which has been widely used in order to assess different policy variables.

The gravity model constructed for this study explores the determinants of trade flows (total trade, exports and imports taken at the 6-digit level) of four reporting countries and their respective FTA partners (up to 28 different country pairs). Product-specific RoO and regime-wide provisions directly obtained from the legal texts of the FTA protocols of origin are coded and introduced exogenously in the gravity equation, along the usual gravity variables. This set-up allows obtaining the impact on trade of the different RoO, which can be subsequently grouped in order to obtain an *ex-post* restrictiveness index.

This chapter explains and justifies the methodology used as well as describes the data nature and sources. The restrictiveness index is constructed in Chapter 6 on the basis of the results obtained from the estimations of Chapter 5.

[58] Additionally, to our knowledge, no product-specific RoO elasticities are available at present.

4.1.1 The Gravity Equation

The gravity equation has become in the last decades one of the most popular empirical devices to analyze trade flows. In words of Anderson (2010) it has become one of the most successful empirical models in economics, ordering remarkably well the enormous observed variation in economic interaction across space in both trade and factor movements. Consequently, it has been used to control for practically any factor potentially influencing trade flows.

In its basic form, the gravity model predicts bilateral trade as a function of two countries' mass and distance. The economic mass of the countries reflects potential supply and demand whereas distance reflects resistance to trade. Since economic mass and distance cannot be alone considered to explain bilateral trade flows, the gravity model has been completed by a myriad of factors that are thought to influence bilateral trade. These factors can range from policy decisions to natural forces. Among others, the literature includes studies about the use of a common currency, formation of regional trade agreements, language, presence of networks and many more. [59]

The original gravity equation, work of Timbergen (1962), was challenged for its weak theoretical foundation. [60] Many authors have since provided the necessary theoretical support to the gravity equation. The best known works are those of Anderson (1979), Bergstrand (1985, 1989) and Deardorff (1995). However, still today virtually every variable included in the gravity model is subject to discussion.

Two main reasons stand out to place the gravity model as the preferred method of estimation in the context of this study. First, the gravity equation provides a relatively acceptable theoretical framework for the use of RoO. In virtually every theoretical contribution to the gravity equation, distance is introduced as a proxy for costs.[61] In other words, the gravity equation explains bilateral trade based on the potential supply and demand (countries' GDPs) as well as on the restriction to trade between both countries. Though distance may be a good proxy for costs, it is not necessarily the only one. Factors like

[59] See Greenaway and Milner (2002) for a review of different applications of the gravity model in the context of FTAs.
[60] Anderson (1979)
[61] See Anderson and van Wincoop (2004) for an extended discussion on this topic.

sharing a common currency or speaking the same language are usually included in the gravity equation in this spirit (Anderson, 2010). The implications of this theoretical observation is that virtually any factor into the gravity equation, as long as it has the potential to affect the costs of trading between both countries. Several authors have found the connection of policy variables with trade costs sufficiently sound, such as Linemann and Verbruggen (2002), who analyze the impact of tariffs on trade, Frankel *et al.* (1995), who look at the effect of RTAs or Wagner *et al.* (2002), for whom common language influences trade volumes.

While some of the factors included in the literature may have had weak implications regarding the trade costs between to countries, the potential effect of RoO on costs has been extensively documented in the theory, as described in Chapter 2.[62] The impact of RoO on costs seems to guarantee sufficient theoretical support for the use of a gravity model in this context.

A second crucial reason for choosing gravity modeling as the preferred framework is its good empirical fit, as has been documented extensively in the past.[63] Such good empirical performance led economists, such as Anderson (2010) to "believe that the gravity equation must have some underlying theory". While tracing the link with theory is important to ensure the validity of the results, the main contribution of this study is essentially empirical, which prompts the use of one the most well adapted empirical tools.

Once the gravity model has been indicated as the preferred methodological framework, there are a number of issues that need careful theoretical consideration. First, one of the main goals of this thesis is to establish a generalized result with regards to the impact of RoO on trade. It therefore needs to look at a representative sample of trade, which includes both North-South as well as North-North trade flows. The composition and the determinants of trade between both types of flows are likely to be different. On one hand, North-South trade is thought of consisting mostly of homogeneous goods, driven by comparative advantage factors between countries; on the other hand, North-North trade is made up mainly of intra-industry heterogeneous goods. Considering the different nature of trade object of the present study, it

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[62] See Yamarik and Gosh (2005) for a robustness check of some of the usual variables included in gravity models.

[63] Feenstra (2002), Anderson and van Wincoop (2004) and Evenett and Keller (1998) are among the examples of well-known works that have acknowledged the good fit of the gravity equation.

needs to be asserted whether the gravity model provides a correct theoretical framework for such analysis.

Second, by definition, it is imperative that in order to conduct a study on product-specific, the model is evaluated at disaggregated level, in particular at the same level as the rules of origin are set. The theoretical underpinnings of the gravity model ought to be analyzed so as to confirm whether it is suitable for disaggregate data analysis.

Third, in order to expand the scope of the study, the intention is to look at the impact of the rules both for the exporter and the importer. Again, theory behind the determinants of gravity modeling is explored to assess if such analysis can be undertaken on a theoretical sound manner.

Finally, the theoretical justification of the model build-up concludes with a discussion about the unobserved determinants of trade included in the gravity model which need to be taken into account in order to correctly specify the equation. It turns out that such a discussion prompts the use of panel data as opposed to cross-section as the correct way of conducting the analysis.

This section provides a close look to the gravity equation in order to confirm the theoretical validity of an analysis under such parameters.

4.1.1.1. Gravity for North-South and North-North trade

Puzzled by the good fit of an econometric device that had no theoretical underpinnings, trade economists started an attempt to link this success to different theories of trade; their intention being to explain what the main forces behind the gravity equation were. Once this question is established, it can be assessed whether the gravity equation is better equipped to predict North-South trade, more consistent with trade in homogeneous goods or North-North trade in differentiated products. The implication is that if just one theory is found to be responsible for the success of the gravity equation, the use of this device to calculate trade flows that are not consistent with such theory can be potentially flawed.

Early theoretical work on the gravity relied purely on product differentiation, which was assumed, as in Anderson (1979) or Bergstrand (1985), where products were consumed based on country differences (i.e. Armington assumption). Further theoretical work, exemplified by the contributions of Helpman (1987) and more particularly Bergstrand (1989) continued to trace the derivation of the gravity model to other sources of product differentiation, this time caused by increasing returns to scale. Whatever the determinant of the differentiation, this leads countries to perfectly specialize in the production of one good (or variety). When production is perfectly specialized, countries are the only suppliers of each good, which means that the share of imports of country *i* from country *j* of product *k* equals total imports of country *i* of product *k* from the world. When production is added to all sectors, this leads to countries to import its share of world income:

$$M_{ij} = \frac{Y_i Y_j}{Y_w} \tag{4.1}$$

which is the general form of the gravity equation, or the frictionless gravity model.[64] It has been argued that this equation has nothing to say about factor proportion or comparative advantage, as noted by Augier *et al.* (2004). However, Evenett and Keller (1998) point out that the driving force behind equation (4.1) is not product differentiation *per se* but complete specialization; large differences in factor proportions could also lead to perfect specialization and hence to the gravity equation above. This finding was exploited by Deardorff (1995), who derived the gravity equation after a Hecksher-Ohlin model of differences in factor proportions for homogeneous goods. His model considers a "pool" of exports from where consumers randomly obtain their imports. If consumers have identical and homothetic preferences then equation (4.1) above holds as they all consume the same share of each product. If preferences are dissimilar, then countries with larger capital endowments will over consume (and overproduce) capital abundant goods. The key to his explanation is that "exports" to itself must be considered and hence any export above the value predicted in equation (4.1) would be absorbed by each country itself. In fact, Bergstrand (1989) had previously attempted to reconcile both inter and intra-industry determinants of trade by incorporating increasing returns to scale into a two model two factor two good economy, where each industry had different factors of production. His link to the H-O came with the

[64] The derivation of the proper gravity equation with the presence of distance is dealt with in several ways which are not relevant for the discussion at hand. See Anderson and van Wincoop (2004) for a survey of such methods.

introduction of Gross Domestic Product (GDP) per capita into the equation which he viewed as a proxy of the capital to labor ratio.

Feenstra *et al* (1998) note that most theoretical explanations of the gravity model arise from specialization which is consistent for differentiated goods but not for homogeneous goods. The authors generate a gravity equation that motivates trade in homogeneous goods using a model of "reciprocal dumping" where the firms sell the Cournot—Nash homogeneous goods in each other's markets when marginal revenue exceeds marginal cost. The authors conclude that the theoretical foundations to the gravity equation are actually quite general and can also be used to derive the model for homogeneous goods. The theoretical opaqueness of homogeneous goods in the gravity equation is further cleared by Eaton and Kortum (2002), who develop a gravity model for trade in homogeneous goods under Ricardian comparative advantage. In their model, goods are defined independently of the countries, with specialization being governed by comparative advantage. The importing country will buy depending on price, which in turn depends on technology and distance. Each country's efficiency on good *g* is randomly obtained from each country's specific Frechet distribution function. This depends on the state of technology and the dispersion of productivity within goods, which measures the relative efficiency within that country. Hence the extent of the of the comparative advantage. On this model, Harrigan (2001) comments that the authors had elegantly generated the gravity equation for trade in homogeneous goods and that it worked for trade between developing countries.

Further contributions to the theoretical readiness of the gravity equation to predict actual trade flows in today's world comes with the work of Evenett and Keller (1998) and Haveman and Hummels (2004), who obtain and test the validity of the equation for models of imperfect specialization trade in both differentiated and homogeneous goods. Evenett and Keller (1998) derive what they call an Increasing Returns to Scale (IRS)/unicone H-O model of imperfect specialization in which each country produces both a differentiated and a homogeneous good. In their model, γ_i represents country's *i* share of the homogeneous good on GDP, $\gamma_i = Z_i /(p_x X_i + Z_i)$, where Z is the homogeneous good and X the differentiated one. With homothetic preferences country *j* will import from *i* its share of the world's GDP which, together with balanced trade means that country *i*'s imports from *j* are given by:

$$M_{ij} = (1-\gamma_i)\frac{Y_i Y_j}{Y_w}\lambda \tag{4.2}$$

where λ is the share of the trade homogeneous goods and is common to all countries. The authors then test the data on differently generated gravity models in order to assess which theory can be accounted responsible for the success of the equation and find support for the imperfect specialization model due to differences in factor proportions. Haveman and Hummels (2004) derive a model of imperfect specialization (although they do so after what they call a statistical relationship and not as a specific prediction about bilateral trade). They test their model on disaggregated trade data and conclude that they are not inclined to consider imperfect specialization as the only determinant of the gravity equation. However, they recognize its important contribution to its success, in particular due to the presence of zeroes in the data, which complete specialization models have difficulties in justifying.

As mentioned above, it has been proven that virtually any trade theory, and even combinations thereof can generate the gravity equation. Empirically, the results also provide evidence that the gravity equation can be used to explain different motivations for trade. Other than the contributions mentioned in the paragraph above, two other widely-quoted studies throw light in this respect. The first one is that of Hummels and Levinsohn (1995) who find that the gravity model based on IRS worked as well on trade flows between countries with low shares of intra-industry trade as it did on flows between countries with high shares, which implies that the gravity equation can be well-suited not only for North-North trade with high levels of Intra-Industry Trade (IIT) but also for North-South trade on heterogeneous goods. The second one is that of Rauch (1999), who tested the gravity equation on three different sets of commodities, organized exchange, referenced price (both of which are homogeneous goods) and differentiated products. The author finds that the gravity coefficients are different for the three groups although this difference is small in absolute magnitude, lending support to the fact that the gravity equation is consistent with different trade theories. Finally, Feenstra *et al* (2001) undertake a study of the entry barriers for different types of goods. They use the same product classification as Rauch (1999) and like him, they find evidence for differences in the three product categories but again, they conclude by stating that the gravity equation is consistent for both types of goods.

To sum up, although there may be some differences in the coefficients of different types of products, both theory and practice agree on the good fit of the gravity equation as a tool to examine trade flows motivated by alternative trade theories and compatible with either North-North and North-South trade. At the same time, differences in the coefficients for both homogeneous and differentiated products suggest an interesting avenue for possible disparities of the impact of rules of origin on them.

4.1.1.2. Gravity for disaggregate trade

Most econometric studies exploring the issue of RoO are performed at an aggregate level. There are a number of reasons that account for this circumstance. On the empirical side, the majority of the work involving RoO has been predominantly interested on the effect of a particular RoO regime as a whole on aggregate trade, or on the impact that a particular regime-wide provision, such as cumulation, may have on a given set of products. Theoretically, early justifications for the gravity model, such as Anderson (1979), involved the use of "Armington" type assumptions, whereby products where differentiated by country of origin only, consistent with aggregate trade. More recently, it has been argued that the gravity model is not suited for sectoral-level analysis because on its standard form it does not take into account the determinants of comparative advantage, which are needed to explain trade at the sectoral level (Augier *et al.* 2004). Also Molinari (2003) notes that it is reasonable to expect that a country will export more of the good intense in the factor which the country is relatively abundant on. This may in principle cause an endogeneity problem when measuring trade at disaggregated levels. Finally, North-South trade has traditionally been thought of consisting basically of inter-industry trade on perfectly specialized homogenous goods, thus better grasped by aggregate variables.

However, as shown in the section above, the myriad of theoretical studies behind the gravity model provide enough justification for different trade theories to be behind the success of the gravity equation and hence, for a comfortable use of disaggregated variables. The conviction highlighted above that the determinants of comparative advantage are not included in the standard gravity model is refuted by Eaton and Kortum (2002). As long as product differentiation comes as a result of other factors than country of origin, the gravity equation becomes compatible with the disaggregated data, and such is the case in the theoretical formulations of Deardorff (1995) or Bergstrand (1989), described earlier.

In fact, virtually every theory-based gravity model is generated from sectoral (or product) level and then aggregated to total trade, independently of the theory they are obtained from. In Deardorff's (1995) model of perfect specialization of factor proportions, countries spend fraction β_k of their incomes on good *k* and country's *j* consumption of this good is given by $c_{jk} = \beta_k Y_j / p_k$. Matching *j*'s consumption with country *i*'s contribution to world output of good *k* γ_{ik} leads to total *j*'s imports from *i* to be given by:

$$T_{ij} = \sum_k p_k c_{ijk} = \sum_k \gamma_{ik} \beta_k Y_j \ , \tag{4.3}$$

which includes the share of *j*'s total GDP spent on each good *k*. Only when aggregating over all goods, the share β_k = 1 and total GDP is reached.

The same conclusion can be reached looking at Anderson's (2004) derivation of the gravity model under the assumptions of trade separability and Constant Elasticity of Substitution (CES) preferences, the total exports from *i* to *j* are given by: [65]

$$X_{ij}^k = \left(\frac{p_{ij}^k}{P_j^k} \right)^{1-\delta_k} E_j^k \tag{4.4}$$

where δ_k is the elasticity of substitution among brands, p_{ij}^k is the price charged in *i* for exports to *j* and P_j^k is a CES price index. From here, the author derives the gravity equation to be:

$$X_{ij}^k = \frac{E_j^k Y_i^k}{Y^k} (...) \text{ [66]} \tag{4.5}$$

where as in the example of Deardorff (1995) the relevant output variable is the sectoral output. Again, it only matches total GDP when aggregated over all *k*s. As Anderson and

[65] Trade separability refers to the fact that the allocation of production and consumption within a country Y_{ik} and E_{ik} is separable from the allocation of trade across countries. This assumption is obtained from separable preferences and technology. According to Anderson and van Wincoop (2004) under this assumption, the gravity model can be obtained no matter what further assumptions are made about the production function, technology, competition or specialization.
[66] The term in brackets is not relevant for the present discussion.

van Wincoop (2004) note, only when considering a one-sector economy can the subscript for the good be dropped. This assumption has been made in several gravity derivations, such as Bergstrand (1985, 1989) or Anderson and Van Wincoop (2001) although it is clearly an unreal one.

The implication of this aspect of the gravity equation is that at the moment of considering the estimation of sectoral exports/imports, the proper specification of the gravity model requires sectoral size variables. Therefore, one point of concern must be drawn here with regards to the size variables incorporated in gravity models on disaggregated trade. Usually, total importer or exporter *GDP* are the gravity variables which stand in the gravity equation as a proxy of the countries' size. Yet, when performing the study at the industry level, it may be advisable to proxy industry size, rather than country. The economic issue behind this concern is exemplified by Baldwin et al (2005) who says that:

"When using sectoral trade data, however, the mapping between L [endowment of factors] and E [expenditure on imports] and GDPs is less clear. On the importer's side, one can think of using the corresponding sector's gross value added. However, the import demand for, say, chemicals arises from many sectors other than the chemicals sector. On the export side, one can think of using sectoral production as a proxy for the number of varieties, but sector production data is difficult to get for long time periods and a broad sample of countries. Moreover, such sectoral value added measures are typically fraught with many measurement problems."

However, for convenience, or under the assumption that total GDP could be a good proxy of sectoral GDP, several authors have used total GDP. For instance, Rauch (1999) estimates the impact of proximity and common language on different types of commodities using the classical aggregate proxies, such as GDP both for the importer and the exporter, as his study looks at bilateral trade, rather than just exports or imports. Feenstra *et al.* (1998), Evenett and Keller (1998) and Portugal-Pérez (2008) also use aggregate size variables on sectoral trade flows in the usual gravity specification.

Examples of sectoral data are less common in the literature. Augier *et al* (2004) make use of sectoral variables when establishing a model to assess the effect of cumulation on the textile sector. They use total production of textiles in the exporting country as the proxy of the supply variables and they use total apparent consumption of textiles in the demanding country, represented by:

$$E_l = Q_j + M_j - X_j \tag{4.6}$$

where Q_j is total production in textiles, M_j is textile imports and X_j is textile exports. Baldwin et al. (2005) perform an exercise using both aggregate and sectoral variables. For the sectoral variables, they use value added per sector deflated by overall manufacturing producer prices for the exporter, and the same measure of apparent consumption described above for the importer.

It can then be concluded that the use of disaggregated trade data on gravity models is not only possible, but ensures a more solid theoretical foundation. However, its use comes at the price of complicating the size variables, which should be also taken at sectoral level.

4.1.1.3. Exports, imports and total trade

A final point must be made regarding the use of exports, imports or total trade. Theoretical gravity models have been derived for both exports and imports, as well as for total trade. In fact, this issue has not seemed to spark strong debate in the literature. Examples of gravity models generated for exports are those of Bergstrand (1985, 1989) or Anderson and van Wincoop (2004). For imports, Anderson (1979) or Deardorff (1995) are among the most quoted examples, whereas Rauch (1999) derives it for bilateral total trade. Indeed, as it should be the case both theoretically and in practice, the accounting identity of balanced trade guarantees the equality of both flows.

One of the few concerns about possible differences in the treatment of either flow is presented by Baldwin *et al* (2005), for whom import data is more reliable due to exporter incentives to under-calculate their figures for tax purposes. However, being the intention of this study to calculate the impact of rules of origin, it seems reasonable to perform the study from both the importer's and the exporter's side as well as on total trade.

4.1.1.4. A Justification for Panel Data

A final consideration about the theoretical aspects of the gravity equation involves the treatment of prices in the model. Intuitively, it may seem logical that prices can influence trade flows between countries. Nevertheless, economists tended to disregard them due to data constraints, for the sake of simplicity or based on arguable assumptions. Among those assumptions which neglect the introduction of prices there is perfect substitutability, no transport costs or no tariffs. In summary, free trade.

Therefore, early years of gravity modeling did not take into account the introduction of prices in the equation. The paper that all of a sudden triggered the discussion on prices was McCallum (1995) on the trade between Canadian provinces and U.S. states. The author estimates the border effects for Canada and the U.S. in their bilateral trade. His results are striking since he estimates a border effect 22 times larger for Canada than for the U.S. In the light of this, many economists challenged the results observed by McCallum[67].

Their main criticism was made on the grounds of McCallum's equation which, did not take into account price differentials between both countries. He assumed free trade, implying no costs for trade. Yet, selling in another country must necessarily be more expensive if we bear in mind, among other elements, tariffs and transport costs. When these variables are included, trade is no longer costless, so prices between countries differ.

Anderson and van Wincoop (2001) intensely defend the use of prices. They argue that prices are one of the building blocks of the supply and demand functions of the gravity equation. Consequently, they introduce a multilateral resistance term which depends on trade barriers with all the partner countries. These barriers are based on transport costs and other ones, such as information costs, that cause domestic prices to be cheaper than imports and these, in turn, to differ between themselves. When a model that includes price variables is estimated, the border effect, though still large, is greatly reduced. When including this multilateral trade resistance index, the gravity equation proposed by Anderson and van Wincoop (2001) takes the form

$$z_{ij} = \left(\frac{x_{ij}}{y_i y_j} \right) = k + (1-\sigma)\rho d_{ij} + \left[(1-\sigma)b\right](1-\delta_{ij}) - P_i^{1-\sigma} - P_j^{1-\sigma} + \varepsilon_{ij} \tag{4.7}$$

where σ is the elasticity of substitution between all goods. It enters the equation in a multiplicative form with the trade cost parameters ρ and b and is therefore not identified. d_{ij} is the distance between trading partners. δ_{ij} is a dummy variable that takes the value of one when trade is intra-region/country trade and zero when takes place inter regional/country. P_i and P_j are the multilateral trade resistance indices of the importer and the exporter. They are equal to

[67] See Feenstra (2002), Baier and Bergstrand (2001), Anderson and van Wincoop (2001), Havemann and Hummels (2004)

$$P_j = \left[\sum_i \left(\beta_i p_i t_{ij} \right)^{1/(1-\sigma)} \right] \tag{4.8}$$

where p_i is the consumer price index in country i, t_{ij} is the trade cost between countries i and j

Baier and Bergstrand (2001) offer another way of addressing the price issue. They also reckon that prices play a role for exporters and importers. Consumers buy from the cheapest source and the producer does not face the same costs when exporting to every country. The difference of their approach and that of Anderson and van Wincoop (2001) is the introduction of a price variable using price indices. As a result, their equation introduces GDP deflators to proxy the barriers to trade for both the demand and the supply side.

Feenstra (2002) builds on the approaches of previous studies. He presents a very similar criticism to McCallum (1995) as that of Anderson and van Wincoop (2001) (he even considers their way of solving the problem as almost the ideal). Feenstra (2002) argues that the conclusions attained by McCallum (1995) are highly biased because of the omission of price variables in the equation. He asserts that in the presence of border effects (this is, always in international trade), prices are not anymore the same across countries. This conviction makes clear the fact that he must introduce prices in the equation. His problem then is not whether to include prices or not but how to do so. He compares the approaches of Anderson and van Wincoop (2001) and Baier and Bergstrand (2001) and introduces a new one with fixed effects, which account for unobserved effects, including the price effects. He concludes that the best way to do it is by introducing fixed effects because even though Anderson and van Wincoop's (2001) approach may be slightly more accurate, the gain is marginal compared to the computational easiness of the fixed effects method. Hence, his proposed gravity looks like

$$\frac{X^{ij}}{Y^i Y^j} = \alpha d^{ij} + \gamma\left(1-\delta^{ij}\right) + \beta_1^i \delta_1^i + \beta_2^i \delta_2^i + (1-\sigma)\varepsilon_{ij} \tag{4.9}$$

where δ_1^i takes the value of one if region i is the exporter and zero otherwise, whereas δ_2^i takes the value of one if region i is the importer and zero otherwise. Both variables

account then for the exporter and importer fixed effects. This takes Feenstra to interpret the coefficients on these variables as $\beta_1^i = \left(P^i\right)^{\sigma-1}$ and $\beta_2^i = \left(P^j\right)^{\sigma-1}$, the same as the multilateral trade resistance terms of Anderson and van Wincoop.

This procedure seems to have gained popularity among economists and many others have proposed a similar equation including fixed effects.[68] It can be considered that this way of dealing with price effects is probably the most recommendable one.

The problem arises now in how to estimate a fixed effects model in the presence of time-invariant variables. Several authors have addressed this issue in recent times and they propose a number of different solutions.

Wagner, Head and Ries (2002) estimate the impact of migration on trade flows using a model in which they account for fixed effects by introducing country dummies. In a similar way Matyas (1997), follows a three-way fixed effects estimation method, assigning a specific effect to time, exporter and importer. These dummy variables should capture all the unobservable fixed effects that are specific to each exporting and importing country and which, in its absence, will bias the results. Price variations affecting trade are comprised in these unobservable effects.

Cheng and Wall (2004) propose a two-stage regression by which they keep the within-residuals from the first regression and run them on the time-invariant variables in a second step. The authors present a two-way fixed effect model (importer and exporter), allowing bilateral flows to differ depending on the direction. Martinez-Zarzoso and Nowak-Lehman (2003) use the same approach when looking at MERCOSUR-EU trade flows.

4.2. The equation

Four main issues stem from the discussion in the previous section: i) the gravity equation can be the benchmark for different patterns of trade; ii) its good fit in the presence of disaggregated data; iii) its equivalence for exports, imports and total trade; and iv), the

[68] See Hillberry and Hummels (2003), Haveman and Hummels (2004) and Redding and Venables (2000)

desirability to use panel data. In view of these, the basic gravity equation (1.2) is transformed and augmented by the policy variables of interest to take the following general form:

$$TF_{kijt} = \alpha_0 + \beta_1(\eta X_{kit} + \lambda X_{kjt}) + \beta_2(\eta M_{kjt} + \lambda M_{kit}) + \beta_3 d_{ij} + \beta_4 \sum_{i=1}^{I}\sum_{j=1}^{J} D_{ij} + \sum_{k=1}^{K}\sum_{i=1}^{I}\sum_{j=1}^{J}\gamma_{kij} + \sum_{i=1}^{I}\sum_{j=1}^{J}\zeta_{ij} + \sum_{i=1}^{I}\delta_i + \sum_{j=1}^{J}\phi_j + \sum_{t=1}^{T}\chi_t + \varepsilon_{ijt} \quad (4.10)$$

where TF_{kijt} are the flows (total trade, exports or imports, as the case may be) between reporter *i* and partner *j* in product *k* and period *t*; X_{kit} are X_{kjt} are total reporter's and total partner's exports to the world of product *k* in time *t*; M_{kit} and M_{kjt} are total reporter's and total reporter's imports from the world of product *k* in time *t*; d_{ij} is the geographical distance between reporter *i* and partner *j*; D_{ij} are the gravity-type variables for specific circumstances between reporter and partner, in this case common language and contiguity; γ_{kij} and ζ_{ij} are the key variables of interest, γ_{kij} representing the product specific rules of origin and ζ_{ij}, the regime-wide provisions; $\sum_{i=1}^{I}\delta_i$ and $\sum_{j=1}^{J}\phi_j$ are the reporter and partner country specific fixed effects, respectively and $\sum_{t=1}^{T}\chi_t$ are the time effects; and ε_{ijt} is the error term.[69]

4.2.1 Variable Specific Issues

In light of the discussion in section 4.1.1 about the theoretical underpinnings of the gravity equation, two crucial clarifications on the variables introduced in equation (4.10) ought to be done.

First, as explained in the theory, the correct specification of a gravity model using disaggregated data should not consider GDP as size variable. Indeed, considering the dependant variables are product-level trade flows, adding an aggregate measure as size variable, such as GDP does not necessarily provide useful information, as one country may not produce at all any given product due to several factors other than its size. Consequently,

[69] A detailed explanation of the issues incidental to each variable is provided in Section IV.3.1 below

one needs to substitute GDP for other size variables at product level. Two strategies were considered to control for size. First, adding a sector specific dummy variable, for each Harmonized System (HS) chapter. However, as discussed below, collinearity is a recurrent concern throughout the study and adding more dummy variables increased substantially the problems related to it. In addition, although section variables may add more information than aggregate GDP, they still lay at a superior level compared to products. The second strategy was to substitute GDP by total exports to the world of a specific product and total imports from the world of that same product. The reasoning is simple, instead of trade between two countries being a function of their aggregate size and their distance, trade between two countries in a specific product must be a function of their total exports and total imports of that product and the distance between them. In other words, the "push" and "pull" measures are total exports and total imports to and from the world of each product respectively. Therefore, instead of the usual GDP variable for proxying size, total exports X_{kit} (X_{kjt}) and total imports M_{kit}.(M_{kjt}) of product k are included. This specification is in line with that of Cadot and de Melo (2007).

Secondly, the purpose of this study is to contribute with as much information as possible about rules of origin, i.e. assessing whether the rules affect in the same way exports and imports, as well as showing in which way they promote or hamper global trade. Therefore, the study is conducted for total trade, exports and imports. In the present context, trade flows (TF_{kijt}) in equation (4.10) is substituted by either total trade, exports or imports. Numerically, $TF_{kijt} = TT_{kijt} = E_{kijt} + I_{kijt}$, where E_{kijt} is exports of product k between reporter i and partner j in time t, I_{kijt} is the equivalent for imports and TT_{kijt} for total trade. Consequently, equation (4.10) is transformed in three different equations, one for total trade, one for imports, and one for exports. When the analysis includes total exports (when looking either at total trade or at exports), η takes the value of 1 and zero otherwise, whereas in the case of imports, λ takes the value of 1 and zero otherwise.

Therefore, when total trade is the subject of study equation (4.10) becomes:

$$TT_{kijt} = \alpha_0 + \beta_1(\eta X_{kit} + \lambda X_{kjt}) + \beta_2(\eta M_{kjt} + \lambda M_{kit}) + \beta_3 d_{ij} + \beta_4 \sum_{i=1}^{I}\sum_{j=1}^{J} D_{ij}$$
$$+ \sum_{k=1}^{K}\sum_{i=1}^{I}\sum_{j=1}^{J}\gamma_{kij} + \sum_{i=1}^{I}\sum_{j=1}^{J}\zeta_{ij} + \sum_{i=1}^{I}\delta_i + \sum_{j=1}^{J}\phi_j + \sum_{t=1}^{T}\chi_t + \varepsilon_{ijt}$$

(4.10-a)

when only exports are considered, equation (4.10) becomes

$$E_{kijt} = \alpha_o + \beta_1 X_{kit} + \beta_2 M_{kjt} + \beta_3 d_{ij} + \beta_4 \sum_{i=1}^{I}\sum_{j=1}^{J} D_{ij} + \sum_{k=1}^{K}\sum_{i=1}^{I}\sum_{j=1}^{J}\gamma_{kij} +$$
$$\sum_{i=1}^{I}\sum_{j=1}^{J}\zeta_{ij} + \sum_{i=1}^{I}\delta_i + \sum_{j=1}^{J}\phi_j + \sum_{t=1}^{T}\chi_t + \varepsilon_{ijt} \qquad (4.10\text{-b})$$

and, in the case of just imports,

$$I_{kijt} = \alpha_o + \beta_1 X_{kjt} + \beta_2 M_{kit} + \beta_3 d_{ij} + \beta_4 \sum_{i=1}^{I}\sum_{j=1}^{J} D_{ij} + \sum_{k=1}^{K}\sum_{i=1}^{I}\sum_{j=1}^{J}\gamma_{kij} +$$
$$\sum_{i=1}^{I}\sum_{j=1}^{J}\zeta_{ij} + \sum_{i=1}^{I}\delta_i + \sum_{j=1}^{J}\phi_j + \sum_{t=1}^{T}\chi_t + \varepsilon_{ijt} \qquad (4.10\text{-c})$$

As exemplified in equations (4.10-a) through (4.10-c), total exports and total imports vary depending on whether the focus lies on exports, or imports, or both. The change in the order of the subscripts *i* and *j* in equations (4.10-b) and (4.10-c) is not coincidental. The explanation demands particular attention. Take the case where only exports are considered (equation 4.10-b). In this scenario, the size variable, total exports X_{kit} and total imports M_{kjt} are respectively, total exports to the world of reporting country *i* for product *k*, and total imports from the world of the partner country *j* for that same product *k*. However, when imports are the dependant variable (equation 4.10-c), total exports X_{kjt} are total exports to the world of partner country *j* of product *k,* and total imports M_{kit} are total imports from the world of reporting country *i* of product *k.*

4.2.2 Modeling Rules of Origin

The main goal of this thesis is to grasp the trade effects of rules of origin. The way in which RoO are modeled is thus of crucial importance, more so in view of the intrinsic complexity of the rules. The preferred way to obtain the impact on trade of the rules in this study is to code each product specific RoO and then introduce through a dummy variable in the gravity equation for which the value of the coefficient can subsequently be estimated.

Additional clarifications about the methodology used to estimate the trade effect of the rules relate to the type of approach used. In view of the complexity of the rules, four different approaches are considered in order to ensure their complete analysis. As detailed in Chapter 3, product-specific RoO may adopt many different forms. The four main "families" of existing RoO (Regional Value Content (RVC), Change in Tariff Classification (CTC), Technical Test (TT) and Wholly Obtained (WO)) are often combined among themselves, either providing an alternative between two or more rules or demanding the fulfillment of more than one. In addition, exceptions to the specific rule applicable to one product are commonplace. When more than one rule is combined for a single product, it becomes impossible to identify which of them was fulfilled. Therefore, devising the proper method of estimation becomes one of the single most important contributions of this study.

Four different methods are considered, each of them with its own strengths and weaknesses, as described below. In the context of the estimated equations (4.10-a) through (4.10-c) specific rules of origin are represented by γ_{kij} and regime-wide provisions by ζ_{ij}.

One important consideration is that each method of estimation requires different type of information regarding RoO and hence, the way of coding the rules differs, although they all begin from the same starting point. Specific rules of origin are combinations of the different types of RoO (CC, CTH, CTS, RVC, RVCEU, TT and WO). Therefore, every rule can be split into each of these components.[70] Exceptions to the general rule are sometimes found (EXC). Additionally, rules can either complement (COMB) each other or be provided as an alternative (ALT). In view of these considerations, every rule includes one or more of the following ten aspects: CC, CTH, CTS, RVC, RVCEU, TT, WO, COMB, ALT, EXC. A random number from one (CC) to zero (EXC) is then assigned to each of them, as shown in Table 4.9.

[70] CC, CTH and CTS are usually considered to be part of the Change in Tariff Classification family (CTC),

Table 4.1. Variables modeling Specific Rules of Origin

Rule Code	Number Assigned	Description
CC	1	Change in Chapter
CTH	2	Change in Tariff Heading
CTS	3	Change in Tariff Subheading
RVC	4	Regional Value Content
RVCEU	5	Specific case of Regional Value Content
TT	6	Technical Test
WO	7	Wholly Obtained
COMB	8	Combination of Rules
ALT	9	Alternative Rules
EXC	0	Exception to a change in tariff classification

The four different methods of estimation are explained as follows:

Method 1: In this first approach, γ_{kij} includes all possible interactions of rules that may occur in the flow of product *k* between countries *i* and *j*. This means that γ_{kij} is decomposed in Change in Chapter (CC), Change in Tariff Heading (CTH), Change in Tariff Subheading (CTS), Regional Value Content, Regional Value Content – Paneuro Type (RVCEU), Technical Test, Wholly Obtained (WO), Combination of Rules (COMB), Alternative between rules (ALT) and Exceptions to any type of Tariff Classification (EXC). Numerically, it means that:

$$\gamma_{kij} = CC_{kij} + CTH_{kij} + CTS_{kij} + RVC_{kij} + RVCEU_{kij} + TT_{kij} + WO_{kij} + COMB_{kij} + ALT_{kij} + EXC_{kij} \tag{4.11}$$

Each of the ten variables in equation (4.11) (the same as in Table 4.9) is a dummy variable that takes the value of one when they are present and zero otherwise.

The different types of specific rules of origin have been described in Chapter 3. However, some clarifications must be made. The category RVC includes both rules that are defined as a requisite for a minimum amount of value being incorporated nationally into a product as well as rules that set a maximum limit of foreign value in a product. These two rules are spelled reversely, although the spirit of the rule remains the same, i.e. requiring a certain percentage of the total value of the product to be included in the country of origin. The rule tagged RVCEU is a particular case of RVC used exclusively in EU agreements whereby they

request a particular material included in a product not to surpass a certain threshold. Therefore, it is an RVC-type of rule as it sets a maximum limit in terms of value but it differs from traditional RVC in that it does not apply to the entire product but to part of it.

An important aspect of equation (4.11) is that a specific rule may require a product to comply with a combination of two or more rules in order to confer origin. In such cases, the variable COMB is included. Accordingly, if the rule offers the possibility to choose between two different rules, ALT takes the value of one. Finally, EXC refers to the instances when a change of tariff classification with exceptions is required. The inclusion of these three variables represents an attempt to grasp the implication of including more than one specific rule of origin in the requirements to confer origin.

The fact that rules are combined among themselves, or provided as alternative, allows that the sum of these dummy variables does not necessarily add to one. In fact, it is more common to find alternative/combinations of rules than to find product which are subject to exclusively one rule. The following example shows how rules are modeled using this approach. Take the following rule for tariff subheading 2810.10 in the US-Chile Agreement.

Example 1

A change to subheading 2818.10 through 2818.30 from any other chapter, except from Chapters 28 through 38; or A change to subheading 2818.10 through 2818.30 from any other subheading within Chapters 28 through 38, including another subheading within that group, whether or not there is also a change from any other chapter, provided there is a regional value content of not less than: (a) 35 percent when the build-up method is used, or (b) 45 percent when the build-down method is used.

This type of rule provides an alternative between a change in chapter with exception, or a change in subheading with exception combined with a regional value content requirement. In other words, the elements that are present in this rule are: CC, CTS, RVC, COMB, ALT and EXC. Consequently, the specific rule for such product would be coded with CC=1, CTS=1, RVC=1, COMB=1, ALT=1 and EXC=1, and zero the remainder variables.

The strengths of this method rely on its comprehensiveness, as it takes into account each possible combination of rules. Thus, it offers information about the interactions between every type. However, it presents the problem of identifying under which rule the product gains originating status, which is impossible with the data available.

Method 2: The second approach used to assess the impact of the specific rules relies on those products that are only subject to one type of rule, without combinations, alternatives or exceptions. In such way, CC, CTS, CTH, RVC, RVCEU, TT and WO are mutually exclusive and hence $\sum \gamma_{kij} = 1$. Numerically:

$$\gamma_{kij} = CC_{kij} + CTH_{kij} + CTS_{kij} + RVC_{kij} + RVCEU_{kij} + TT_{kij} + WO_{kij} = 1 \tag{4.12}$$

Note that COMB, ALT and EXC have been dropped as these three variables only come into play when there are combinations of rules, which are, by choice discarded from this method. Hence, for this approach, only products with one individual rule are considered, while all other products are dropped from the sample. Consequently, the rule presented in Example 1 above is not considered in this method, as it involves interaction of more than one rule. Instead, only rules of the following type are considered:

Example 2

1207.99 A change to subheading 1207.99 from any other chapter.

Example 3

Chapter 14	Vegetable plaiting materials; vegetable products not elsewhere specified or included	Manufacture in which all the materials of Chapter 14 used must be wholly obtained

The rule listed in Example 2 is taken to be a change in chapter (CC) and the rule in Example 3 a wholly obtained rule (WO). As it can be seen, these rules are individual and are not combined/given as alternative with any other rule. As such, CC would equal one in

Example 2, and all other types of rules would equal zero whereas in Example 3, WO would be the only that would take the value of one.

The main strength of this method is that it allows direct comparison between the types of rules subject of study as it individualizes the effect of each of them. On the other hand, it fails to provide information about interactions of rules and cannot be used to answer questions relating the trade impact of providing an alternative rule, for instance.

Method 3: The third approach is an extension of the second in which the specific rules are grouped in "families". The main four families of rules are those requiring a change in tariff classification, value content requirement, a technical test or the product being wholly obtained. Therefore, CC, CTS and CTH are grouped in one category, Change in Tariff Classification (CTC). Hence, the variables now become CTC, RVC, TT and WO, and again $\sum \gamma_{kij} = 1$. Equation 4.12 is now transformed into:

$$\gamma_{kij} = CTC_{kij} + RVC_{kij} + TT_{kij} + WO_{kij} = 1 \tag{4.13}$$

The motivation to group the rules in families is to follow traditional literature on rules of origin, which usually classifies rules in those four families. The rule presented in Example 2 above is now considered CTC and the rule in Example 3 retains its WO classification.

Method 3 presents the same strengths and limitations as Method 2, i.e. it has the advantage of isolating the effect of individual rules but it ignores the effect of including combinations, alternatives or exceptions.

Method 4: Finally, the fourth approach assigns a different value to each possible combination of rules found in origin protocols. Interactions of the four main families of rules described above result in 37 different types of rules. In other words, protocols of origin are studied and each possible combination of rule is assigned a different dummy variable. In this manner, γ_{kij} now becomes R1, R2,…R37, as there are 37 possible combinations of rules. Numerically:

$$\gamma_{kij} = \sum_{f=1}^{37} R_f \ , \tag{4.14}$$

and again $\sum \gamma_{kij}$ =1. The 37 different types of rules are described in Table 4.2

Codification of rules according to this method requires additional transformations, as follows. According to the random numbers assigned in Table 4.1, if a rule requires a simple CTH (2), that rule is coded with "2". If a rule requires a CTS (3) combined (8) with a RVC (5), that rule is coded with "385". On the other hand, if the rule provided the RVC requirement as an alternative (9) to the CTS, the rule would have been coded as "395". Once the written rules are translated into numbers, introducing them into the equation is straightforward. The scrutiny of the origin protocols showed 79 different combinations of rules. These rules are then numbered from 1 to 79, and a dummy variable is easily created for each of them. [71]

[71] It must be noted that CC, CTH and CTS are all three grouped as CTC. When considered independently, the number of possible combinations of rules raises from 37 to 79. This increased the problem of outliers as there were many rules with very low frequencies.

Table 4.2. Description of the different combination of RoO

Rule Number	Description
R1	CTC
R2	RVC
R3	TT
R4	WO
R5	CTCex
R6	CTC OR CTC
R7	RVC OR RVC
R8	RVC & RVC
R9	TT OR TT
R10	TT & TT
R11	WO & WO
R12	CTC OR RVC
R13	CTC OR TT
R14	CTC & RVC
R15	CTC & TT
R16	CTC & WO
R17	RVC OR TT
R18	RVC & TT
R19	TT OR WO
R20	TT & RVC
R21	TT & WO
R22	WO & RVC
R23	CTCex OR RVC
R24	CTCex OR TT
R25	CTCex & RVC
R26	CTCex & TT
R27	CTCex & WO
R28	CTC OR (CTC & RVC)
R29	CTC & WO & RVC
R30	CTCex OR (CTC & RVC)
R31	CTCex OR (CTC & TT)
R32	CTCex & WO & RVC
R33	CTC OR (CTC & TT)
R34	(CTC & RVC) OR RVC
R35	(CTC & TT) OR RVC
R36	(RVC & RVC) OR RVC
R37	WO OR (TT&RVC)
Note:	OR stands for an alternative rule & stands for a combination ex stands for exception in CTC

Reverting to the examples provided above, the rule in Example 1 is coded as R31 under this method. The rule in Example 2, as R1 and the one in Example 3 as R4.

Again, this approach has advantages and drawbacks. On the positive side, this method can be thought of being the most comprehensive because it allows estimating the impact of each possible rule included in origin protocols. On the negative side, dividing into 37 the number of observations reveals an econometric problem, as many of them become insignificant and are therefore taken away from the equation. In what follows, the rules created in this method (rules R1 through R37) will be referred to as "unique rules" as each of them defines a unique interaction of rules.

Analyzing the impact of the rules under these four methods implies estimating equations (4.10-a) through (4.10-c) four different times, each accounting for the four different specifications of γ_{kij}.

Finally, modeling the regime-wide provisions ζ_{ij} showed two unsurpassable problems. First, every agreement shared most of the provisions. Five different provisions were object of study: cumulation, tolerance rule (*de minimis*), absorption principle, minimal operations and certification procedures. It turned out that all the agreements had provisions to allowing a tolerance rule, the absorption principle and they all included a list of minimal operations that did not confer origin. Therefore, the analysis could only be limited to those provisions that did differ from agreement to agreement, i.e. cumulation and certification. However, again collinearity became an issue so both of them could not be modeled. The choice was made to model certification procedures, as the impact of allowing self-certification as opposed to public certification might be much easier to grasp than cumulating production between countries, which entails a degree of vertical integration among those countries which may depend on many other factors than stating the provision in the agreement. Consequently, $\zeta_{ij} = Selfcertification_{ij}$.

One implication of this specification is that rules are assumed to be determined exogenously. Rules of origin are sometimes perceived as alternative means of protection when countries lose the capacity to impose tariff measures.[72] In particular, Cadot *et al* (2002) and

[72] See Duttagupta and Panagariya (2003) or Estevadeordal (2000) for illustrations of such situations.

Estevadeordal (2000) find evidence of increased RoO restrictiveness in the presence of lower tariffs. If RoO are used as a protectionist means if can be argued that they are endogenous to trade. However, in the case of RoO this is not a plausible situation as most protocols on rules of origin are usually highly rigid documents, particularly those of the EU and US. Only minor changes are negotiated from FTA to FTA and modifications over time occur very rarely. Whereas changes in trade do happen, RoO remain fixed over time and to some extent across partners for each reporting country. In view of this, it can hardly be the case, as expressed by Cadot *et al* (2002) that future trade patterns can be behind the design of RoO. The few studies identified in the literature that attempt to estimate the trade impact of RoO treat them exogenously as well, as is the case in Portugal-Pérez (2008) and Cadot *et al* (2002).[73]

Despite their use in the literature as exogenous variables, the risk of encountering factors that may cause endogeneity bias cannot be completely ruled out, as they may exist some unobserved factors that can influence simultaneously the adoption of a given type of rule and the volume of trade. Such a factor could be the presence of powerful lobbies that advocate, for instance, for trade-conducive RoO to favor their already large volume of exports. If this were the case, this omitted variable would induce coefficients to be biased, as no correction is performed in this study to account for this problem.[74]

4.3. Data and Statistics

The study comprises bilateral trade flows (total trade, imports and exports) between four reporting countries and 16 Free Trade Area (FTA) partner countries, accounting for 28 different combinations of country pairs. The purpose of the analysis is to be as comprehensive as possible with regards to the validity of the results. The selection of the reporting countries is hence performed according to the following criteria: First, the main condition is the number of active FTAs. The precision about the word active is important here as there are many FTAs in force which have become inactive, as is the case of an important number of FTAs in the Arab world. Similarly, only broad FTAs are considered, this is those that liberalize close to 100 percent of products. Most FTAs in the Latin American

[73] RoO are considered to be endogenous to tariff preferences in Estevadeordal (2000) and Cadot *et al* (2006), but not to exports.

[74] One notable way to solve the endogeneity bias is to use fixed effects estimation at the product-level. This would rule out all information about RoO, which is a solution that the present study cannot afford.

Integration Association (LAIA) cover just one or few sectors and have hence not been included.

Second, the choice of the reporting as well as the partner countries intends to include developed and developing economies, so as to ensure a larger scope of the analysis. For instance, EFTA countries have more agreements than the US, but their choice of FTA partners, as well as the structure of the RoO, replicates those of the EU to a large extent. Third, FTAs in order to conduct a representative panel analysis, data needs to be available for at least four periods. The last across-the-board year of available data is 2008, implying that FTAs needed to be active in 2005 at the latest.

In view of these considerations, the best combination of reporting countries is given by Chile, the EU, the US and Mexico.[75] Table 4.3 shows the combination of reporters and partners:

Table 4.3. Reporter and Partner Countries

	Reporter			
	Chile	**EU**	**Mexico**	**USA**
Partner	CANADA	SWITZERLAND	CANADA	AUS
	SWITZERLAND	CHILE	SWITZERLAND	CANADA
	EU	EGYPT	CHILE	CHILE
	ICELAND	ICELAND	EU	ISRAEL
	KOREA	MEXICO	ICELAND	JORDAN
	MEXICO	NORWAY	ISRAEL	MEXICO
	NORWAY	TUNISIA	JAPAN	
	USA	SOUTH AFRICA	NORWAY	
			USA	

4.3.1 Trade Data

All trade data was obtained from COMTRADE. The data is captured at the six-digit level, which is the most disaggregated level available and is also the lowest level at which rules of origin are reported.[76] Both export and import data were directly obtained from the

[75] The number of reporting countries was limited to four in view of the size of the data set, already with over 1,200,000 observations.
[76] On very rare occasions rules can be reported at the 8-digit level. Those instances have not been considered.

COMTRADE database, whereas total flows were calculated just as the sum of both exports and imports.

Data sets were compiled for trade in all goods for the 28 country-pairs. Thus, there are 28 different sets of bilateral data. Data is taken yearly between 2005 and 2008. The resulting 112 combinations of data yield a total of 1,224,833 observations.

Data for total exports and total imports represents exports to the world and imports from the world for every reporting and partner country for each six-digit product. As mentioned in the preceding chapter, these two variables serve as proxies for the country's weight or, more precisely, for the weight of each product traded by each country. When a reporting country is recorded to be exporting, the total exports variable represents total exports of this country to the world for each product whereas the total import variable represents total imports of the partner country from the world for that product; vice-versa when the reporting country is importing. Take the following example given in Table 4.4:

Table 4.4. Illustration of the use of size variables

	Chile exports to Canada of product 01.06.90	**Chile imports from Canada product 01.06.90**
Value (Dependant variable)	Chilean exports to Canada of product 01.06.90	Chilean imports from Canada of product 01.06.90
Total exports (size variable)	Total Chilean exports to the world of product 01.06.90	Total Canadian exports to the world of product 01.06.90
Total imports	Total Canadian imports from the world of product 01.06.90	Total Chilean imports from the world of product 01.06.90

COMTRADE does not report zero values. However, using matching procedures between total exports/imports to/from world and recorded figures allows generating zero values, which represent a large proportion of the sample, i.e. 56 percent of the entire sample.[77] Equally, products enter and exit the sample, resulting in an unbalanced panel.

[77] The details concerning estimating the model in the presence of zero values are discussed in the next Chapter.

Data is obtained using the Harmonized System 2002 version, which is available for the widest range of countries in recent years. The choice for Harmonized System as opposed to other classifications such as the Standard International Trade Classification (SITC) is straightforward since most origin protocols are spelled using this system and therefore allows for direct comparison. All reporting and partner countries report data for the selected years in HS 2002 except Egypt, which used HS 96 until 2008. Data is reported in thousands of US dollars at constant prices.

4.3.2 Gravity Data

Distance data as well as the variables on common language and contiguity are obtained from the publicly available DIST_cepii.xls file by CEPII. Distance data is calculated using the great circle formula.

Distance in gravity models has traditionally measured distance between capital cities or most important cities in the reporting and partner country. However, as part of the attempts to solve the "border puzzle" found by McCallum (1995) and discussed above, several authors such as Head and Mayer (2002) and Helliwell and Verdier (2001) suggest that the "border effect" might be a consequence of measurement errors in the distance variable. In words of Head and Mayer (2002), correcting for distance does not solve the "border puzzle" but shrinks it. The authors find that existing measures in the literature overestimate closer distances hence augmenting the border effect. They suggest a distance measure which is calculated on the basis of the bilateral distance between the two most important cities in a country in terms of population, and weighted by the share each city represents in the total population of its country. In such way, distance takes the following form:

$$d_{ij} = (\sum_{k \in i} (pop_k / pop_i) \sum_{l \in j} (pop_l / pop_j) d_{kl}) \tag{4.15}$$

where k and l are the largest agglomerations in countries i and j. Following Head and Mayer (2002), their measure of distance equals the one used in equation (4.10) and throughout.

Common language and contiguity are usually incorporated into gravity equations to account for specific conditions of each bilateral pair of countries. Examples of studies using these variables are Feenstra et *al.* (1998) or Cheng and Wall (2004). Common language indicates

whether two countries share a common official language. Contiguity distinguishes between countries sharing a common land border or not.

4.3.3 Data on Rules of Origin

Data on rules of origin is directly obtained from the FTAs' protocols of origin, which are all available at the countries responsible trade ministry/agency. Except for marginal exceptions, product-specific rules of origin can be spelled at the HS Chapter, 4-digit or at the 6-digit level. EU-based origin protocols usually contain about 800 different product-specific rules, whereas US-based account to over 2,000. Some of the 28 country pairs included in the sample share agreements, such as the North American Free Trade Area (NAFTA), shared by both Mexico and the US, or they are both reporters and partners, such as EU and Chile, EU and Mexico or Chile and Mexico. The total number of origin protocols is hence reduced to 16. At an average of 1,400 data entries by origin protocol, it yields a total of close to 24,000 product-specific rules. Each of these entries is a short sentence specifying the corresponding rule. The coding procedure of these rules is explained in the methodological section above.

Data on regime-wide provisions which, in view of the issues discussed above turned out to be reduced to self certification procedures is also obtained from the protocols attached to FTAs.

4.3.4 Summary Statistics

Tables 4.5-4.8 provide information about the data used in the model, for overall trade, by reporter. The tables show how the logarithmic transformation reduces the skewness of the data, as total trade, total imports and total exports report comparable figures for all four reporters. Dispersion in total trade is greater for Mexico than the remainder reporters, who show similar figures. Total imports and total exports combine imports from the world and exports to the world both from the reporter and partner country. Consequently, the fact that EU figures show a larger dispersion suggests that EU partners display greater variation in their figures which is a plausible explanation considering the difference in the development level of EU partners.

Table 4.5. Summary Statistics – CHL

Variable	Obs	Mean	Std. Dev.
LVAL	71898	10,417	3,044
LIMP	71898	15,368	2,729
LEXP	71898	16,077	3,071
DIST	71898	9,231	0,275
SELFCER	71898	0,615	0,487
LANG	71898	0,141	0,348
CONTIG	71898	0,000	0,000
CC	71898	0,197	0,398
CTH	71898	0,559	0,497
CTS	71898	0,196	0,397
RVC	71898	0,402	0,490
RVCEU	71898	0,024	0,153
TT	71898	0,098	0,297
WO	71898	0,028	0,166
COMB	71898	0,264	0,441
ALT	71898	0,300	0,458
EXC	71898	0,174	0,379

Table 4.6. Summary Statistics – EU

Variable	Obs	Mean	Std. Dev.
LVAL	207089	12,579	2,933
LIMP	207089	15,892	3,201
LEXP	207089	16,306	3,338
DIST	207089	7,890	1,129
SELFCER	207089	0,000	0,000
LANG	207089	0,181	0,385
CONTIG	207089	0,341	0,474
CC	207089	0,001	0,037
CTH	207089	0,498	0,500
CTS	207089	0,028	0,164
RVC	207089	0,464	0,499
RVCEU	207089	0,061	0,239
TT	207089	0,237	0,425
WO	207089	0,078	0,268
COMB	207089	0,222	0,415
ALT	207089	0,353	0,478
EXC	207089	0,022	0,146

Table 4.7. Summary Statistics – MEX

Variable	Obs	Mean	Std. Dev.
LVAL	126399	11,454	3,783
LIMP	126399	16,581	2,343
LEXP	126399	15,875	2,978
DIST	126399	8,643	0,631
SELFCER	126399	0,547	0,498
LANG	126399	0,082	0,274
CONTIG	126399	0,275	0,446
CC	126399	0,253	0,435
CTH	126399	0,559	0,497
CTS	126399	0,214	0,410
RVC	126399	0,405	0,491
RVCEU	126399	0,014	0,119
TT	126399	0,114	0,318
WO	126399	0,016	0,125
COMB	126399	0,296	0,457
ALT	126399	0,347	0,476
EXC	126399	0,237	0,425

Table 4.8. Summary Statistics – USA

Variable	Obs	Mean	Std. Dev.
LVAL	133343	13,168	2,959
LIMP	133343	16,240	2,755
LEXP	133343	16,170	2,980
DIST	133343	8,511	0,823
SELFCER	133343	1,000	0,000
LANG	133343	0,591	0,492
CONTIG	133343	0,509	0,500
CC	133343	0,312	0,463
CTH	133343	0,371	0,483
CTS	133343	0,249	0,433
RVC	133343	0,371	0,483
RVCEU	133343	0,000	0,000
TT	133343	0,123	0,328
WO	133343	0,191	0,393
COMB	133343	0,415	0,493
ALT	133343	0,215	0,411
EXC	133343	0,271	0,444

The different interactions among the variables are provided in Table 4.9, which provides the correlations among them.

Table 4.9. Correlation matrix among variables

	LVAL	**LIMP**	**LEXP**	**DIST**	**SELFCER**	**LANG**	**CONTIG**	**CC**	**CTH**	**CTS**	**RVC**	**RVCEU**	**TT**	**WO**	**COMB**	**ALT**	**EXC**
LVAL	1,00																
LIMP	0,33	1,00															
LEXP	0,54	-0,02	1,00														
DIST	-0,30	-0,01	0,05	1,00													
SELFCER	0,03	0,02	-0,06	0,12	1,00												
LANG	0,14	0,05	-0,05	-0,22	0,31	1,00											
CONTIG	0,37	0,07	-0,07	-0,78	0,18	0,26	1,00										
CC	-0,03	-0,02	-0,10	0,01	0,41	0,07	0,15	1,00									
CTH	0,02	0,06	0,04	0,00	-0,06	-0,06	0,00	-0,37	1,00								
CTS	0,05	0,06	0,03	0,04	0,32	0,06	0,07	-0,12	-0,06	1,00							
RVC	0,06	0,10	0,11	0,06	-0,13	0,02	-0,10	-0,25	0,18	0,14	1,00						
RVCEU	0,04	0,03	0,04	-0,03	-0,16	-0,04	-0,02	-0,07	-0,12	-0,07	0,07	1,00					
TT	-0,07	-0,09	-0,06	-0,05	-0,15	-0,08	-0,01	0,02	-0,38	-0,16	-0,28	-0,07	1,00				
WO	-0,04	-0,06	0,00	0,11	0,06	0,16	-0,11	-0,13	-0,27	-0,12	0,08	0,05	0,00	1,00			
COMB	0,04	0,07	0,03	0,05	0,17	0,11	-0,01	-0,01	0,15	0,24	0,57	0,11	-0,02	0,26	1,00		
ALT	0,03	0,05	0,06	0,01	-0,14	-0,08	-0,02	-0,14	0,27	0,26	0,62	0,12	0,01	-0,10	0,37	1,00	
EXC	-0,02	0,01	-0,08	-0,01	0,34	0,04	0,14	0,23	0,03	0,08	-0,18	-0,06	0,01	-0,11	0,03	-0,10	1,00

The correlation matrix shows no worrying signals in terms of interactions between variables except contiguity and distance, which is obvious as contiguity disappears with higher distances. Correlations between total value and the independent variables are in line with the predictions formulated in the previous chapter. The values on CTH, CTS, RVC and RVCEU suggest a positive impact on total trade, whereas CC, TT and WO show a negative one. Probably the one surprise comes with "COMB" which suggests a possible positive impact on total trade. Other interesting features of this table are the high values for "COMB" and "ALT" on "RVC" which indicates that this type of rule appears mostly as a combination or as an alternative rather than as an individual rule. Finally, total exports indicates a higher possible impact on total trade than total imports, which is an indication that "push" forces are more important than "pull" forces in determining trade flows.

4.3.5 Descriptive Statistics

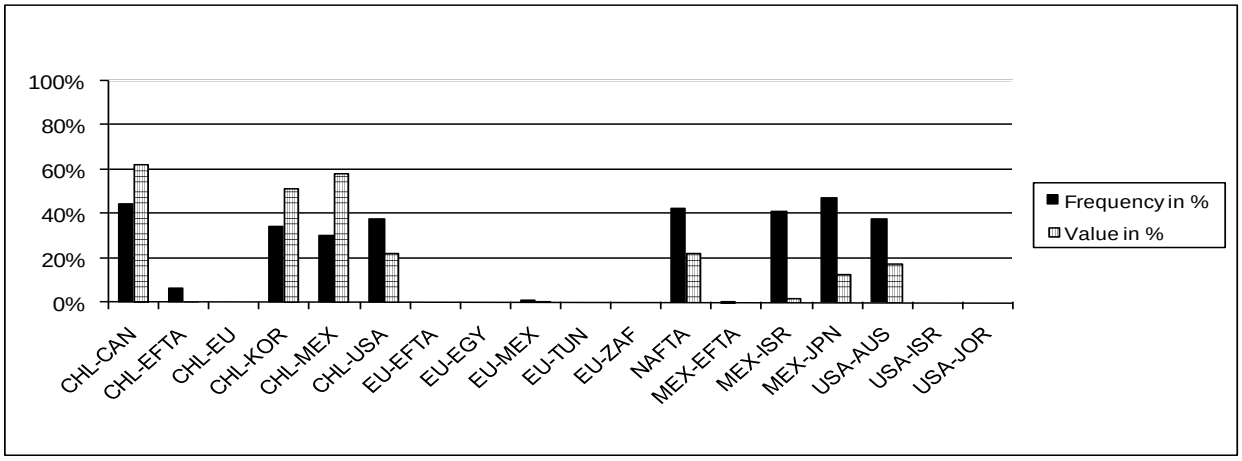
This section provides information for a better understanding of the data. Figures 4.1-4.10 indicate the frequency and total trade observed under each specific rule for all the agreements in the sample.[78] They are useful to compare the relative importance of the different types of rule for each agreement in terms of the percentage of all products that are traded under that rule and the percentage volume that trade represents. All Figures have been computed for one particular rule except Figure 4.4 which combines information on CTC, which is the sum of CC, CTH and CTS, and EXC. By definition, exceptions are can only take place with CTC, whether a CC, CTH or CTS.

Frequencies reveal how CTH is the most common type of rule across agreements, followed by RVC. Figure 4.4 indicates that several agreements rely entirely on CTC based rules, although reading together with the rest of the Figures confirms that in most cases, those rules are used in combination or as an alternative to other rules. This is more prominently in US-based agreements. EU-based agreements, on the other hand only marginally rely on CC rules. The latter are the only ones to use RVCEU because as explained in the previous chapter, this type of rule is a variation from the RVC used in EU agreements. Alternative rules are more common in EU-based agreements whereas combinations occur more frequently in US-based. This, in principle adds restrictiveness to US agreements as opposed

[78] Frequencies in Figures 5.1-5.9 do not necessarily add up to a total of 100% because of the interactions between the different rules through combinations and alternatives. Similarly, values recorded in the Figures surpass total trade as volumes are counted double when there is an alternative or a combination in the rules.

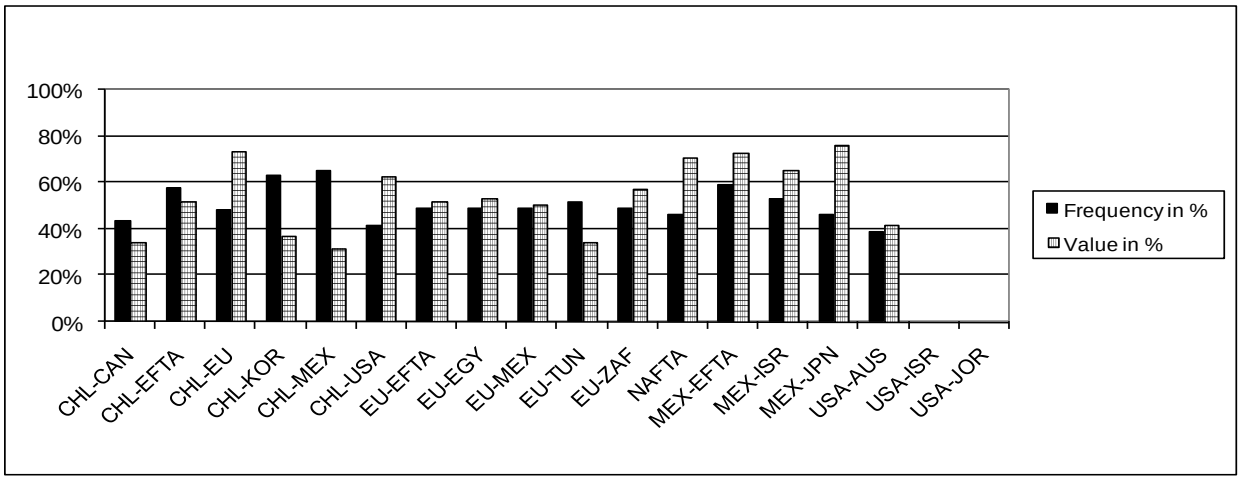
to EU. On the other hand, EU-based agreements rely more on TT rules which have the potential for being more restrictive.

With regards to trade conducted under each rule, one of the prominent features is that most agreements seem to trade more in relative terms than the relative frequency for CTH and RVC, with the exception of Chile. In turn, in Chile's agreements, relative trade volumes are higher than frequencies for CC. In terms of the rest of the rules, no clear pattern emerges. In general Chile conducts a larger share of its trade under CTS than the relative frequency of this rule reveals whereas the rest of the countries have mixed results. As for TT, it is the EU the only reporter that indicates a larger share of trade than proportion of rules. On the contrary, the records less relative trade than percentage of rules in WO. Lastly, all countries except Chile conduct a larger share of their trade under ALT than its frequency.



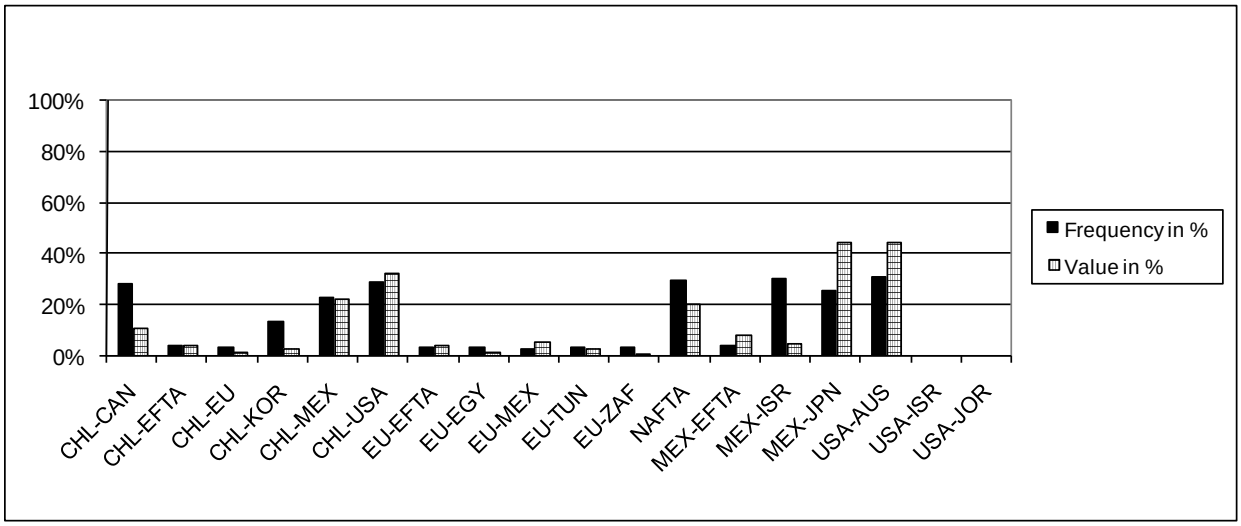
Source: Origin Protocols, own calculations

Figure 4.1. Freq. and Value of Change in Tariff Chapter (% of Total Rules)



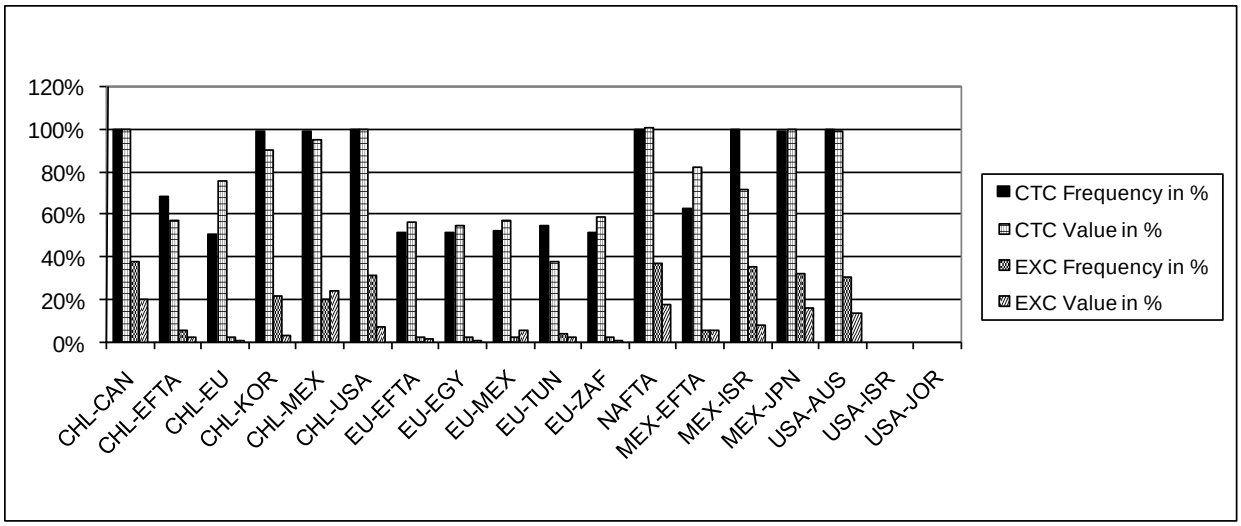
Source: Origin Protocols, own calculations

Figure 4.2. Frequency and Value of Change in Tariff Heading (% of Total Rules)



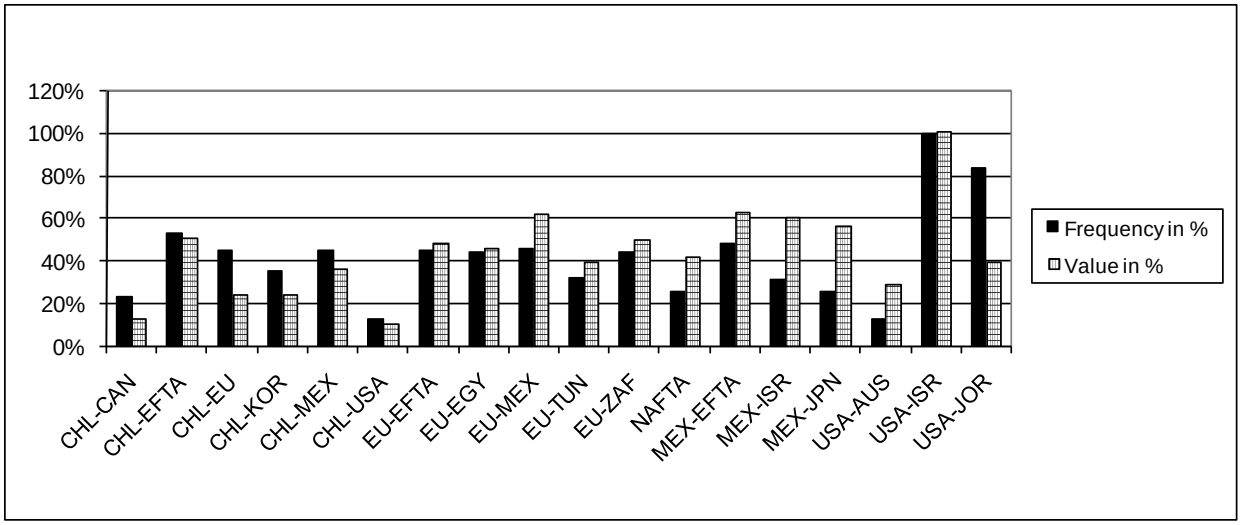
Source: Origin Protocols, own calculations

Figure 4.3. Freq. and Value of Change in Tariff Subheading (% of Total Rules)



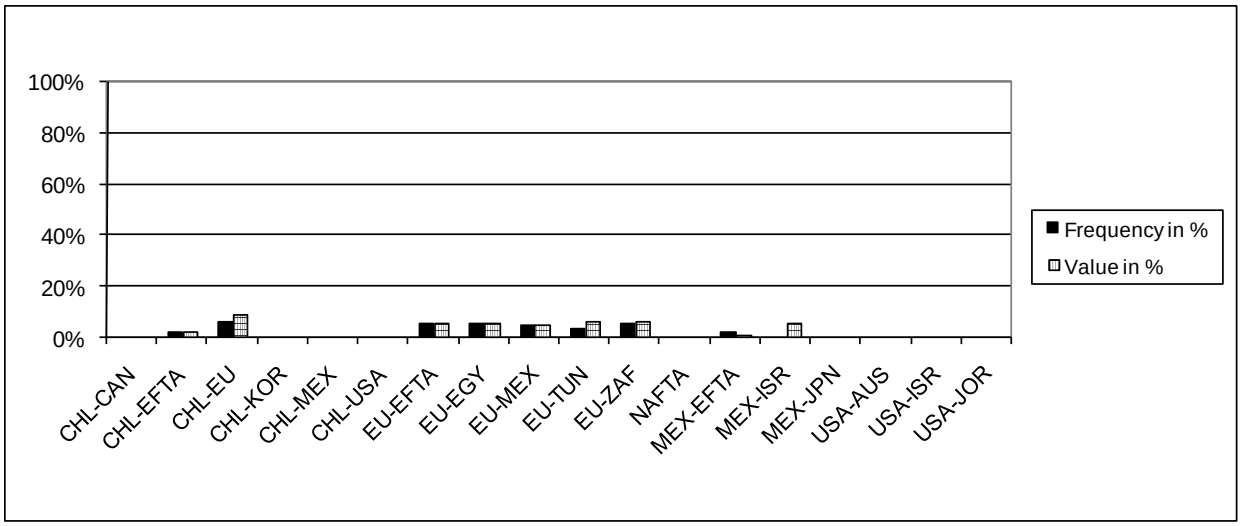
Source: Origin Protocols, own calculations

Figure 4.4. Frequency and Value of CTC and Exceptions (% of Total Rules)



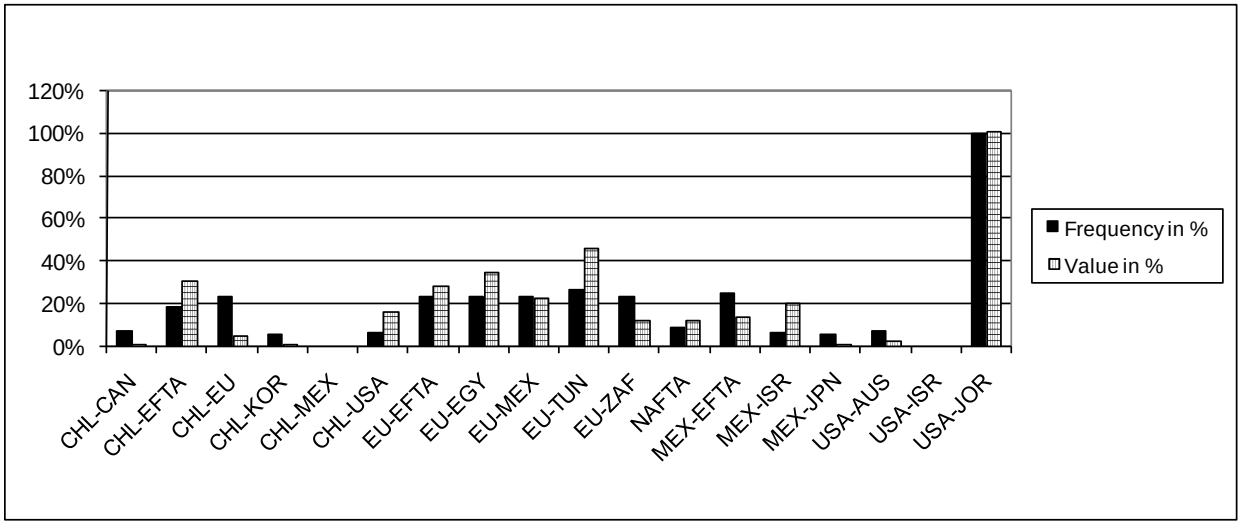
Source: Origin Protocols, own calculations

Figure 4.5. Frequency and Value of Regional Value Content (% of Total Rules)



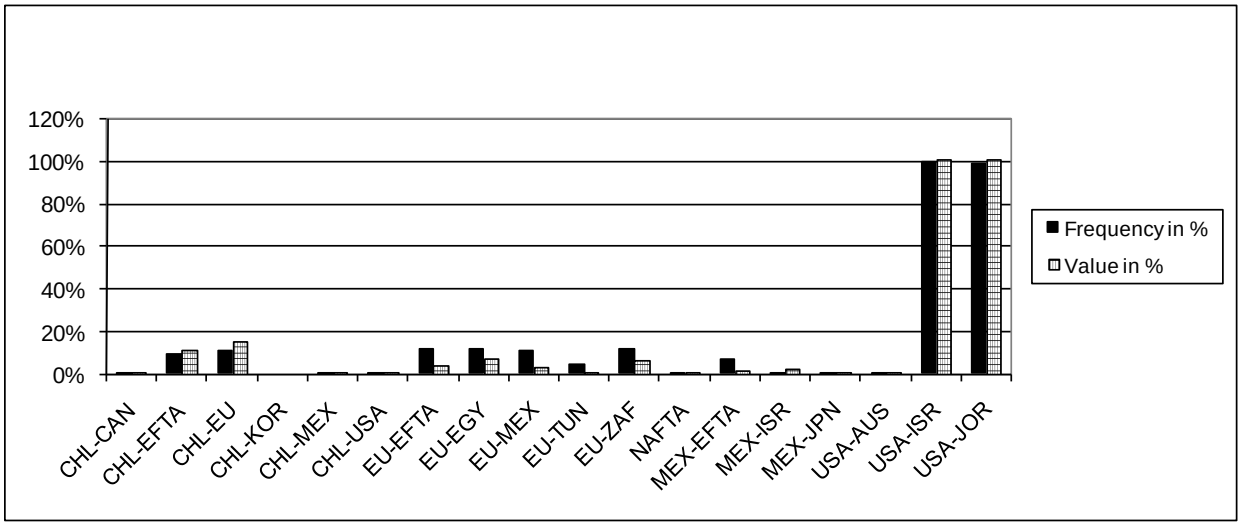
Source: Origin Protocols, own calculations

Figure 4.6. Freq. and Value of Regional Value Content-EU(% of Total Rules)



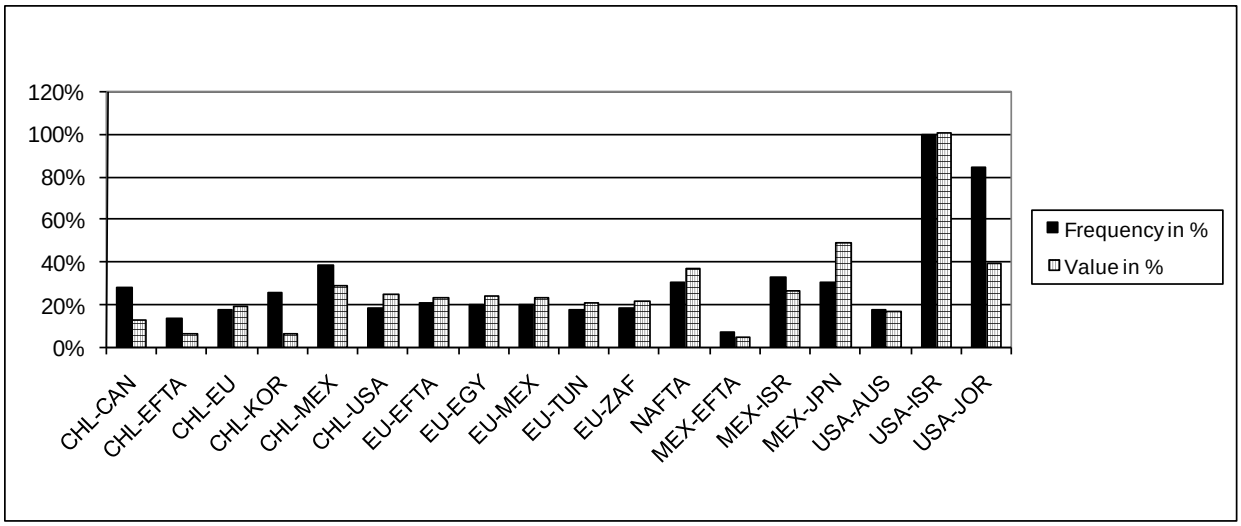
Source: Origin Protocols, own calculations

Figure 4.7. Frequency and Value of Technical Test (% of Total Rules)



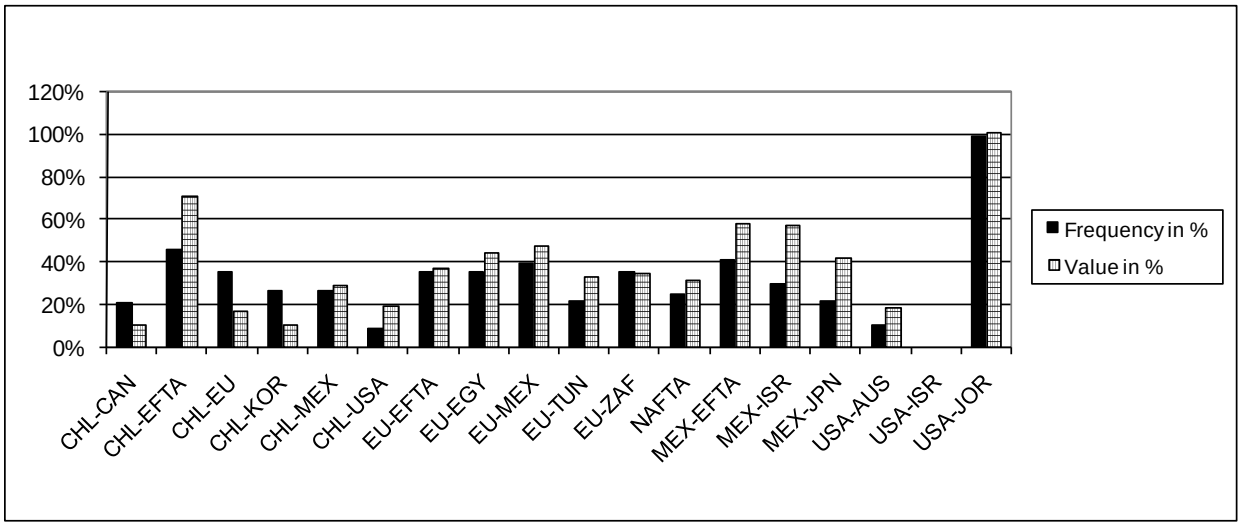
Source: Origin Protocols, own calculations

Figure 4.8. Frequency of Wholly Obtained (% of Total Rules)



Source: Origin Protocols, own calculations

Figure 4.9. Frequency and Value of Combinations of Rules (% of Total Rules)



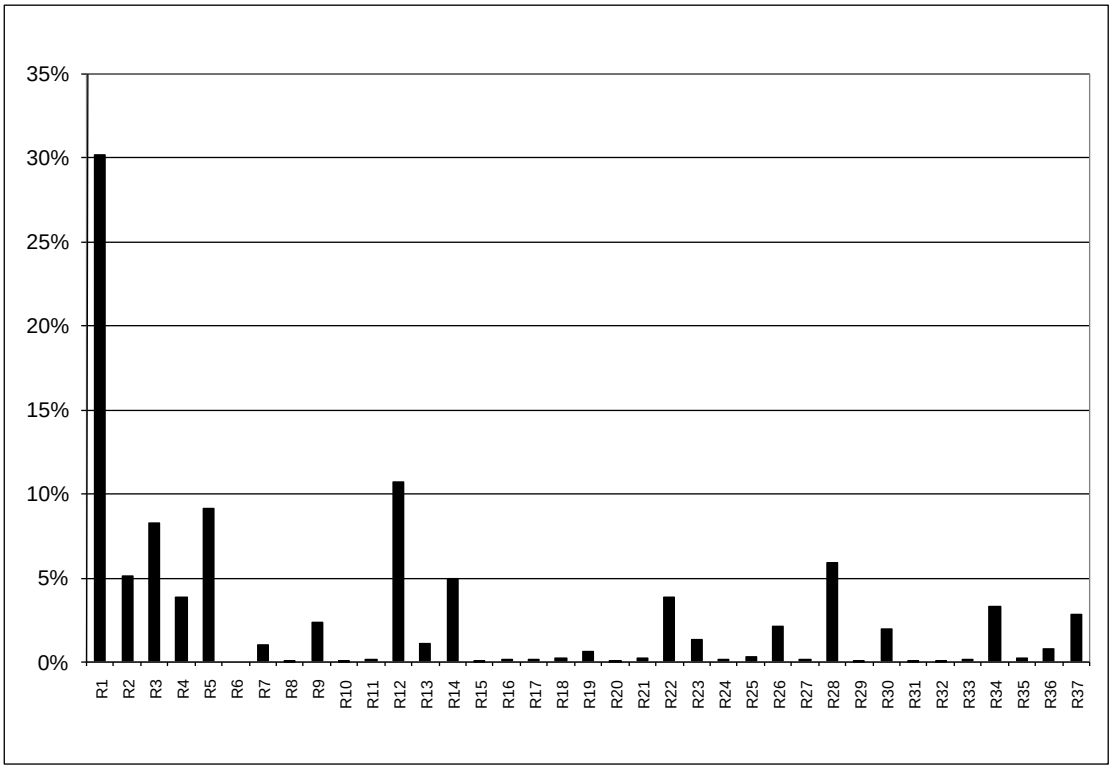
Source: Origin Protocols, own calculations

Figure 4.10. Frequency and Value of Alternative Rules (% of Total Rules)

Figures 4.11 and 4.12 compare a similar aspect albeit focused on "unique" rules. Relative frequencies are provided in Figure 4.11 and relative trade in Figure 4.12. The main difference with previous Figures is that 4.11 and 4.12 look at aggregate trade and frequencies for all agreements, rather than by individual ones. Also, because these rules are unique, the sum of the proportions of frequencies and trade does add up to one. Dividing origin protocols in 37 different rules implies that the frequency of each of them is greatly diminished. As a result, only seven rules are present in more than five percent of the total. By far, the rule that is more present is R1 (CTC), with over 30% of the total.[79] The other rules surpassing 5 percent are R2 (RVC), R3 (TT), R5 (CTC with exception), R12 (alternative between CTC or RVC), R14

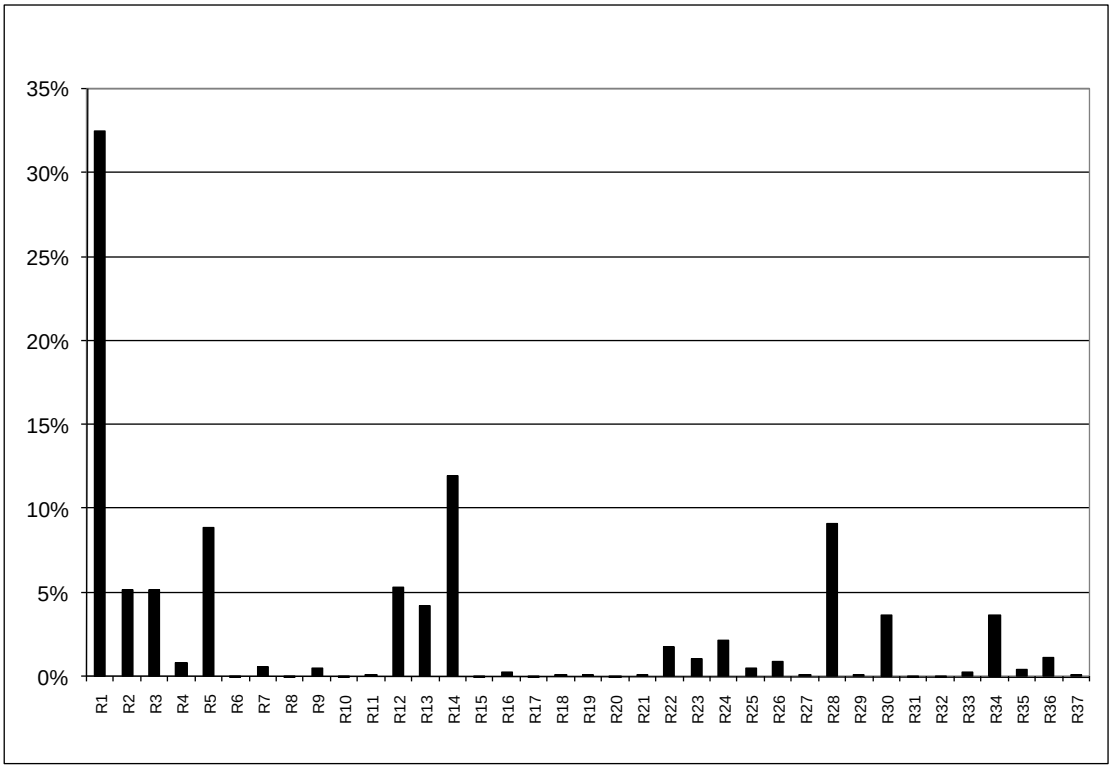
[79] It must be noted that CTC is the sum of CC, CTH and CTS

(combination of CTC and RVC) and R28 (alternative between CTC or CTC combined with RVC). This Figure confirms the prevalence of CTC rules over other type of rules. Another implication of this Figure is that simple rules, i.e. those that are not presented in combination or as an alternative to other rules, are predominant in origin protocols. A similar trend is shown in Figure 4.12 although there exist some notable aspects. R12 (combination of CTC and RVC) increases its share in total trade from its share in total frequency and R14 (alternative between CTC and RVC), diminishes it. These observations are counterintuitive; an alternative should promote trade and a combination, reduce it. Equally, R28 (alternative between CTC or CTC combined with RVC) also shows a higher percentage in terms of trade, whereas R3's (TT) is lower.



Source: Origin Protocols, own calculations

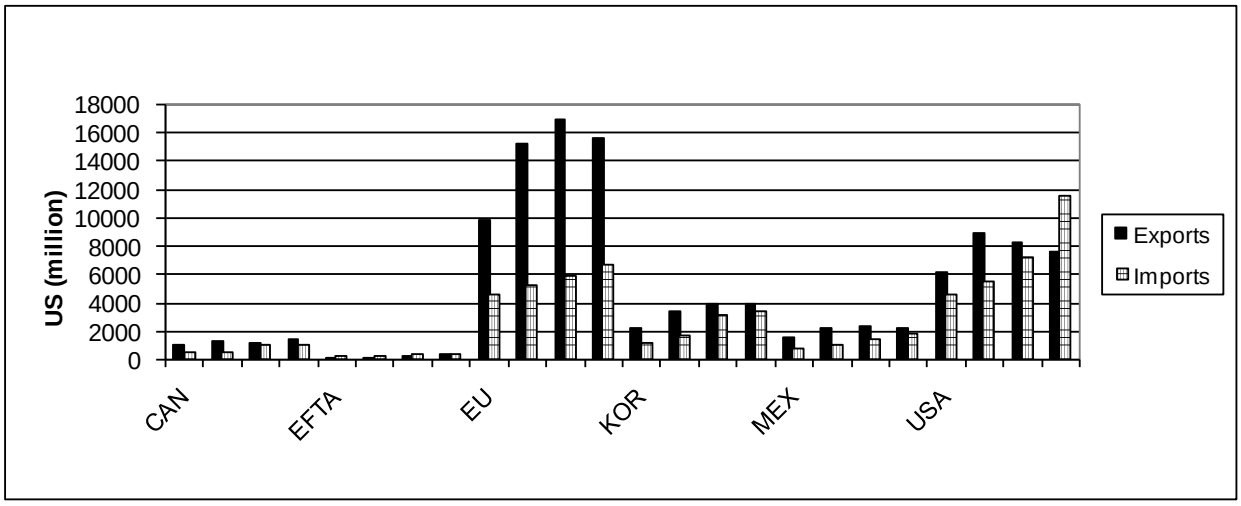
Figure 4.11. Frequency of Each Combination of Rule



Source: Origin Protocols and COMTRADE, own calculations

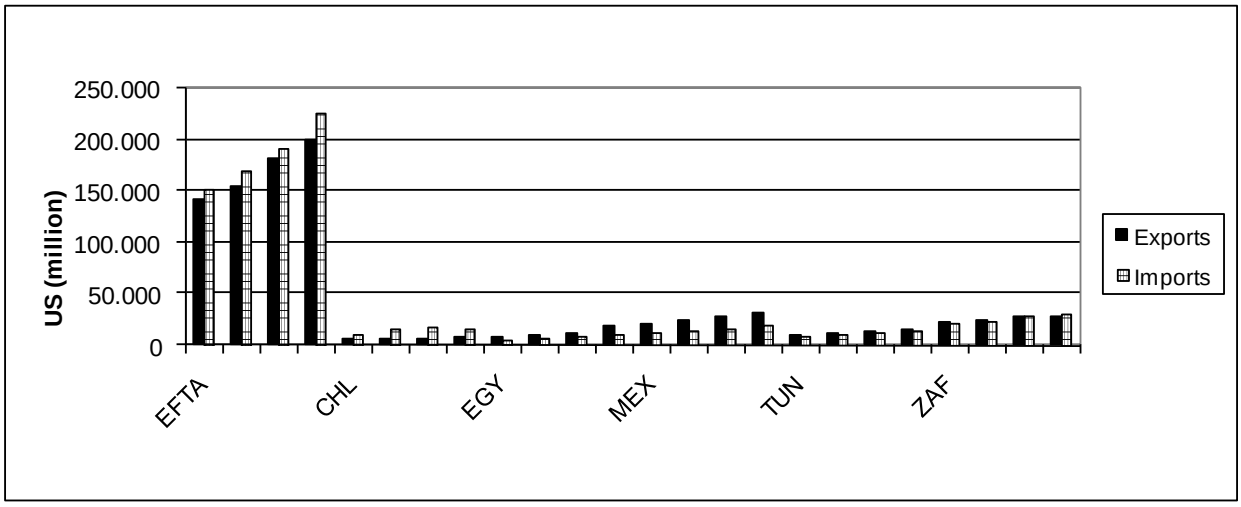
Figure 4.12. Percentage of Total Trade by Type of Rule

The last set of Figures, from Figure 4.13 to Figure 4.16 illustrates trade volumes between reporters and their partners and their evolution over time. The key aspect in these Figures is the existence of very important differences in total trade with their partners for all reporting countries, all having one predominant partner except Chile. Another interesting feature of these Figures is that with the exception of the EU, all countries present considerable differences in their trade balances from one agreement to another. This suggests that there could be additional circumstances affecting their exporting capacity from one market to another, i.e. rules of origin.



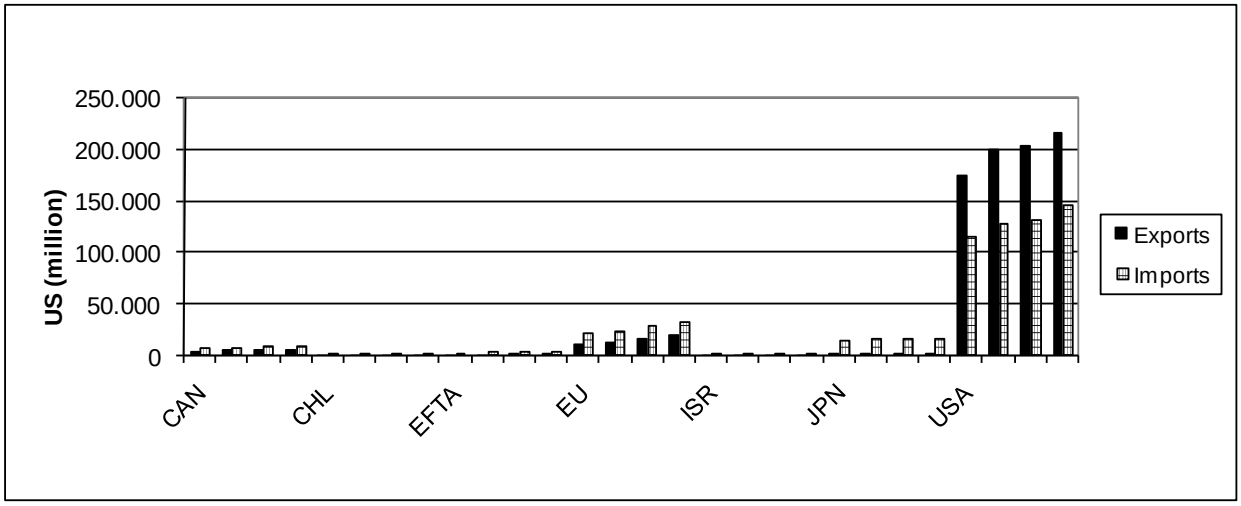
Source: Origin Protocols, own calculations

Figure 4.13. Chile's Total Trade with Partners



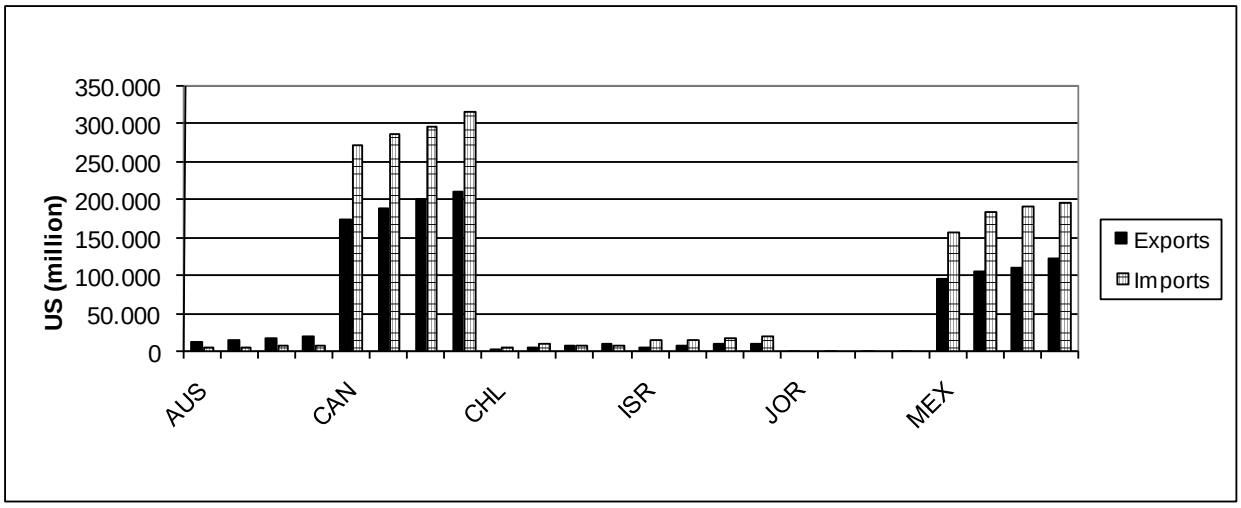
Source: Origin Protocols, own calculations

Figure 4.14. EU's Total Trade with Partners



Source: Origin Protocols, own calculations

Figure 4.15. Mexico's Total Trade with Partners



Source: Origin Protocols, own calculations

Figure 4.16. USA's Total Trade with Partners

4.4. Conclusion

This thesis attempts to provide an estimate of the impact on trade of product specific rules of origin (RoO) and regime-wide provisions, as well as to construct an *ex-post* restrictiveness index on the basis of the results found in the estimations. Therefore, the driving force behind the choice of methodology is how to assess the *ex-post* trade impact of RoO, as opposed to forecasting. The framework chosen for such analysis is the gravity equation, which has been widely used in order to assess different policy variables.

The gravity equation has become in the last decades one of the most popular empirical devices to analyze trade flows, having been used to control for practically any factor potentially influencing trade flows. Two main reasons stand out to place the gravity model as the preferred method of estimation in the context of this study. First, the gravity equation provides a relatively acceptable theoretical framework for the use of RoO. A second crucial reason for choosing gravity modeling as the preferred framework is its good empirical fit. Additionally, a number of theoretical considerations are explored in order to correctly: i) whether the gravity equation suits the desired data sample, consisting of North-North and North-South trade flows; ii) whether the model can evaluated at the disaggregated level; iii) which trade flow can be theoretically sound to be explored. These three questions are looked into by reviewing the theory about the gravity model, which confirms each of the issues. A final theoretical consideration provides a justification to perform the analysis using panel data.

Under the conditions provided for the theoretical aspects, the general equation to be estimated is laid down:

$$TF_{kijt} = \alpha_0 + \beta_1(\eta X_{kit} + \lambda X_{kjt}) + \beta_2(\eta M_{kjt} + \lambda M_{kit}) + \beta_3 d_{ij} + \beta_4 \sum_{i=1}^{I}\sum_{j=1}^{J} D_{ij}$$
$$+ \sum_{k=1}^{K}\sum_{i=1}^{I}\sum_{j=1}^{J} \gamma_{kij} + \sum_{i=1}^{I}\sum_{j=1}^{J} \zeta_{ij} + \sum_{i=1}^{I} \delta_i + \sum_{j=1}^{J} \phi_j + \sum_{t=1}^{T} \chi_t + \varepsilon_{ijt}$$

which will be estimated for total trade, exports and imports.

Subsequently, the approach for modeling the RoO is described. The underlying logic beneath it is to transform the product-specific RoO in dummy variables that can be plugged into the equation and their coefficients estimated. However, the intrinsic complexity of rules the rules of origin calls for the elaboration of four different types of analysis in order to ensure their correct study, each of them requiring its own way of introducing the product-specific RoO. The first method considers all possible interactions of the four families of rules, including combinations, alternatives and exceptions to the main rule; the second method attempts to identify the individual impact of each of the main four families; the third method is an extension of the second, with the difference that divides the main CTC family into its subcomponents (CC, CTH and CTS); and the fourth method assigns an individual value to every possible combination of rules, classifying each of them as a different dummy variable.

One implication of this methodology is that it considers RoO as being exogenous, which may give rise to potential endogeneity bias. The usual way to correct this bias is the use of fixed effects at the individual level. This option is discarded regarding the time-invariant nature of the key variables of interest.

The study analyzes total trade, exports and imports at the 6-digit level for four reporting countries and 16 partner countries for the period between 2005 and 2008, yielding 1,224,833 observations. Trade data is obtained from COMTRADE. Data for rules of origin is obtained directly from the protocols of origin of each FTA. Considering that EU-based protocols amount to around 800 product specific rules and US-based to around 2,000, it yields a total of close to 24,000 rules that need to be coded.

The most frequent rule in origin protocols is CTH, followed by RVC, although these two rules are less commonly used individually and rather are combined or supplemented with other rules. Additionally, these two rules are, on average, represent a higher proportion of total rules present in origin protocols than the trade channeled through them on total trade.

Chapter 5. Estimation and Results

5.1. Estimation

Equations (4.10-a) through (4.10-c) are subject to a number of clarifications from its main form before being estimated, determined either by the choice of the analysis to be performed on the rules of origin or by the type of estimation required, as explained below. The first question is if it is econometrically feasible to estimate equation (4.10-a) through (4.10-c) using panel data, as suggested in the discussion above.

However, before deciding to use panel data, it needs to assessed whether it is possible to add data pertaining to different periods. Therefore, a "poolability" test is conducted. This test consists on performing a Wald test on the time coefficients. Specifically, it tests the null hypothesis of time coefficients being jointly zero.

Table 5.1. Poolability Test

```
( 1)  time1 = 0
( 2)  time2 = 0
( 3)  time3 = 0
           Constraint 1 dropped

           F(  2,455598) =   14.49
                Prob > F =    0.0000
```

The test rejects the null, so it can be concluded that the different period data is relevant and pertain to the model.

Once it has been confirmed the appropriateness of using panel data, the next question is whether to use fixed effects (FE) or random effects (RE). In a RE model it is assumed that

heterogeneity of observations is random and does not correlate with any of the independent variables.[80] The consequence is that the individual effect is included in the constant, through the interaction of the random component u_i. Numerically, this means that a general panel specification:

$$Y_{it} = \alpha_i + \beta_1 X_{1it} + \varepsilon_{it} \tag{5.1}$$

transforms into

$$Y_{it} = \alpha + \beta_1 X_{1it} + u_i + \varepsilon_{it}, \tag{5.2}$$

as the intercept now becomes $\alpha_i = \alpha + u_i$. In the case where $\sigma_u^2 = 0$, there is no difference between equations (5.1) and (5.2). Therefore a suitable test to assess the benefit of using an RE over a pooled equation is given by the Breusch-Pagan test. The null hypothesis is that $\sigma_u^2 = 0$, therefore, rejecting the null implies that there is a difference between (5.1) and (5.2) and hence the RE model should be used.

Table 5.2. Breusch-Pagan Test for Random Effects

```
Breusch and Pagan Lagrangian multiplier test for random
effects:

        lvalue[idp,t] = Xb + u[idp] + e[idp,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                  lvalue |   11.94447       3.456077
                       e |   4.576555       2.139288
                       u |          0              0

        Test:   Var(u) = 0
                             chi2(4.1) =  2.5e+07
                        Prob > chi2 =     0.0000
```

The tests clearly rejects the null, so the RE is superior to the pooled estimation. On the other spectrum, an FE model assumes that individual heterogeneity (in this case, country heterogeneity), is constant over time and specific to each individual, but uncorrelated to the

[80] The discussion about fixed and random effects is largely based upon Aparicio and Marquez (2005)

error term. Hence, the difference within individuals is captured by the constant α_i, which varies from individual to individual. In FE specification, (5.1) maintains its form, since the unobserved heterogeneity is kept by the intercept, which now varies across countries. The test to evaluate the presence of fixed effects, as opposed to the pooled specification is equally an F-test, based on the joint significance of the individual effects.

Table 5.3. Fixed Effects Test

```
( 1)  idpdum1 = 0
( 2)  idpdum2 = 0
( 3)  idpdum3 = 0
( 4)  idpdum4 = 0
( 5)  idpdum5 = 0
( 6)  idpdum6 = 0
( 7)  idpdum7 = 0
( 8)  idpdum8 = 0
( 9)  idpdum9 = 0
(4.10)  idpdum10 = 0
(4.11)  idpdum12 = 0
(4.12)  idpdum13 = 0
(4.13)  idpdum14 = 0
       Constraint 5 dropped

       F( 12,455598) = 2265.63
            Prob > F =    0.0000
```

Again, the null is rejected so the inclusion of fixed effects in the model is well justified. This leaves the question as to what model is preferred, RE or FE. The first decision rule is theoretical. Using RE requires the assumption of the observations being randomly drawn from a population and that the individual effects are not correlated with the regressors. This, in principle is a hard assumption to maintain in trade settings, where the characteristics of trade patterns are inherent to each country. In addition, a further argument, based on Baier and Bergstrand (2005) encourages the use of fixed effects. This argument refers to the fact that there may be "random" factors influencing both the stringency of RoO and the volume of trade, for instance large trading companies could have important lobbies. Although these factors are "random", FE allow arbitrary correlations between them and the RoO.

An additional way to decide between RE and FE is based on econometric grounds and is given by the Hausman test. This test is based on the idea of no correlation between the individual effects and the regressors, both FE and RE coefficients should be similar. If this is the case, it can be assumed that the individual effects are not correlated to the regressors.

However, if the null is rejected, there is evidence for such correlation and hence FE is preferred.

Table 5.4. Hausman Test

```
 b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained
from xtreg

Test:  Ho:  difference in coefficients not systematic

chi2(4.17) = (b-B)'[(V_b-V_B)^(-1)](b-B)=    21526.82
                Prob>chi2 =      0.0000
                (V_b-V_B is not positive definite)
```

The test rejects the null of systematic difference of the coefficients, which confirms the theoretical argument in favor of FE rather than RE.[81]

Other benefits arise from the introduction of country fixed-effects, which account for the unobserved price effects, as shown in the theoretical discussion. Also, the inclusion of the fixed effects solves the heterogeneity bias encountered in cross-section estimation. This bias refers to the bias induced[82] in OLS due to omitted heterogeneity. In other words, certain unobserved characteristics of the individuals may influence the dependant variable despite not being observed, and it can lead to omitted variable bias. Cheng and Wall (2004) note this problem arises because standard cross-section does not allow countries to differ from each other. Hence, two countries with similar size and distance from a third country should experience a similar level of trade with that third country. According to Wall (2000), the consequence of this bias is that unless accounted for, heterogeneity tends to overpredict trade between low-volume traders and underpredict trade between low-volume traders. Similarly, Baier and Bergstrand (2005) find that heterogeneity bias may cause flows to be underestimated by as much as 75 percent. Other than adding more information to the sample, the use of panel data seems therefore appropriate in order to include fixed effects that can correct the heterogeneity bias.

---

[81] Although the preferred choice is the FE model, RE estimation was also performed for robustness. Results are reported in Appendix 5.1

[82] Hutchinson (2002) notes that introducing country fixed effects in a disaggregated trade setting will not solve heterogeneity bias, as heterogeneity relates to the commodity level. Introducing fixed effects at the product level would sweep away all time-invariant information, including that pertaining to RoO and this study would hence lose all its purpose. The extent to which heterogeneity bias may be present remains therefore a possible caveat of the present estimation.

Fixed effects are introduced into the equation as $\sum_{i=1}^{I} \delta_i$ for the reporter (I=4) and $\sum_{j=1}^{J} \phi_j$ for the partner country (J=16). In both cases they are dummy variables which take the value of one for each reporting and partner country, with their summatory adding up to one. However, adding a country specific variable for each of the reporting and partner countries highly increased the collinearity of the variables in the equation, putting in the danger the robustness of the results. Therefore, two transformations are made in order to reduce collinearity. First, reporter specific country effects are grouped into two groups, developed and developing countries. Therefore, $\sum_{i=1}^{I} \delta_i$ becomes an individual dummy variable that takes the value of one for the EU and the US and zero for Chile and Mexico. Secondly, a further transformation was needed in the partner country dummies. The solution was to cluster Switzerland, Norway and Iceland into one group as European Free Trade Area (EFTA) members, hence reducing J from 16 to 14. Table 5.5 shows the collinearity diagnostic before and after the transformations mentioned, i.e. dropping cumulation, combining developed country reporters and merging EFTA countries.

Table 5.5. Collinearity Diagnostic

Variable	Before Transformation		After Transformation	
	VIF	Tolerance		Tolerance
Limp	1.15	0.8709	1.13	0.8874
Lexp	1.18	0.8468	1.13	0.8818
Ldist	77.25	0.0129	7.24	0.1382
Contig	30.01	0.0333	4.23	0.2364
Lang	2.90	0.3442	2.16	0.4626
Fullcum	30.68	0.0326	NA	NA
Selfcer	243.29	0.0041	9.97	0.1003
Cc	4.62	0.2166	4.60	0.2174
Cth	5.96	0.1677	5.94	0.1682
Cts	3.57	0.2805	3.56	0.2812
Rvc	6.25	0.1599	6.21	0.1610
Rvceu	1.47	0.6825	1.46	0.6831
Tt	4.66	0.2146	4.64	0.2157
Wo	3.92	0.2554	3.85	0.2595
Comb	4.34	0.2306	4.32	0.2316
Alt	4.19	0.2386	4.18	0.2391
Exc	1.22	0.8178	1.22	0.8188

Note: Collinearity diagnostics for reporting and partner country as well as time effects are omitted.

Once the decision is made as to estimate equation (4.10) using FE, the estimation technique needs to be specified. One common approach is to use the within-groups fixed effects. This method calculates the average for each variable and subtracts them from the data, yielding:

$$Y^*_i = \alpha_i + \beta_1 X^*_{1i} + \varepsilon^*_{it}, \tag{5.3}$$

where the asterisk denotes the mean value. Subtracting (5.3) from (5.4), gives

$$Y_{it} - Y^*_i = \beta_1 (X_{1it} - X^*_{1i}) + \varepsilon_{it} - \varepsilon^*_{it} \tag{5.4}$$

which sweeps away the individual effects. The one drawback of this method is that it eliminates all the information about time-invariant variables, which become part of the

unobserved. This caveat eliminates this method as a possible path for the present study, as its main outcome is to estimate the impact of time-invariant RoO.[83] The solution is then to estimate the model using Least Square Dummy Variables, which consists of assigning one dummy variable to each of the different group fixed effects. These dummies account for all the unobserved group effects, which are then brought into the equation.

There are three major sources of concern regarding the use of the Least Squares Dummy Variable (LSDV) model. First, LSDV may raise problems as the number of individuals tends to infinity. The consistency of the dummy variables coefficients suffers as N increases, as the number of dummy variables increases alongside, leading to inefficient parameters.[84] This is not the case in this sample, where N(=J)= 16. Second, as the number of variables increases, the degrees of freedom may be severely reduced. Once again, this is not a major issue in this sample where J is limited to 14. Third, a problem which is regularly linked to LSDV is that it cannot be used to estimate time-invariant variables since dummies are perfectly collinear with constant or quasi constant variables. This is true when there is no variation within-group, as the dummy variable absorbs all the variation across groups, leaving just within group information. This is the case when a different fixed effect is computed for each individual in a sample. In the present study, however, fixed effects (dummies) are allocated to countries, while observations are conducted at the product level. The problem highlighted here would be relevant if observations took place at aggregate level or if the fixed effects where assigned to each product instead of to each country.[85] In such case and assuming Gauss-Markov assumptions and non-stochastic regressors, LSDV estimator is unbiased, consistent and linear efficient, as noted by Kunst (2010).

Having specified the estimation technique, variables $\sum_{i=1}^{I}\delta_i$ and $\sum_{j=1}^{J}\phi_j$ in equation (4.10), are introduced in the equation as dummy variables, such that

$$\sum_{i=1}^{I}\delta_i = 1 \text{ with } I=4$$

[83] There is nothing preventing specific rules of origin from varying over time. Indeed, it is not uncommon to renegotiate the rules and change them. However, the degree of variation for the selected sample is neglegible.
[84] This is known as the "incidental parameter problem", first found by Neyman and Scott in 1948.
[85] See Matyas (1997), Aiello *et al* (2008) or Pastore *et al.* (2009) for examples of this type of framework.

and

$\sum_{j=1}^{J} \phi_j$ =1 with J=16

Table 5.6. Breusch-Pagan Test for Heteroskedasticity

```
      Breusch-Pagan   /   Cook-Weisberg   test   for
heteroskedasticity
             Ho: Constant variance
             Variables: fitted values of lvalue

             chi2(4.1)      = 54468.77
             Prob > chi2  =   0.0000
```

In connection with the discussion above, the bias of Ordinary Least Squares (OLS) is likely to be higher in the presence of heteroscedasticity. Therefore, I conduct a Breusch-Pagan test to test for the homogeneity of the variance of the residuals. The results are very conclusive in rejecting the null that the residuals have constant variance:

Thus, in order to correct heteroscedasticity problems and, in turn, minimize the extent of the bias highlighted above, the White heteroscedasticity-consistent (HC1) covariance matrix estimator of standard errors is used.

A final concern with panel data is its tendency to show autocorrelation. Autocorrelation refers to the fact of the error term in one period being correlated to the error term in previous periods. Under the strict exogeneity assumption of FE, $E(x_{it}u_{is}) = 0$, which implies that the error term cannot be correlated to previous errors. This translates into $u_t = \rho u_{t-1} + \varepsilon_t$, where ρ is the coefficient of autocorrelation. In such case, the variance of the parameter is affected and the OLS estimator is no longer efficient, hence affecting the t-values. Autocorrelation is a common problem in trade panel data as it is usually the case that trade flows in one period are influenced by trade flows in previous periods. It therefore becomes necessary to test its existence.

The method used to test the prevalence of autocorrelation is the Breusch-Godfrey test. This test builds on the assumption that if no autocorrelation is present, the residuals from the estimated equation should not be correlated with their lagged residuals. In order to do this, a second regression is run on the residuals from the first equation over the lagged residuals under the null that the lagged residuals are zero. If the null is rejected, the lagged residuals are different from zero and there is autocorrelation.

Table 5.7. Results from the second regression running the residuals over the lagged residuals
And the test on the coefficients of *e1* and *e2*

	Residuals
E1	0.012
	(14.06)**
E2	0.011
	(11.86)**
Constant	0.019
	(0.15)
Observations	455629
R-squared	0.00
Robust t-statistics in parentheses	
* significant at 5%; ** significant at 1%	
Note: Output for all other variables is omitted	

Table 5.8. Significance of Lagged Residuals

```
test e1 e2

 ( 1)  e1 = 0
 ( 2)  e2 = 0

       F(  2,455594) =  171.16
            Prob > F =  0.0000
```

which confirms the presence of autocorrelation.

One solution to circumvent this issue is to estimate an alternative equation that accounts for ρ. In such equation, all the variables are transformed, yielding:

$$Y_{it}^{*} = \beta X_{it}^{*} + \varepsilon^{*}_{it} \ , \qquad (5.5)$$

where the asterisk denotes the following transformation

$$X_{it}^{*} = (X_{it} - \rho X_{it-1}) \tag{5.6}$$

and equivalently for the dependant variable. Equation (5.5) is derived in such way so as to yield $\operatorname{var} \varepsilon_{it}^{*} = \sigma^2 I$, therefore implying that the error terms in the equation are uncorrelated with equal variance. This process is known as Generalized Least Squares and it is equivalent to applying OLS to a linear transformation of the data. According to Greene (2003), if we assume that the errors of the transformed equation are uncorrelated to the regressors ,i.e. $E[\varepsilon_{it}^{*} / X_{it}^{*}] = 0$, the Generalized Least Squares (GLS) estimator is unbiased, consistent efficient and asymptotically normally distributed.

The capacity of this method to solve autocorrelation while accounting for heteroscedasticity, makes it the preferred estimator to perform the regressions. Wooldridge (2002) states that this estimator is a natural way to follow when there is evidence of serial correlation. Hence, GLS is used throughout the analysis. This GLS estimation with fixed effects is in line with the work of Iwanow and Kirkpatrick (2007) and Antonucci and Manzocchi (2006).

A final concern regarding model specification regards the transformation of the variables into logarithms. This transformation is not strictly needed for the regression.[86] However, it greatly helps reducing the dispersion of the data. Even more when the study concentrates of disaggregated trade data between 28 country pairs. A further benefit of the log-transformation is that it provides a useful interpretation of the coefficients. This approach has been widely used for empirical research in the gravity setting and has also been used to derive the theoretical gravity equation in contributions such as those of Feenstra *et al.* (2001), Haveman and Hummels (2004) or Head and Mayer (2002).

However, the log-transformation brings along one consequence, this is, it discards all zero-trade in the sample, as the logarithm of zero is undefined. Three possibilities can be used to deal with zero values: i) discard those observations; ii) add a small value to each of them; and iii) more refined estimation techniques, such as Santos and Tenreyro (2006), who suggest an alternative specification for the gravity model based on a Poisson Pseudo-Maximum Likelihood estimation technique. This approach has been followed and extended by other studies such as Burger *et al.* (2009), who highlights Poisson's model problems of over-

[86] In fact, as pointed out in the previous paragraphs, GLS estimator is already asymptotically normally distributed.

dispertion and suggests a modified Poisson fixed-effects estimation (negative binomial, zero-inflated). Other contributions include Martinez-Zarzoso *et al.* (2007) who use a Gamma Pseudo-Maximum-Likelihood estimation technique. According to Van Bergerijk and Brakman (2010) using the first two procedures is correct as long as the zeroes are randomly distributed along the sample. If they are not, as is usually the case, they induce selection bias. However, despite the possibility of the bias and the new techniques mentioned above, this discussion is still unsettled. Authors such as Linders and Groot (2006) or Martin and Pahm (2008) or Baier and Bergstrand (2005), who compare a wide range of estimation techniques suggest that truncated OLS may result in the preferred option for estimation.[87] Accordingly, throughout this study, and in view of the advantages of a log-linearized model, truncated zero trade will be used, which may, however induce selection bias as mentioned above.

5.1.1 Model Predictions

In view of the literature discussed in previous chapters, the following are the predictions for each of the variables of interest.

CTC: All rules based on changes in tariff classification are thought to be relatively lenient. However, its dispersion should vary widely from the more restrictive change in tariff chapter to the more lenient change in tariff subheading. The reason is that a change in tariff chapter eliminates all other components from the same chapter, while the change in tariff subheading does so only for the other components of the subheading, hence limiting a smaller number of materials.

<u>Prediction 1</u>: CC > CTH > CTS

RVC: Rules that have a regional value content requirement or an import limitation depend widely on the extent of the requirement, i.e. it usually goes from 25 percent to 50 percent of local value. Therefore, the extent of the rule itself is not easy to predict. Estevadeordal (2000) establishes it half-way in its restrictiveness index (4 out of 7) albeit always in combination with a different rule. Likewise Cadot *et al.* (2006) sets it at 4 out of 7 if the requirement is to add less than 40 percent of local content and 5 out of 7 if it is more than that. Therefore:

[87] Martin and Pahm points out that while the Poisson Pseudo-Likelihood Model does react better in presence of heteroskedasticity, it is found to be strongly susceptible to limited-dependant variable bias when a substantial fraction of the observations are censored, which is likely to be the case in international trade.

Prediction 2: CC>RVC=CTH>CTS

Prediction 3: CTC=RVC

RVCEU: This sort of rule sets a threshold on the limit of a given product that can be used. It targets certain materials that are commonly used in the manufacturing of a product.

Prediction 4: RVCEU>RVC

Technical Test: These type of rules offer the widest range of discretion by legislators as they require a specific transformation to be made on the product. The motivation behind this requirement offers many interpretations, but a very plausible one is that powerful pressure groups lobby legislators to strengthen the rules and act as potential barriers. However, authors differ on this point; while Estevadeordal (2000) sets it in the most restrictive layer (although in combination with another rule), Cadot *et al.* (2006) assign the second least restrictive value.

Prediction 5: TT>RVC

Prediction 6: TT>CTC

Prediction 7: TT=CC

Wholly obtained: Rules that require all materials used to be wholly obtained in the country of origin are usually more commonly used in agricultural products. While unprocessed agricultural products in general would typically comply easily with this rule, processed products may find in it a daunting barrier. Given its more common use in lower levels of processing, it is reasonable to assume that it is a trade-conducive rule.

Prediction 8: WO<Any other rule

Exception: Adding an exception to a CTC can unmistakably be prejudicial for trade, as it restricts the number of products that prevent conferring originating status.

Prediction 9: Exception has negative coefficient

Combination: Likewise, requesting to comply with two rules instead of one necessarily adds complications to the manufacturer. Thus:

Prediction 10: Combination has a negative coefficient

Alternative: On the contrary, allowing to choose between two different rules relaxes the restrictiveness of the rule, as the manufacturer can comply with either of them in order to gain originating status.

Prediction 11: Alternative has a positive coefficient.

"Unique rules": The large amount of rules included in this set precludes the prediction of each of them. However, in line with previous predictions, any rule that includes an alternative between two or more rules should be trade facilitating. Similarly, any rule that requires any combination of rules should be trade obstructing. In parallel, part of the criticism about rules of origin lies not only on the restrictiveness of the rules but on their complexity. It is not only a matter of adapting production to the requirements of the rule but it may also become a complicated process to understand.

Prediction 12: Rules that include and alternative are more facilitating than rules that require a combination of two or more criteria.

Prediction 13: Simple rules (i.e., those defined in the lower numbers of the scale) are more trade-conducive than complex rules

Selfcertification: This provision allows the manufacturer to issue his own proof of origin without having to be inspected by public authorities. In line with the argument of the previous paragraph, part of the restrictiveness of the rules resides on the difficulty to comply with the process rather than with the rule itself. Permitting the manufacturer to independently produce its proof of origin should invariably be trade promoting as it represents a way of removing red tape.

Prediction 14: Selfcertification has a positive impact on trade flows.

Lastly, in line with gravity literature, coefficients of the reminder variables should take the following sign:

Table 5.9. Expected Gravity Coefficients

Variable	Coefficient Sign
LEXP	(+)
LIMP	(+)
DIST	(-)
LANG	(+)
CONTIG	(+)

5.2. Results

5.2.1 Presentation of the Results

Estimation results are provided in Tables 5.10 through 5.12. The dependant variable in all three tables is total trade in column one, total exports in column two and total imports in column three.[88]

Table 5.10 corresponds to estimation method 1, explained in Chapter 4. It illustrates the results for all combinations of rules. It can be thought as being the most general of the three as it observes trade in all goods, accounting for every type of rule of origin, including combinations, alternatives and exceptions.

The results in Column (1) indicate that this model specification explains 72 percent of total trade. All variables are significant at the one percent level except *RVCEU* and *COMB*. Size

[88] Exports and Imports from Mexico and Chile to the EU and the US, and from Mexico to Chile are excluded from the sample. The opposite flows are recorded for the EU, the US and Chile, respectively. Adding them implies including the same information to measure two different things, exports to one country and imports from the other. All the equations have been estimated with partner fixed effects and development dummy for reporters EU and US, as well as time dummies. Coefficients on those variables are not shown.

variables (total imports and total exports) both have the expected sign. The magnitude of their coefficients is .481 for the total exports and .301 for total imports.

The distance coefficient is negative although smaller than negative one, as the standard gravity model predicts (-.542). The coefficient on *CONTIG* is positive, as expected (1.25). Finally, the coefficient on common language also shows the expected positive sign (.50).

The coefficients on the specific rules of origin reveal interesting results. All rules cause overall trade to diminish except regional content rules (*RVC*). Inclusion of this rule increases trade by 8 percent. The most trade restrictive rule is wholly obtained (*WO*); products with a *WO* rule are traded 36 percent less holding everything else constant. Technical tests (*TT*) are almost as trade-restrictive, diminishing trade by 34.7 percent. Equally, rules adopting a change in tariff chapter do so by 33.8 percent; adding the possibility to choose between two or more rules (*ALT*) increases trade by 13.1 percent. Combining two rules and the special case of European value content are not significant at the 10 percent level. *CTH* also has a negative impact on total trade (-.146), which is smaller than the impact of *CC*, but larger than the hampering effect of *CTS* (-.115)

Finally, allowing exporters to produce their own proof of origin (*SELFCER*) increases total trade by 40 percent.

Results for exports are displayed in Column (2). Now, a larger proportion of the dependant variable is explained by the model (R-squared = 0.79). Again, most variables are significant at the one percent level. In terms of variable significance, *COMB* is now significant at the one percent level; *RVC* loses significance although it still is at the 10 percent level; and *ALT* in only significant at the five percent level.

All variables are significant at the one percent level with the exception of *COMB*, and *RVCEU*, which is significant at the five percent level.

The coefficients on the standard gravity variables are comparable to the previous case, although they show some variation in size. The gap between exporter's and importer's size coefficient is now widened (.621 and .244, respectively); since the dependant variable is now exports, the argument put forward by Marchetti (2009) seems to be reinforced. The importance of distance decreases, although this is done in approximately the same

proportion as the *CONTIG* coefficient increases, i.e. distance is reduced from -.542 to -.419 while *CONTIG* increases from 1.25 to 1.43. Additionally, the coefficient on language increases to .89. Taken together, these variables suggest that exporters may have well established markets to which they direct their products.

The coefficients on the specific rules of origin show some relevant variations from those for total trade. Namely, all rules increase their negative impact on trade, with the exception of *CC* (-.335). Surprisingly, *COMB* now becomes positive; this result is counterintuitive. At the same time, *ALT* reduces its positive impact (.048) and adding an exception to a *CTC* is not as trade damaging (-.148). Likewise, self-certification, though still favoring trade, diminishes its importance (.34).

Estimates for imports as dependant variable are provided in Column (3). The model fit is now slightly lower (R-squared = .69). The size of the coefficients moves in the opposite direction than for exports. The gap between the relative importance of exporter's and importer's size practically disappears, their coefficients now being .436 for the exporter and .431 for the importer. Imports reveal being more sensitive to distance than exports, i.e. the distance coefficient is now -.616. Both the impact of having a common border and sharing a common language is diminished (1.205 and .369, respectively).

Regarding specific rules of origin, all rules are now significant except *CTH*. Their impact on imports is as follows: the most restrictive rule is now *TT* (-.21), while *WO*, which was the most restrictive rule before, now shows a positive impact on imports (.211). *RVC* is again the most trade conducive rule; including it raises imports by 22.9 percent. The negative impact of *CC* is reduced to -18 percent, while that of *CTS* is -14.3 percent. *RVCEU* is significant at the five percent level, as opposed to the two previous instances; it has a negative coefficient of -.131. Adding an exception to a rule reduces imports by -24 percent. The coefficient for *ALT* is now significant at the one percent level and increases its size to -178. *COMB*, is again negative and highly damaging, reducing imports by 22.1 percent. Finally, *SELFCER* greatly augments its size to .828.

Table 5.10. Combination of Rules

	(1)	(2)	(3)
	All Trade	**Exports**	**Imports**
LIMP	0.301	0.244	0.431
	(154.43)***	(85.89)***	(100.33)***
LEXP	0.481	0.621	0.436
	(240.19)***	(164.12)***	(141.08)***
DIST	-0.542	-0.419	-0.616
	(31.17)***	(12.41)***	(28.97)***
LANG	0.503	0.890	0.369
	(25.84)***	(37.08)***	(16.30)***
CONTIG	1.251	1.430	1.205
	(41.47)***	(36.06)***	(25.43)***
SELFCER	0.404	0.340	0.828
	(12.09)***	(10.56)***	(17.09)***
CC	-0.338	-0.335	-0.180
	(11.31)***	(10.11)***	(4.45)***
CTH	-0.146	-0.298	-0.039
	(6.12)***	(11.50)***	(1.11)
CTS	-0.115	-0.299	-0.143
	(4.20)***	(9.88)***	(3.76)***
RVC	0.085	-0.045	0.229
	(3.41)***	(1.68)*	(6.20)***
RVCEU	-0.002	-0.057	-0.131
	(0.06)	(1.39)	(2.22)**
TT	-0.347	-0.394	-0.210
	(12.83)***	(13.25)***	(5.29)***
WO	-0.360	-0.568	0.211
	(10.55)***	(14.55)***	(3.98)***
COMB	0.005	0.263	-0.221
	(0.22)	(10.91)***	(6.63)***
ALT	0.131	0.048	0.178
	(6.50)***	(2.27)**	(5.76)***
EXC	-0.244	-0.148	-0.242
	(13.20)***	(7.11)***	(10.53)***
Constant	1.360	-0.675	1.629
	(7.03)***	(2.50)**	(6.17)***
Observations	437101	240193	196908
R-squared	0.72	0.79	0.68
Semi-robust t-statistics in parentheses			
*** significant at 10%; ** significant at 5%; *** significant at 1%**			

The results for the grouped rules (Methods 2 and 3) are displayed in Tables 5.11 and 5.12. The analysis of these two tables diverges from the previous one in that in order to isolate the effect of individual rules; it does not take into account any product which is subject to more than one of them. The implication of this is that the rules are now a linear combination of the others so one variable needs to be dropped to avoid the "dummy variable trap". Throughout both tables, *RVC* is the rule that has been dropped so it acts as a benchmark for the remaining rules. There is only one difference between Tables 5.11 and 5.12: *CC*, *CTH* and *CTS* are recorded individually in Table 5.11 and combined into *CTC* in Table 5.12.[89] Therefore, both tables illustrate the same results for all the remaining variables.

With some slight differences, the fit of the models is the same as in Table 5.10 for total trade, exports and imports. All variables are significant at the one percent level in both tables with the exception of *CC*, which is significant at the five percent level when exports is the dependant variable. Likewise, "gravity variables" show comparable coefficients, both in sign and size.

In terms of total trade (Column (1)), *RVC* is by far the least restrictive rule; all others diminishing trade by at least 30 percent (29.6 percent in the case of *CC*). *WO* is confirmed as the most restrictive for overall trade reducing it by 60.8 percent compared to *RVC*. The coefficient on *TT* is -.351 that of *RVC*. When combined into one single rule as a change in tariff classification (*CTC*, Table 5.12), this rule is -30.3 percent more restrictive than *RVC*. Interestingly, the disaggregation of these three rules seems at odds with the predictions. *CC* appears as the least damaging (-.296), followed by *CTH* (-.301) and then *CTS* (-.377). Again, the coefficient on *SELFCER* indicates a large and positive reaction of total trade to this policy (.581).

In terms of exports (Column (2) in Tables 5.11 and 5.12), *RVC* remains as the most trade facilitating rule, although the difference with the rest of the rules is less pronounced than for total trade. *WO* remains considerably negative (-.613); the coefficient of *TT* is now -.26; and *CTC* -.210. When observed individually, *CTH* becomes now the most prejudicial for exports of the three (-.211), followed by *CTH* (-.152) and *CC* (-.110). The impact of self certification for exports is, as in Table 5.10 above, somewhat dampened compared to total trade (.350).

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[89] RVCEU is not considered in either table as it cannot be considered part of any of the four standard families of rules.

Regarding imports (Column (3) in Tables 5.11 and 5.12), *RVC* continues to be the most trade conducive rule, with *TT* as the most restrictive (-.306). *WO* goes from being the most restrictive for exports to follow *RVC* in terms of promoting trade (-.240). *CTC* reduces imports by 28.2 percent compared by *RVC*. When observing its three components in Table 5.11, *CC* and *CTH* show a similar impact -.275 and -.274 respectively; *CTS* exhibits a surprisingly damaging effect (-.577). Lastly, the coefficient on self-certification attains its highest value (1.041).

Table 5.11. Grouped Rules

	(1)	**(2)**	**(3)**
	All Trade	**Exports**	**Imports**
LIMP	0.293	0.240	0.407
	(113.77)***	(59.68)***	(63.10)***
LEXP	0.508	0.644	0.441
	(191.33)***	(114.92)***	(96.94)***
DIST	-0.530	-0.401	-0.548
	(18.05)***	(7.44)***	(15.47)***
LANG	0.579	0.962	0.432
	(22.77)***	(25.08)***	(12.15)***
CONTIG	1.222	1.407	1.225
	(31.34)***	(24.03)***	(17.43)***
SELFCER	0.581	0.350	1.041
	(14.64)***	(7.34)***	(13.99)***
CC	-0.296	-0.110	-0.275
	(8.22)***	(2.40)**	(4.97)***
CTH	-0.301	-0.211	-0.274
	(12.93)***	(7.81)***	(7.05)***
CTS	-0.377	-0.152	-0.577
	(9.89)***	(3.28)***	(9.49)***
TT	-0.351	-0.260	-0.305
	(14.23)***	(9.00)***	(7.32)***
WO	-0.608	-0.613	-0.240
	(16.20)***	(13.86)***	(3.59)***
Constant	1.604	-2.792	1.931
	(6.49)***	(4.91)***	(5.47)***
Observations	204294	114524	89770
R-squared	0.73	0.79	0.67

Semi-robust t-statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Note: *RVC* dropped from regression, hence used as benchmark rule

Table 5.12. Grouped Rules by Family

	(1)	(2)	(3)
	All Trade	**Exports**	**Imports**
LIMP	0.293	0.240	0.406
	(113.97)***	(59.60)***	(63.32)***
LEXP	0.508	0.644	0.442
	(191.45)***	(114.97)***	(97.09)***
DIST	-0.532	-0.399	-0.553
	(18.14)***	(7.41)***	(15.60)***
LANG	0.582	0.962	0.442
	(22.85)***	(25.03)***	(12.43)***
CONTIG	1.222	1.414	1.222
	(31.40)***	(24.16)***	(17.39)***
SELFCER	0.565	0.404	0.985
	(15.57)***	(9.48)***	(13.89)***
CTC	-0.303	-0.210	-0.282
	(13.02)***	(7.76)***	(7.24)***
TT	-0.351	-0.260	-0.306
	(14.25)***	(9.02)***	(7.36)***
WO	-0.609	-0.614	-0.241
	(16.21)***	(13.89)***	(3.61)***
Constant	1.635	-2.895	1.573
	(6.62)***	(5.10)***	(4.98)***
Observations	204294	114524	89770
R-squared	0.73	0.79	0.67

Semi-robust t-statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Note: *RVC* dropped from regression, hence used as benchmark rule

The results for Method 4 are illustrated in Table 5.13. This method observes every possible combination of rules that occurs in origin protocols, assigning to each of them a different value. This method has the advantage of allowing the estimation of all possible interaction of rules, being certain of the impact of each of them, as opposed to Method 1, where it is impossible to observe under what rule trade is actually conducted. The drawback is that a large number of rules lose significance. Thirty seven different rules where identified and introduced in the equation; 17 are reported to be significant in one of the three equations; of

those, only five are significant throughout the three equations. Not significant variables in any of the equations have been omitted.[90]

The explanatory power of the model is similar to previous methods (R-squared = .73, .78 and .67, for total trade, exports and imports, respectively). Correspondingly, all the gravity variables show analogous sign and magnitude for all three dependant variables than before.

In terms of total trade, (Column (1)), rule is R37 (WO OR (TT & RVC)), is the most restrictive, with a coefficient of -1.075. Also showing a negative effect and in order of more restrictive to less restrictive are R26 (CTCex & TT), R25 (CTCex & RVC), R4 (WO), R13 (*CTC* OR TT) and R5 (CTCex), which marks the lower bound of the rules with a negative coefficient (-.039).

On the trade-facilitating rules, R23 (CTCex OR RVC) has the largest coefficient (.474), followed by R2 (RVC), R12(*CTC* OR RVC), R14 (*CTC* & RVC) and R28 (*CTC* OR (*CTC* & RVC)).

In terms of exports, roughly the same hierarchy as before is maintained for restrictive rules. Some rules that were not significant for total trade become significant (and negative) now. These are R21 (TT & WO) and R30 (CTCex OR (*CTC* & RVC)). In addition, R28, which had a positive for total trade, turns negative for exports. Only three rules show a significant and positive coefficient: R36 ((RVC & RVC) OR RVC), R2 (RVC) and R14 (*CTC* & RVC).

The picture varies considerably for imports. Now, only three variables show a negative and significant coefficient, these being R26 (CTCex & TT), R25 (CTCex & RVC) and R5 (CTCex). However, several variables become positive and significant: R23 (CTCex OR RVC), R22 (RVC & WO), R17 (RVC OR TT), R12 (*CTC* OR RVC), R2 (RVC), R4 (WO), R28 (*CTC* OR (*CTC* & RVC)), R14 (*CTC* & RVC) and R1 (*CTC*).

Lastly, self-certification shows the same results as in previous methods.

[90] Several variables are omitted due to collinearity. Although this does not preclude the comparison among the rules included in the sample, the interpretation of the dummy variable coefficients is not straightforward.

Table 5.13. Unique Rules

	(1)	(2)	(3)
	All Trade	**Exports**	**Imports**
LIMP	0.307	0.250	0.425
	(162.77)***	(82.83)***	(96.42)***
LEXP	0.495	0.606	0.444
	(254.30)***	(153.37)***	(137.83)***
DIST	-0.528	-0.454	-0.607
	(29.38)***	(13.23)***	(27.37)***
CONTIG	1.294	1.340	1.271
	(45.96)***	(32.63)***	(24.26)***
LANG	0.456	0.904	0.314
	(27.05)***	(36.41)***	(13.09)***
SELFCER	0.507	0.419	0.790
	(18.40)***	(13.09)***	(14.68)***
R1	0.013	-0.010	0.075
	(0.48)	(0.35)	(1.70)*
R2	0.323	0.256	0.338
	(11.09)***	(7.70)***	(6.90)***
R4	-0.237	-0.369	0.169
	(6.00)***	(8.11)***	(2.40)**
R5	-0.141	-0.135	-0.115
	(4.48)***	(3.61)***	(2.25)**
R12	0.249	-0.051	0.521
	(8.43)***	(1.45)	(10.81)***
R13	-0.210	-0.383	-0.118
	(3.60)***	(5.34)***	(1.27)
R14	0.152	0.186	0.133
	(4.49)***	(4.67)***	(2.44)**
R17	0.192	0.052	0.525
	(0.93)	(0.19)	(1.72)*
R21	-0.125	-0.380	0.278
	(1.05)	(2.96)***	(1.12)
R22	-0.073	-0.057	0.601
	(1.31)	(0.72)	(6.93)***
R23	0.474	0.013	0.736
	(7.33)***	(0.15)	(8.28)***
R25	-0.624	-0.192	-0.888
	(5.97)***	(1.35)	(5.74)***
R26	-0.924	-0.630	-0.963
	(22.04)***	(11.61)***	(15.22)***
R28	0.063	-0.088	0.164
	(1.89)*	(2.13)**	(3.13)***
R30	-0.039	-0.179	-0.001
	(0.85)	(2.90)***	(0.01)
R36	0.150	0.384	-0.051
	(1.53)	(4.17)***	(0.31)
R37	-1.075	-0.655	-0.411
	(3.57)***	(2.70)***	(0.77)
Constant	1.165	-0.295	0.526
	(6.43)***	(0.90)	(2.26)**
Observations	437101	240193	196908
R-squared	0.73	0.78	0.67

Semi-robust t-statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

5.2.2 Discussion

The results of the estimations prove to be very encouraging with regards the main purpose of this study, i.e. to assess the impact on trade of the different types of product-specific rules of origin. Most of the variables are significant throughout the estimations and show coefficients in line with the expected outcomes and, when available, with previous studies. In line with the results above it becomes evident that the precise specification of the RoO does indeed matter. An RVC type of rule can increase trade by 22.9 percent whereas a TT can reduce it by 21 percent.

One note of attention must be drawn here with regards to the interpretation of the coefficients in the different methods. Method 1 is the only one which allows direct inference on the impact on trade of the specific rules because it is the only method where the dummies included therein are not mutually exclusive. The results for this method suggest that setting a different type of RoO can have more than 45 percent impact on trade (positive eight percent for RVC against negative 36 percent for WO). Another trade facilitating aspect shown in this method is the fact that an alternative between rules may increase total trade by 13 percent.

The reminder methods offer a different interpretation. Since one variable is dropped in each of them, the coefficients presented therein are taken in comparison to the dropped variable, which is an encouraging way of confirming the hierarchy of the rules presented in Method 1. Across the methods, it is confirmed the relative trade-conduciveness of the RVC rule, which may increase trade by as much as 30 percent compared to CTC rules (Table 5.12), or 60 percent compared to WO rules (Tables 5.11 and 5.12)

Despite the positive results, there are a number of counterintuitive results which may through important light to the understanding of the RoO. Most of them relate mainly to differences between exports and imports. The explanation for the differences in the estimation coefficients for the different types of rules between both flows are in line with the findings of Duttagupta and Panagariya (2003) and Portugal-Pérez (2009). These authors find a political economy explanation for setting up a system of RoO. Their argument is essentially comparable in its main points. Exporters of final goods have an incentive to enter an FTA in

the expectation of reaching to other markets. At the same time, intermediate good producers are at risk, since they now face competition from other export-competing intermediate good producers. Therefore, in order to accept a Free Trade Area (FTA), they will lobby their government in order to ensure a captive market for their goods. According to Portugal-Pérez (2009), intermediate good producers are normally located in Northern countries, i.e. powerful countries. It follows that powerful countries will try to establish stringent rules to satisfy their intermediate producers while not harming their exporters. These lines of argument provide some hints to solve the exporter-importer dichotomy in some of the variables observed in the previous chapter.

Imported products appear to be more sensitive to distance and partner's country size, i.e. compared to exports these two characteristics suggest that imports are more sensitive to characteristics other than the product itself. By comparison, exports' markets react less to size and distance variables, so they can be thought as relying more on the specific conditions of the product itself.

This observation, coupled with some of the counterintuitive results, i.e. a positive effect for Combination of Rules (COMB) for exports or a much larger negative impact of CTS than CC for imports, leads to the following argument: rules of origin tend to be set by the exporting, hegemonic, country. Their exporters have fewer problems in complying with the rules, while local intermediate producers receive extra protection. In other words, rules are primarily designed to protect local producers. A number of authors agree with this observation. Cadot et al. (2005) find empirical support to affirm that rules of origin serve as a subsidy to intermediate good producers in the powerful country, transferring rents from taxpayers. Duttagupta and Panagariya (2003) show theoretically how the political viability of FTAs referred above is only achieved after the producers in the local market receive extra protection. Garay and De Lombaerde (2004) find a similar conclusion from a different perspective: based on the participation on a survey organized by the European Commission, they observe how European preferential rules "reflect the objectives of European industrial policy (rather than trade or development policy)". The results find herein seem to reinforce this argument.

The results explained above are in accordance to some extent with the predictions made in the previous chapter:

Prediction 1: CC > CTH > CTS, with ">" meaning "more restrictive than"

The results regarding this prediction are mixed. On the one hand this prediction holds in the first method, when these rules interact with other rules. On the other hand, it does not when the rules are analyzed independently. In this case the order is actually the opposite (CC<CTH<CTS). These findings parallel those of Cadot et al (2002) regarding Mexican exports to the US. In their estimation they find that the most restrictive rule is the Change in Tariff Item (not considered in the present study), which is meant to be less restrictive than a CTS.

The reason for this may reside on the fact that CTS rules are in fact very precise rules. Whereas CC and CTH may consist of more general rules that are applied a larger spectrum of products, CTS are instead targeted against particular products for which they forbid the use of the particular element that is key in manufacturing a product.

Prediction 2: CC>RVC=CTH>CTS

Prediction 3: CTC=RVC

The clear-cut positive effect of RVC is potentially the key finding of this study. Consequently, these two predictions, based on the observation rules of Cadot et al. (2006) and Estevadeordal (2000), have shown to be far away from the results.

RVC is consistently throughout all the methods the most lenient type of rule. Several "old generation" agreements, such as SADC, used this type of rule as a general rule across all products. Reformulating them to a "modern" approach with a specific rule for each product was perceived as a restrictive move. In the words of Flatters (2002):

"The regional content rules originally agreed for [the Southern African Development Community] (SADC) were simple, general and consistent with those in other developing country PTAs, including the Common Market of Eastern and Southern Africa (COMESA)[…]Certain Member States then pressed for exceptions to these rules. This led to 'made-to-measure' sector-specific rules that are far more restrictive than originally agreed."

Pelzman and Shoham (2010) note a number of problems regarding RVC. They argue that it is unsatisfactory because it generates substantial compliance costs; it is subject to price fluctuations of the raw materials and exchange rate volatility. However, it is also recognized that the value added method is praised for its simplicity.

Theory on RoO tends to support the view that content requirements are trade-deterring.[91] In its very basic form, any content requirement alters the optimal combination of factors, hence reflecting in an increase in price, as noted by Krishna (2005). However, all these theoretical contributions were made in comparison to not facing RoO, unlike the present study, which is undertaken in the context of a sub-optimal situation, i.e. the rules of origin are not compared to not having rules of origin but against other type of rules.[92]

The results highlighted here are in line with Portugal-Pérez (2008), who finds evidence of a 45 percent increase in exports of textile products associated to the inclusion of an RVC alternative rule.

The results of these estimations suggest that simplicity is valued extremely high by exporters when it comes to rules of origin.

Prediction 4: RVCEU>RVC

This prediction is confirmed in the sole comparison available, i.e. Table 5.10. In fact, RVCEU rule turns out to be prejudicial for imports only, as it is not significant when the dependant variable is total trade or exports. The logic behind its estimated negative impact may reside in the fact that, as noted above, alters the optimal composition of factors of production as occurs with local content rules but it fails to provide the simplicity of standard RVC. To my knowledge, there are no studies available to verify these findings based on this type of rule.

Prediction 5: TT>RVC

Prediction 6: TT>CTC

Prediction 7: TT=CC

[91] See the Literature Review Chapter for a discussion of the different effects of this type of rule.
[92] An in-depth discussion about the pros and cons of RVC-type of rule is provided in Chapter 7

These three predictions are confirmed by the results of the analysis to a certain extent. Its impact is higher to that of CTC (Table 4.19). According to the results of Table 5.10, its impact is comparable to that of CC. However, prediction 7 is built on the expectation that CC lies on the upper bound of restrictiveness within the CTC family. Results in Table 5.11 provide evidence that the opposite is true.

Whatever the restrictiveness of the CC rule, the technical test is confirmed to be restrictive throughout the analysis, in accordance with the observation rule of both Estevadeordal (2000) and Cadot et al. (2006). These authors are of the view that TT are the most obscure of the entire spectrum of RoO, as they are made ad-hoc for specific purposes, which normally entail protecting ones market.

Prediction 8: WO<Any other rule

The impact of this rule varies widely from exports to imports. It is the most restrictive rule for exports and the second least restrictive for imports. In fact, it is the only one that suggests any positive impact on trade (imports) other than RVC, as indicated in Column (3) of Table 5.10. Cadot et al. (2006) places it at the lowest restriction level.

Being as it is generally applied to agricultural products, this rule can be largely lenient, if the product is grown locally, but it can be the most stringent deterrent if it is not, as there is no way of adapting production processes.

Prediction 9: Exception has a negative coefficient

Exceptions to the general Change in Tariff Classification rule can only be assessed in Table 5.10. As expected, it is recorded negative in all three instances, fulfilling the expectations that adding just another twist to the general rule provides additional complications. In fact, exceptions to CTC are potentially extremely trade obstructing, as they can be designed so as to limit the use of the exact good that is needed in a particular country to manufacture any given product. As such, it displays the highest negative coefficient in the Imports column.

Prediction 10: Combination has a negative coefficient

Combinations of rules can only be assessed independently in Table 5.10 (results in Table 5.13 must be taken cautiously, as explained below). There, it is shown that this prediction holds for overall trade and imports, but it does not for exports. This result is extremely counterintuitive, as demanding to comply with more than one rule can only be thought as being overly restrictive. Its implications have been analyzed in detail above and throw important light about the definition of RoO.

Prediction 11: Alternative has a positive coefficient.

Prediction 12: Rules that include and alternative are more facilitating than rules that require a combination of two or more criteria.

Likewise, predictions 11 and 12 can only be checked against Table 5.10. The findings therein confirm this prediction. In all three instances, providing an alternative represents a way of facilitating trade. This result is indeed certainly intuitive, as setting two possible ways of complying with a rule instead of one is necessarily easier. A different scenario could arise in the case that an alternative was offered only when two very restrictive rules were in place. However, this study has not analyzed the frequency of alternatives with respect to other types of rules.

Prediction 13: Simple rules (i.e., those defined in the lower numbers of the scale) are more trade conducive than complex rules

Interpretations of "unique" rules must be taken cautiously. Only five out of 37 are significant throughout the three equations. However, there are some valid results. First, RVC is confirmed to be the most lenient type of rule. It is the only one that is trade-conducive for total trade, exports and imports. Other simple rules are not necessarily beneficial for trade: CTC only turns slightly positive for imports; WO follows, although its positive impact is larger than that of CTC, confirming the results shown in Tables 5.10-5.12. In general, complex rules appear to be more restrictive. In fact, only two rules that involve more than two rules (R28 – CTC OR (CTC & RVC) for global trade and R36 ((RVC & RVC) OR RVC) for exports have a positive impact.

With regards to combinations and alternatives of rules, there is some evidence in favor of Prediction 12, although this is not definitive. Five out of twelve trade restricting rules (across the three columns) require a combination; rules allowing an alternative are found to be negative in four instances. On the positive side, combinations of rules appear in three four occasions (out of a total of 17 instances in which a rule is found to be positive across the three estimations). Eight rules involving an alternative are found to have a positive impact.

Prediction 14: Selfcertification has a positive impact on trade flows.

This prediction is clearly confirmed in all nine columns. In every case, self certification is positive and significant. Both exporters and importers (although more in the case of importers) appreciate policy decisions alleviating their administrative burden. Cadot et al (2004) estimate at 45 percent of the entire preference margin the cost of complying with the rules themselves. Any step removing red tape has the potential to greatly increase preferential trade within Regional Trade Agreement (RTA) members, as it is shown here.

5.2.2.1. Gravity Variables

Despite the difference in the size variable with traditional variables in gravity literature, i.e. GDP, GDP per capita, population, the magnitude of the coefficients on total exports and total imports lies within the expected range. Usually, GDP is expected to increase directly proportionally with trade. However, lower estimates are common in the literature.[93] Santos Silva and Tenreyro (2006) argue that in fact, coefficients on GDP are not close to one in the traditional gravity which may help the gravity equation reconcile with the fact that the trade-to-GDP ratio decreases with size. If the gravity prediction of one-to-one GDP and trade, this ratio would not hold. Specific fixed effects absorb part of the of the impact of each variable, as noted by DeRosa (2007). Throughout the equations, total exports has a higher impact on trade flows than total imports, revealing stronger "push" rather than "pull" forces. Marchetti (2009) interprets this as an indication of the "home market" effect. In the presence of high transport costs and economies of scale, manufacturers tend to concentrate production in countries that have strong internal demand. Those products are subsequently exported, hence establishing the link between market size and exports.

[93] See Kisu (2010) and Rahman et al. (2006)

As regards to distance, although the prediction is to be indirectly proportional to trade, several authors have found it to be considerably lower. The reported coefficient in table 5.10 (-.542) lies well within the limits reported in the literature.[94] Additionally, distance tends to have a smaller impact when combined with an adjacency measure. The coefficient on this variable illustrates a large tendency of countries to trade with their neighbors. Adding an adjacency control variable "corrects" the inclination to trade with close-by countries. In its absence, distance would show more sensitivity to trade that takes with border countries (i.e. within close distances) and display a higher coefficient. The positive impact of sharing a common language is explained by two factors. Speaking the same language facilitates communication and hence trade but is also normally the consequence of some common cultural or historical traits that may have helped establishing a commercial relation. Its impact on total trade (50%) is in line with the literature.[95]

5.3. Conclusion

Prior to estimating the equations, a number of clarifications need to be made. First, a poolability tests performing a Wald test on the coefficients of the estimated equation confirms the validity of pooling the data. Second, a choice has to be made between the use of fixed effects and random effects. Theoretically, fixed effects are preferred because using random effects requires the assumption of the observations being randomly drawn from a population and that the individual effects are not correlated with the regressors. This, in principle is a hard assumption to maintain in trade settings. This decision is confirmed econometrically by the Hausman test and country fixed effects are included, which help solve an eventual heterogeneity problem; this positive outcome is however likely to be jeopardized by the fact that fixed effects are not included at the individual level but a country level. Third, collinearity diagnosis reveals a problem of multicollinearity, which is solved after some transformations in the data, notably combining EFTA countries into one unique country and grouping reporting country fixed effects in two groups, developed (EU and US) and developing (Mexico and Chile).

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[94] See Frankel et al. (1995) provides several specifications; the largest one in size is -.68. Ogueldo and MacPhee (1994) estimate distance to have an effect between -.25 to -.76

[95] See Linders (2006)

Subsequently, a Least Squares Dummy Variable (LSDV) method is chosen to perform the regressions. However, the Breusch-Pagan and the Breusch-Godfrey test reveal the presence of heteroscedasticity and autocorrelation, respectively, inducing estimation by Generalized Least Squares (GLS), which yields unbiased estimators. Lastly, the variables are transformed in logarithms in order to reduce the dispersion of the data. This comes at the price of dropping zero values, which, although the way of dealing with them has still not been properly settled in the theory, may lead to selection bias.

The regressions show very interesting results, with most variables being significant across each method of estimation and showing the expected sign of the coefficients. The specification of the RoO does matter. An RVC type of rule can increase trade by 22.9 percent whereas a TT can reduce it by 21 percent. Each of the methods of estimation show interesting results, except method four, where most variables are insignificant. The one clear-cut fact about the regressions is that RVC type of rule is by and large the most trade-conducive rule. Two *a priori* counterintuitive results – the fact that a combination of rules favors export trade and that CTS reveals clearly more trade-obstructing than CC for imports – lead to the argument that rules of origin are clearly devised by importing hegemonic countries. Their exporters do not really "care" about them but the importers ensure that protection is granted to the home market. Lastly, gravity variables show the expected sign and coefficient.

Chapter 6. Restrictiveness Index for RoO

6.1. Motivation

At present, empirical literature on RoO relies entirely on *ex-ante* indices, first developed in Estevadeordal (2000) and subsequently followed and augmented in a series of studies. The second main goal of this study is to provide a "real" index of RoO restrictiveness.

The main motivation that led economists to create a restrictiveness index for RoO addressed in Estevadeordal (2007). This was to compare RoO regimes around the world. Being obscure as they are, until the development of the indices, different RoO regimes did not have any means of being assessed against each other and the development of the indices helped bridge this gap. In words of Estevadeordal (2007), the development of the restrictiveness indices became especially useful in order to analyze RoO-regimes in terms of their characteristics, rather than their effects. In other words, they are not good means of assessing the effective restrictiveness of the regimes.

Despite this self-criticism of the indices, they have been used as exogenous explanatory variables in virtually every subsequent empirical analysis involving RoO. Examples of such applications are Estevadeordal *et al* (2004bis) and Anson *et al* (2005), who model trade flows on the basis of RoO restrictiveness or Cadot *et al*, (2002) who explore to the cost of complying with the RoO of NAFTA for Mexican exporters.

Therefore, the indices are being used in an unintended way for the main reason that at present there exists no other alternative. This is probably encouraged by the fact that its simplicity overcomes the problems of using the indices, in view of the alternative complex codification process of RoO. This gap in the literature is therefore intended to be bridged in this chapter.

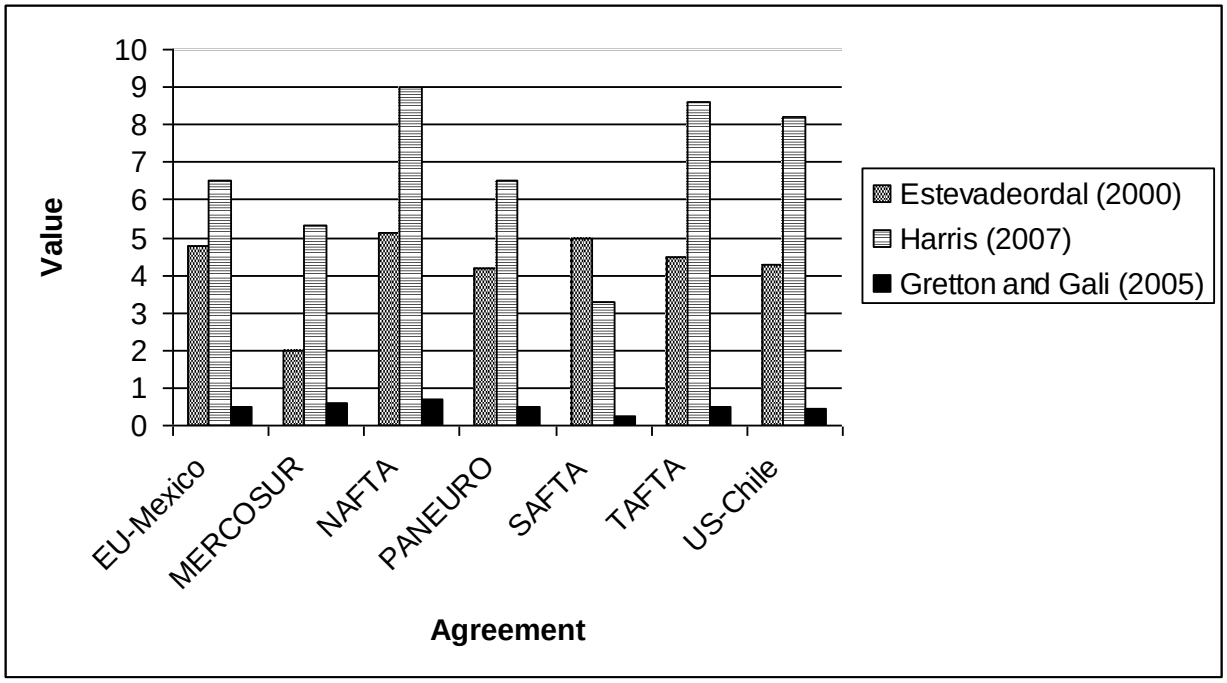
6.2. Criticism of ex-ante indices of restrictiveness

One of the main objectives of the present study is to build a "true" restrictiveness index for specific rules of origin. The reason for doing so is that the most quoted ex-ante indices in the literature on rules of origin present several caveats, namely:[96]

a) Being an ex-ante observation rule, they are based on the author's subjectivity, therefore varying from author to author:

Each of the indices is based on certain assumptions by the authors. For instance, in Estevadeordal (2000), the lowest value of restrictiveness corresponds to a Change in Tariff Item (CTI). For Cadot et al. (2006), this level would be shared by WO and Change in Tariff Subheading (CTS) with exception. Because of this inherent subjectivity, it is practically impossible to establish a clear decision as to the restrictiveness of different FTAs. Figure 5.1 presents some evidence of the difficulty to rely purely on any of these measures. It compares the level of restrictiveness provided by three *ex-ante* indices for selected FTAs. While the three of them share some of the results, like finding the North American Free Trade Area (NAFTA) as the most restrictive regime, there is wide divergence on every other agreement. For instance, MERCOSUR is the most lenient for Estevadeordal (2000) while it is the second most restrictive for Gretton and Gali (2005). The Southern Asian Free Trade Area (SAFTA), which is the most lenient for Harris (2007) is the second most restrictive for Estevadeordal (2000). Further, adding the facilitation index developed by Estevadeordal and Suominen (2004bis) would not reconcile the results of the indices, as it for instance ranks NAFTA as the most facilitating.

[96] See the Literature Review Chapter for a description of each of the indices.



Source: Own calculations from Estevadeordal (2000), Harris (2007) and Gretton and Gali (2005)

Figure 6.1 Comparison of ex-ante indices

b) Ex ante indices are based on unchecked premises:

One consequence of the ex-ante nature of these indices is that authors classify each type of rule of origin based on their own logical assumptions. Indeed it does seem reasonable to think that a rule is more restrictive the more components it forbids from being used in the final product. This is the reason why all of them set Change in Chapter (CC) at a stringer level than Change in Tariff Heading (CTH) or Change in Tariff Subheading (CTS). For instance, tomato juice of heading Harmonized System (HS) 20.09.50 is made out of tomato (HS Chapter 7). However, setting a CC or a CTS would have the same impact here so there would be no justification for a difference in their restrictiveness level. In addition, classifying content rules, technical tests or wholly obtained rules is less straightforward. Regional Value Content (RVC), which is taken to be as relatively restrictive in most indices, turns out to be the most lenient, according to the estimations in the previous chapter. Similarly, combining two types of rules seems more trade-restrictive than using just one. But the second rule could be neutral and hence have no reason to be classified as more stringent, at least *a priori*.

c) Imports are more relevant than exports:

In view of the results presented in the previous chapter it becomes evident that it is not trivial who sets the RoO. Exporters to the hegemonic market struggle to meet the RoO. In turn, they are very sensitive to facilitating measures, such as alternative rules or self-certification procedures. On the contrary, local (hegemonic country) exporters are well able to meet the rules so they are insensitive to additional requirements, such as combinations or exceptions.

It therefore seems that rules of origin really become decisive trade-policy devices when applied to imports entering powerful countries. It is there where the true shape of rules of origin comes into effect. All four reporting countries in the estimation in the previous chapter can be considered hegemonic, at least to a certain extent. The EU and the US are of course, the paradigm of negotiating power. By their part, although Chile and Mexico are developing countries, they are both "FTA champions". Their expertise in participating in FTAs suggests that they are in a position to exert considerable leverage when negotiating their rules of origin.[97]

6.3. Building an *Ex-Post* Restrictiveness Index

The caveats about the restrictiveness indices highlighted in the previous section suggest that in order to build a true index, it is necessary to do so using an *ex-post* observation rule, as opposed to an *ex-ante*. The methodology used for the construction of an *ex-post* restrictiveness index is explained hereafter:

The main logic behind an *ex-post* index it to build it according to the data. This is done so using the estimates obtained from equation (4.10-c) ran for Method 1, as reported in the previous chapter. This equation takes imports as the dependant variable and it allows combinations of each type of rule with secondary rules. Choosing equation (4.10-c) responds to the findings obtained in the results which seem to suggest that rules of origin are set by protectionist hegemonic countries. The fact of obtaining the estimates from Method 1 is less subjective, as it obeys to the fact that this method is the only one that can shed light about the

[97] Except, of course, in their FTAs with the US and the EU, which have not been considered in the estimation sample as it would provide the same information for different variables.

hierarchy of each type of rule, as well as about the combinations, alternatives and exceptions to the rules. Method 4 ("unique" rules) could also serve this purpose but its validity is limited in this context as many of the combined rules are found to be insignificant. The index could have been constructed from the estimates of methods 2 and 3 but they would have lacked vital information about the interactions among rules, not included in these two methods.

Once the appropriate benchmark for the index is chosen, it is built using the reported coefficients, as shown in Table 5.10, as follows:

$$RI_k = (-.180)(\mathrm{CC}) + (-.039)(\mathrm{CTH}) + (-.143)(\mathrm{CTS}) + (.229)(\mathrm{RVC}) + (-.131)(RVCEU) + (-.210)(TT) + (.211)(WO) + (.178)(ALT) + (-.242)(EXC) \tag{6.1}$$

where RI_k is the restrictiveness index, which is defined as the combination of all possible rules. Equation (6.1) sets a different stringency level for each product, according to the rules that affect it. When combined over all the RoO present in origin protocols, RI_k results in 70 possible different values, i.e. 70 different combinations of rules.[98] These 70 rules can now be ordered from 1 to 70 and an index would already be obtained. However, having 70 different values restricts the workability of the index, as there are many of these levels which rarely take place in protocols of origin. In order to develop a more verifiable index, one transformation is performed and these 70 instances are grouped into 20 by dividing them by 3.5.[99] The resulting outcome is shown in Table 6.1.

[98] See Appendix 6.1 for a list of these rules.
[99] Twenty is arbitrary; it represents a compromise between "representativity" and "workability".

Table 6.1. Decomposition of the Restrictiveness Index

RI Level	Type of Rule	
1	CCex&TT CTSex&TT	CC&TT
2	CTS&TT TT&RVCEU	CCex OR CC&RVC CTH&TT
3	CCex OR TT CTH OR CTS&TT	TT&TT
4	CCex CTHex&RVCEU&WO	CTSex OR TT CTH&RVCEU
5	CTSex CCex OR CTS&RVC	CTSex&RVC
6	TT&RVCEU CTHex OR TT	CCex OR CC&RVC CTHex&WO
7	CTHex CCex OR CTH&RVC	CTHex&RVC
8	CTHex OR CTS&RVC TT&WO	CC OR TT **TT**
9	RVC&TT CTSex OR CTS&RVC	**CC**
10	CTH&WO&RVCEU CTS OR TT	CC&RVC CTS&WO
11	CC OR CTS **CTS**	WO&RVCEU
12	CC OR CTS&RVC CTS&RVC	RVCEU RVC&RVCEU
13	CTH OR TT CTH&TT OR RVC	CTH&WO
14	**CTH** CC OR CTH&RVC	TT OR TT CTH&RVC
15	CCex OR RVC WO&WO	CTH OR TT
16	CTH OR CTS&RVC CTSex OR RVC	CTS OR CTS&RVC RVC&RVCEU OR RVC
17	CTHex OR RVC CTH&RVC OR RVC	TT OR WO
18	WO OR TT&RVC RVC OR TT	**WO** WO&RVC
19	CC OR RVC **RVC**	CC&WO
20	CTS OR RVC RVC OR RVCEU	CTH OR RVC RVC OR RVC

Table 6.1 contains the entire spectrum of specific RoO.[100] The order is from more restrictive to less restrictive, i.e. a score of 20 is the least stringent type of rule. Individual classical rules are highlighted in bold. As it was predicted from the estimates in the previous chapter, RVC scores at the second highest level of facilitation, followed by Wholly Obtained (WO). The most restrictive rule is Technical Test (TT), followed by CC. It stands out that CTH ranks better in the index than CTS.

[100] With the excpetion of Change in Tariff Items. This type of rule is of limited importance in origin protocols and has thus been disregarded in recent literature about rules of origin.

There are other notable characteristics. There is a concentration of alternative rules towards the higher end of the index, which is in line with logic. However, "normal" predictions are not an absolute rule for the entire index. While the top end is filled with alternative rules, some combinations of rules, like CC & WO, also rank high. Conversely, the lower range concentrates more combinations, although there are some alternative rules, such as Exception to Change in Chapter (CCex) OR TT. Exceptions to CC, CTH and CTS tend to be quite restrictive. It follows that an exception to any of these three rules ranks always lower than the rule itself, i.e. Exception to Change in Tariff Heading (CTHex)<CTH. In sum, this index is in line with traditional assumptions in its general lines, but it presents some notable exceptions. As such, it has some common points with previous indices but diverges in some others.

6.4. Comparison with ex-ante indices

The restrictiveness index presented here is broader in scope than previous indices. This one covers the entire spectrum of possible combinations of rules, while *ex-ante* indices compare what their authors consider as being representative. The individual differences are as follows:

6.4.1 Estevadeordal (2000)

The only rules that are considered individually in this index are those belonging to the change in tariff classification family. CTS ranks the least restrictive, followed by CTH and CC. This order is altered in the *ex-post* index, as noted above. Estevadeordal (2000) does not take into account the leniency (expected) provided by alternative rules; it refers just to combinations.

On the similarities, his most restrictive rule is CC&TT, which is also in bottom category in the index above. Combinations of Change of Tariff Classification (CTC) and RVC lie in the middle of his index, as it does here.

6.4.2 Cadot *et al.* (2006)

Their index takes TT as the second most lenient rule, while above it ranks as the most restrictive single rule. The order of CTC-family rules is the same as in Estevadeordal (2000),

hence differing with the classification presented here. RVC as a single rule ranks in the middle of his classification; in the *ex-post* index it appears as the most conducive.[101] In the same line, any combination involving RVC is regarded by the authors as very restrictive. This is not necessarily the case above. In fact, of those rules that include combinations, the ones that are coupled with RVC rank relatively high. Finally, as in Estevadeordal (2000), their index does not compute alternatives.

On the common aspects, WO is ranked at the lowest range of restrictiveness in their index and very close to it above. Also, as before, CC & RVC is taken as the most stringent rule. Their classification takes into account several combinations and, those coupled with TT appear towards the most restrictive layer, as it does above.

6.5. Classification of agreements in terms of restrictiveness

In view of the differences, there is a potential for a different classification of the agreements in terms of restrictiveness. Figures 6.2 and 6.3 present the classification of the agreements considered in this study; Figure 6.2 provides the simple average and Figure 6.3 the weighted average in terms of trade volumes.

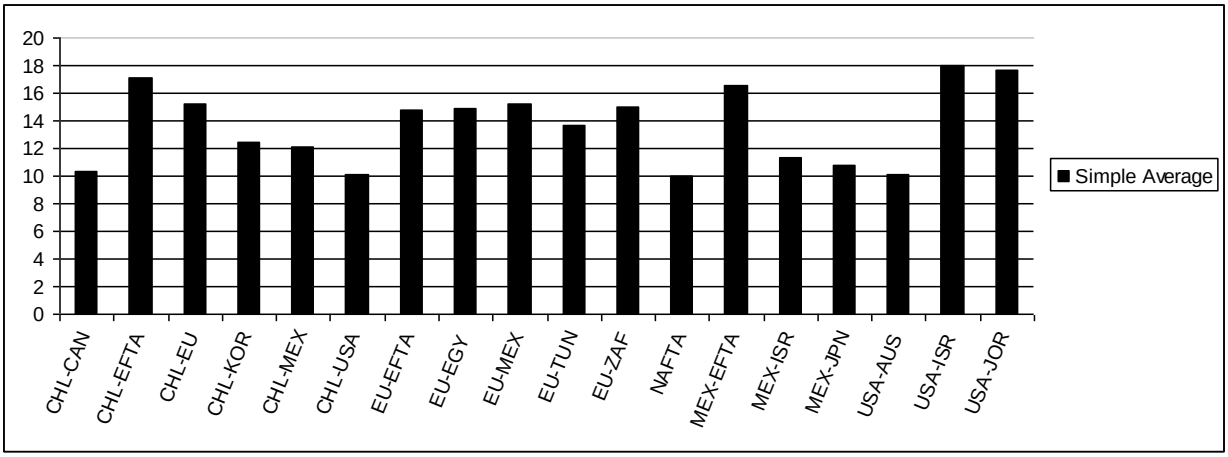


Figure 6.2. Restrictiveness of Agreements

[101] Cadot et al. (2006) split the RVC rule in two, one for a requirement of more 40% of local content and one for less. In that aspect, it is more complete than the *ex-post* index, which does not introduce that distinction.

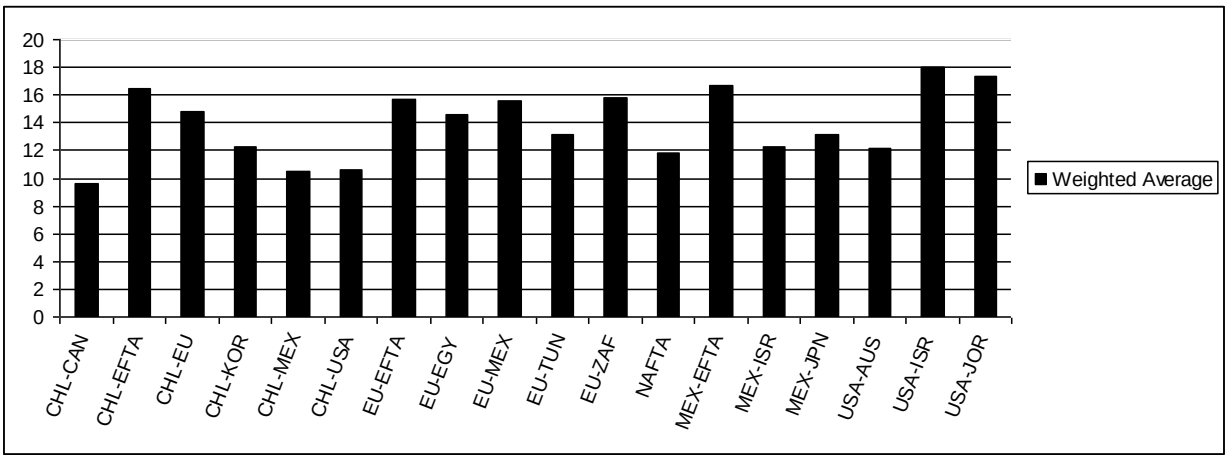


Figure 6.3. Restrictiveness of Agreements

Figure 6.2 signals NAFTA as the most restrictive agreement, followed by other US-based agreements. EU-family agreements rank higher, in particular those of the European Free Trade Area (EFTA) with Mexico and Chile. Not surprisingly, both US agreements and EU agreements do not differ much in their overall restrictiveness within agreements. Both countries rely on one set of rules of origin and with few exceptions, impose it to their partners. Chilean and Mexican agreements lie in some middle ground between US-based and EU-based, although their restrictiveness resembles more that of the US. This is in line with the findings of Garay and Cornejo (2001) who note that Mexico and Chile are prominent signatories of "new generation" agreements, i.e. those that started in the later years of the 90s, where RoO are heavily influenced by NAFTA. Finally, on the other side of the spectrum are US-Israel and US-Jordan. US-Israel is an "old-generation" agreement (signed in 1985). US-Jordan was completed much later, in 2000. However, oddly enough, the US only entered the "new generation" agreements, which had very much been sparked by the signature of NAFTA, until the Bush Administration took office in 2001. Cooper (2006) acknowledges the limitations of these agreements by referring to them as "basic". As a consequence, their rules of origin are not very developed. They consist of general across-the-board provisions with a few exceptions for limited products, namely textiles.

Interestingly, despite the differences highlighted above with *ex-ante* indices, the *ex-post* restrictiveness of the agreements is very much in line with the calculations presented in Figure 5.1. In their view, NAFTA is too the most restrictive, with the EU family presenting more facilitating rules and other US-based FTAs standing in between. No comparison can be made on the agreements where the authors above disagree, i.e. SAFTA and MERCOSUR, as

they are not part of the present study. Lázaro and Medalla (2006), citing the Australian Productivity Commission, note that the US-Australia FTA is estimated to trade under the most restrictive RoO in the world. This finding is in support of the results obtained by the ex-post index that classifies the US-Australia RoO as the second most restrictive ones after NAFTA.

In terms of the weighted average, the hierarchy of the agreements is maintained overall, although there are a few differences with the simple average. Namely, Chile's agreements with Canada and Mexico drop to the last position. This may come as a consequence of Chilean manufacturers targeting exports which may have a difficulty in complying with the RoO to the much larger US market rather than to its NAFTA counterparts.

6.6. Sectoral Restrictiveness

As it has been explained, RoO are likely to be the result of industrial policies in hegemonic countries. However industry has many faces, from fruit juice producers to car manufacturers, going through electronics, each of them having its own agenda. The likely result is that rules of origin diverge considerably from one sector to the next. This is explored in Figure 6.4 and Table 6.2. Both of them take into account data from selected agreements in the sample, namely EU-EFTA, Mexico-EFTA, NAFTA, US-Chile and US-Korea. The reason of this sample is to provide further comparison with past indices. In this case, the comparison is based on Estevadeordal and Suominen (2004bis), who perform the same exercise on those agreements. Figure 5.4 shows the average restrictiveness for each sector across these agreements; Table 6.2 disaggregates further the data by looking at each sector (by HS Section) in each agreement individually.[102]

[102] The index used in Estevadeordal and Suominen (2004 bis) is based on a scale of one tos even, being seven the most restrictive, i.e. the higher value the more restrictive. This is opposite to the *ex-post* index. In order to render both indices comparable, a transformation has been performed on Estevadeoradal and Suominen (2004 bis). The formula used was the following $RI_{\exp post} = [(RI_{Est-Suo} - 1)x(-1) + 6]x19x20/114$

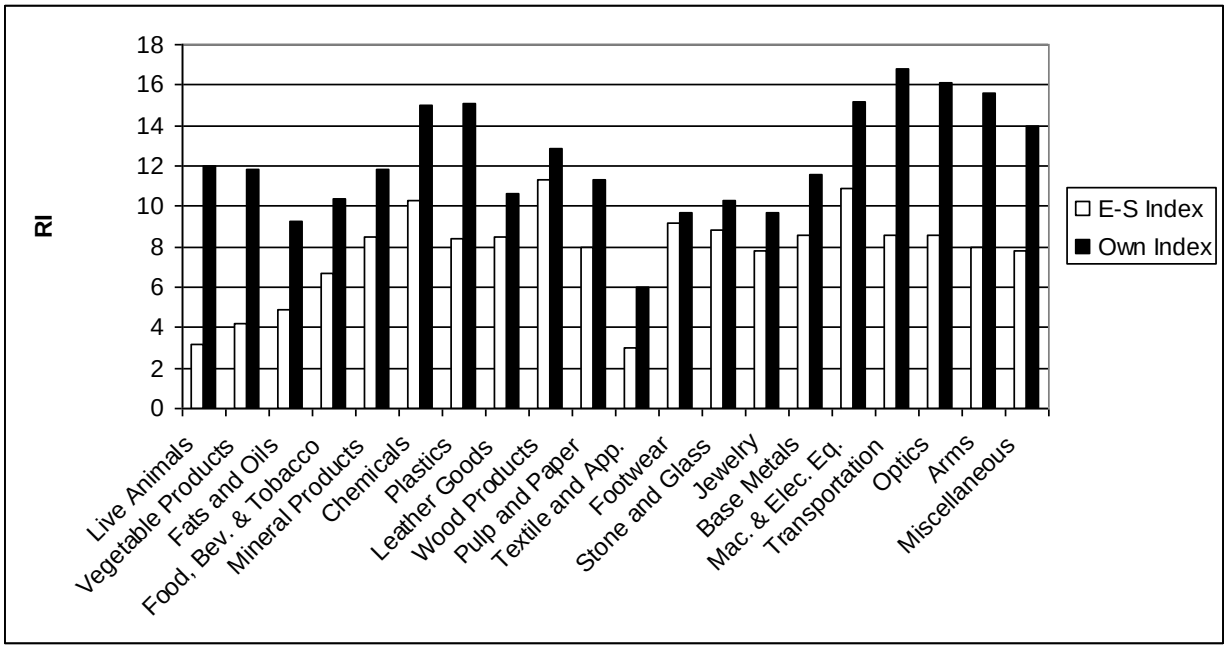


Figure 6.4. Sectoral Restrictiveness Across Selected Agreements

Table 6.2. Restrictiveness Index by HS Section – Comparison of Estevadeordal and Suominen (2004bis) and ***Ex-post*** Index

	EU-EFTA		**EFTA-MEX**		**NAFTA**		**US-CHILE**		**CHILE-KOREA**	
HS Section	**E-S Index**	***Ex-post* Index**	**E-S Index**	***Ex-post* Index**	**E-S Index**	***Ex-post* Index**	**E-S Index**	***Ex-post* Index**	**Est. Index**	***Ex-post* Index**
Live Animals	0.00	17.85	5.67	18.00	3.33	8.09	3.33	8.01	3.33	7.84
Vegetable Products	1.33	15.88	10.00	16.40	3.33	8.80	3.33	9.03	3.00	9.03
Fats and Oils	7.67	13.45	10.00	14.00	3.33	4.47	3.33	4.44	0.00	10.00
Food, Bev. & Tobacco	6.67	10.62	8.67	10.65	7.67	9.01	4.33	8.64	6.00	13.10
Mineral Products	11.67	13.41	11.67	13.52	3.33	9.96	10.33	12.02	5.33	10.06
Chemicals	10.33	18.90	10.67	18.67	5.67	10.68	14.67	10.14	10.00	16.55
Plastics	7.00	15.96	7.00	17.69	7.33	11.37	11.00	12.94	9.67	17.64
Leather Goods	12.33	12.23	11.67	13.81	4.67	8.24	6.67	9.94	7.00	9.11
Wood Products	13.67	10.94	13.67	11.89	10.00	13.76	9.67	13.96	9.67	13.78
Pulp and Paper	8.67	13.51	8.00	12.85	7.33	8.45	7.00	8.88	9.00	12.90
Textile and App.	3.00	9.86	3.00	8.93	0.33	3.59	3.67	2.82	5.00	4.61
Footwear	14.00	9.88	9.67	11.65	7.00	8.44	7.33	9.39	7.67	9.10
Stone and Glass	11.00	12.62	11.00	12.64	7.00	8.34	8.67	9.91	6.67	7.99
Jewelry	11.00	12.13	11.00	12.23	5.67	8.30	6.00	8.84	5.33	7.10
Base Metals	9.33	12.74	9.33	13.83	8.00	9.59	8.00	10.21	8.33	11.44
Mac. & Elec. Eq.	7.33	17.49	10.00	19.37	12.67	13.12	13.67	12.07	10.67	13.72
Transportation	7.67	18.91	9.33	18.36	7.33	14.22	9.33	13.48	9.00	19.01
Optics	6.67	18.43	8.67	19.58	10.00	14.00	8.33	14.49	9.00	13.99
Arms	10.00	19.00	10.00	19.00	7.67	12.23	5.00	12.33	7.33	na
Miscellaneous	9.67	14.97	9.67	15.31	6.33	13.75	5.67	12.26	7.67	13.73

Source: Own calculations and Estevadeordal and Suominen (2004 bis)

Figure 6.4 signals Transportation, Optics, Arms, Machinery, Chemicals and Plastics as the sectors with most lenient rules. This comes as no surprise, as these sectors tend to include the higher value-added, high-level processing, as noted by Low (1998). These sectors concentrate in developed countries, i.e., those setting the rules.

The sector with the highest level of stringency is textiles, by a considerable difference (scoring just six out of 20). This sector has attracted the largest deal of attention by researchers exploring rules of origin, who have shown the negative impact of rules of origin on them.[103] Brenton and Manchin (2003) defend that restrictive technical rules of origin ensure that clothing products produced in partners from third countries do not qualify for preferential treatment. In fact, this sector is filled with TT requirements demanding a two or three-stage transformation on the final product to be considered originating. These rules are perceived as being highly restrictive, which has been confirmed by the large negative impact of TT. It therefore comes as no surprise its low ranking in the index.

The one surprise in terms of sectoral restrictiveness is agriculture, being as it is a highly protected sector.[104] The World Trade Organization (WTO) (2007) shows that EFTA countries liberalized virtually all trade in industrial products *vis a vis* Chile while they maintained protection on roughly 50 percent of agricultural products. Cheong and Cho (2006) find that on average, Western countries liberalize close to 80 percent of their agricultural products in their FTAs, compared to free trade in industrial products. This, in turn comes as the main difference between Estevadeordal and Suominen's (2004bis) calculations and the *ex-post* index. Estevadeordal and Suominen (2004) indicate that the high level of restrictiveness in agricultural products may suggest that RoO in this sector are driven by the same political economy variables that arbitrate the level of tariffs, particularly in the EU and the US. This is very possible, and so it is the fact that agriculture remains the most protected sector. However, the low restrictiveness of the *ex-post* index suggests that agriculture may still be benefitting from tariff protection and hence there is no need to use RoO as a trade policy. Thus, once a tariff line is liberalized, there is a true intention to trade. At the same time, a relatively high

[103] See Brenton and Manchin (2003), Portugal-Pérez (2008) or Augier et *al*. (2004) for different studies about textiles and rules of origin.
[104] To my knowledge, no empirical estimation on the effects of rules of origin on agriculture has been done.

classification of the agricultural sector is less surprising when observing that WO type of rules rank high in the index and EU agreements rely on this type of rule for agricultural products.

Regarding Table 6.2, there is a clear difference between the European family (EU-EFTA and EFTA-Mexico) and the NAFTA family (NAFTA and US-Chile). European rules are more lenient than Americans across the board, except in wood products. For both families, textiles is in the lowest rank, while high-value added products (the same as mentioned above) classify at the top of the list. By its part, restrictiveness of RoO in the Chile-Korea agreement resembles more that in NAFTA than in European agreements. The main differences with NAFTA appear in plastics and transport equipment. The first one comes probably as a result of Chile attaining the levels of plastics exports typical of a developed country.[105] The second one, lenient rules in transport equipment, may have been one of the key objectives by the part of the Korean government when signing the agreement, in account of their pushing automobile industry.

6.7. Empirical Applications

Ex-ante indices are usually used in order to control for the restrictiveness of the rules of origin or to assess the impact on trade of the rules themselves. Examples of the first case are Cadot et al. (2004) who analyze the impact on the utilization of preferences or Estevadeordal et al. (2006) who look at the impact of rules of origin on investment flows. In the second group, some notable examples are Anson et al (2005) who examine the trade effects on NAFTA, or Estevadeordal and Suominen (2004bis), who do so for imports between 155 trading partners.

As a way to test the validity of the *ex-post* index, a similar study is performed here. The index is plugged in the place of the rules of origin in equations 4.10-a through 4.10-c. In order to obtain a better assessment of its performance, the analysis is done on a subset of the sample, i.e. North-South partners. Probably acknowledging the relative ease of Northern producers in complying with rules of origin, the literature on this subject

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105 http://www.bnamericas.com/news/petroquimicos/Exportaciones_de_plasticos_llegarian_a_US*900mn_este_ano

usually concentrates on North-South trade, with particular interest on imports from Southern countries into Northern countries. A similar line is pursued here. Equations (4.10-a) through (4.10-c) take practically the same form as before:

$$TF_{knst} = \alpha_0 + \beta_1(\eta X_{knt} + \lambda X_{kst}) + \beta_2(\eta M_{kst} + \lambda M_{knt}) + \beta_3 d_{ns} + \beta_4 \sum_{n=1}^{N}\sum_{s=1}^{S} D_{ns}$$
$$+ \sum_{k=1}^{K}\sum_{n=1}^{N}\sum_{s=1}^{S} RI_{kns} + \sum_{n=1}^{N}\sum_{s=1}^{S} \zeta_{ij} + \sum_{S=1}^{S} \phi_s + \sum_{t=1}^{T} \chi_t + \varepsilon_{nst} \tag{6.2}$$

$$E_{knst} = \alpha_o + \beta_1 X_{knt} + \beta_2 M_{kst} + \beta_3 d_{ns} + \beta_4 \sum_{n=1}^{N}\sum_{s=1}^{S} D_{ns} + \sum_{k=1}^{K}\sum_{n=1}^{N}\sum_{s=1}^{S} RI_{kns} +$$
$$\sum_{n=1}^{N}\sum_{s=1}^{S} \zeta_{ij} + \sum_{s=1}^{S} \phi_j + \sum_{t=1}^{T} \chi_t + \varepsilon_{nst} \tag{6.3}$$

and,

$$I_{knst} = \alpha_o + \beta_1 X_{kst} + \beta_2 M_{knt} + \beta_3 d_{ns} + \beta_4 \sum_{n=1}^{N}\sum_{s=1}^{S} D_{ns} + \sum_{k=1}^{K}\sum_{n=1}^{N}\sum_{s=1}^{S} RI_{kns} +$$
$$\sum_{n=1}^{N}\sum_{s=1}^{S} \zeta_{ij} + \sum_{s=1}^{S} \phi_j + \sum_{t=1}^{T} \chi_t + \varepsilon_{nst} \tag{6.4}$$

Variables are defined the same way as in equations (4.10-a) to (4.10-c), with a few exceptions. First, the dependant variable, whether total trade, exports or imports only takes place now between developed and developing countries.[106] Third, subscripts are modified from *i* and *j* to *n* and *s*, in account of Northern reporter and Southern partner. As a consequence of the collinearity problems reported in the previous chapter that prompted the modification of reporter countries fixed effects into developed and developing reporters, there are now no reporter fixed effects. *LANG* is dropped from all the equations for the same reason. The third and crucial difference involves the use

[106] See Appendix 6.2 for a list of developed reporters and developing partners

of the restrictiveness index. The variable for rules of origin, γ_{kij}, which was earlier composed by *CC, CTH, CTS, RVC, Regional Value Content - PANEURO Type (RVCEU), TT, WO, COMB, ALT* and *Exception to any type of Change in Tariff Classification (EXC)*, changes now to model the restrictiveness index R_{kij}. As explained above, this variable is now an ordered categorical value that can take values from one (most restrictive) to 20 (least restrictive). Each product has its own restrictiveness level, based on the combination of rules applicable to it. Hence, it varies from product to product as well as from agreement to agreement.

Further, a second set of regressions is run at sectoral level. In the previous chapter it was noted how the impact of the rules differs from exports to imports. In the same fashion, it is reasonable to think that the type of rule may have a different impact on different type of products. Clearly, a WO rule would be more restrictive on an electronics product where production is channeled throughout the world than on a live animal.

In addition, such study becomes relevant regarding the extremely limited literature on the impact of rules of origin at a sectoral level on anything other than textiles. While the impact of textile products on developing countries is certainly important regarding the intensity of labor in production, agriculture and industrial goods are also worth being studied at. The estimated equations are now:

$$I_{anst} = \alpha_o + \beta_1 X_{ast} + \beta_2 M_{ant} + \beta_3 d_{ns} + \beta_4 \sum_{n=1}^{N}\sum_{s=1}^{S} D_{ns} + \sum_{a=1}^{A}\sum_{n=1}^{N}\sum_{s=1}^{S} RI_{ans} + \sum_{n=1}^{N}\sum_{s=1}^{S} \zeta_{ij} + \sum_{s=1}^{S} \phi_j + \sum_{t=1}^{T} \chi_t + \varepsilon_{nst} \tag{6.5}$$

$$I_{bnst} = \alpha_o + \beta_1 X_{bst} + \beta_2 M_{bnt} + \beta_3 d_{ns} + \beta_4 \sum_{n=1}^{N}\sum_{s=1}^{S} D_{ns} + \sum_{b=1}^{B}\sum_{n=1}^{N}\sum_{s=1}^{S} RI_{bns} + \sum_{n=1}^{N}\sum_{s=1}^{S} \zeta_{ij} + \sum_{s=1}^{S} \phi_j + \sum_{t=1}^{T} \chi_t + \varepsilon_{nst} \tag{6.6}$$

and

$$I_{cnst} = \alpha_o + \beta_1 X_{cst} + \beta_2 M_{cnt} + \beta_3 d_{ns} + \beta_4 \sum_{n=1}^{N}\sum_{s=1}^{S} D_{ns} + \sum_{c=1}^{C}\sum_{n=1}^{N}\sum_{s=1}^{S} RI_{cns} + \sum_{n=1}^{N}\sum_{s=1}^{S} \zeta_{ij} + \sum_{s=1}^{S} \phi_j + \sum_{t=1}^{T} \chi_t + \varepsilon_{nst} \tag{6.7}$$

Equations (6.5) to (6.7) use only imports (into developed reporters) as dependant variable in order to concentrate on the impact of developing country exports. All three equations are equivalent with the only difference being the range of products *k* considered. Equation (6.5) looks at the impact on agricultural products, where *a* accounts for HS Chapters 1-24; equation (6.6) focuses on industrial products, where *b* is defined as HS Sections 16-21; and equation (6.7) concentrates on textiles, where *c* is imports belonging to HS Chapters 50-63.

All variables are expected to show the same sign and magnitude as in the results reported in the previous chapter. The restrictiveness index, R_{kij} is expected to be positive. The larger value it gets, the more trade facilitating the rules become. Therefore, an increase in R_{kij} should have a positive impact on trade in all flows and sectors. Results for both sets of regressions are reported in Tables 6.3 and 6.4, respectively.

Table 6.3. North South Trade-All Sectors-Index

	(1)	(2)	(3)
	All Trade	**Exports**	**Imports**
LIMP	0.335	0.286	0.456
	(130.96)***	(65.70)***	(55.28)***
LEXP	0.485	0.657	0.377
	(168.15)***	(124.70)***	(73.71)***
DIST	-1.091	-1.256	-0.597
	(43.52)***	(53.89)***	(9.54)***
LANG	(dropped)	(dropped)	(dropped)
CONTIG	0.817	0.625	1.274
	(15.07)***	(11.37)***	(10.54)***
SELFCER	0.177	0.001	0.703
	(6.49)***	(0.02)	(11.27)***
RI	0.026	0.022	0.016
	(13.97)***	(10.82)***	(4.50)***
Constant	7.316	6.117	2.945
	(37.45)***	(32.16)***	(6.08)***
Observations	172334	110445	61889
R-squared	0.73	0.81	0.68

Semi-robust t-statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6.4. North-South Sectoral Trade-Imports from South-Index

	(1)	(2)	(3)
	Agriculture	**Industry**	**Textiles**
LIMP	0.479	0.630	0.548
	(20.51)***	(44.55)***	(29.42)***
LEXP	0.263	0.286	0.287
	(21.44)***	(36.24)***	(25.31)***
DIST	-0.844	-0.624	-1.111
	(5.07)***	(6.37)***	(7.76)***
CONTIG	0.946	1.595	1.002
	(2.87)***	(8.53)***	(3.40)***
SELFCER	0.953	0.251	0.942
	(5.89)***	(2.53)**	(5.80)***
RI	0.032	0.046	0.035
	(2.54)**	(4.42)***	(2.87)***
LANG			
Constant	4.893	-0.007	7.248
	(3.56)***	(0.01)	(7.13)***
Observations	7645	21295	10254
R-squared	0.69	0.68	0.67

Semi-robust t-statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

The results are reported in Tables 6.3 and 6.4. Trade flows reported in Table 6.3 are reasonably well explained by the variables in the model. R-squared in the three columns stands for .74, .81 and .68. The lower fit of the imports model was also a feature of the results in Chapter 4. All the variables detailed in Table 6.3 are positive at the one percent level except for self-certification in the exports column. The acceptable R-squared along with the significance and expected sign of the coefficients is a positive indication regarding the applicability of the index.

With regards to the magnitude of the "size" variables, the trend highlighted above seem to be strengthened. The gap between the importance of the "push" and "pull" measures is wider for exports than for imports, where it is now actually reversed. It seems to reinforce the argument that exporters sell differentiated products which are less sensitive to the conditions of the market itself. However, the distance variable displays a larger coefficient for exports than imports. This could reflect the overdependence of countries like Mexico and Tunisia on US and EU exports, from which they receive 49 percent and 68 percent respectively.[107] At the same time, there seems to be a trade-off with the contiguity variable. This seems plausible in view of the contiguity variable which is much larger in the case of imports, acknowledging the fact that Mexico is a much more important exporter to the US than Tunisia and Egypt (close but not contiguous countries) are to the EU.

The restrictiveness variable, R_{kij}, is positive and significant at the one percent level in all three equations, as expected. Its coefficients are .032, .022 and .016 respectively for total trade, exports and imports. The variable is defined in levels, implying that a unit change in the index scale translates in 3.2 percent, 2.2 percent and 1.6 percent on the corresponding dependant flow holding all other variables constant.[108] This implies an impact on trade between the most and least restrictive rules of 60.8 percent, 41.8 percent and 30.4 percent, respectively.[109] Equivalently, changing from a TT rule (level eight on the index) to RVC (level 19) entails a 35.2 percent increase in total trade. The restrictiveness index displays the same sign as other examples in the literature as in

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[107] http://ec.europa.eu/trade/creating-opportunities/bilateral-relations/countries-and-regions/

[108] Since the index is defined in discrete numbers, taking the variable in levels allows a better interpretation of its coefficient.

[109] $\Delta = (20-1) * \beta * 100$

Anson et *al.* (2005) and Estevadeordal and Suominen (2004bis), although a more modest impact.[110]

Finally, self-certification remains positive throughout the regressions although in the case of exports it is not significant. Its magnitude is comparable to the results in the previous chapter for imports and somewhat lower for exports.

The fact that exports are more sensitive to improvements in the restrictiveness of the rules of origin than imports is somewhat counterintuitive as exports from developed countries would be expected to show less reaction to changes in the restrictiveness of the rules. Nevertheless, Table 6.4 provides further insight into this question.

In Table 6.4 all variables are significant at the one percent level, with the exception of the restrictiveness index for agriculture, which is significant at the five percent level. Gravity variables show a similar size and magnitude as previous regressions in this study. The size of the coefficient is comparable across the sectors with the exception of distance for textiles, which is larger than for industrial goods (-1.11 versus -.624). As before, there is a trade-off with contiguity in terms of magnitude, suggesting an equivalent explanation as to the size of the Mexican market in the US relative to other developing countries' exports to developed countries. Another reason can be in the fact that 45.9 percent of Mexican exports, a distant country from the EU, are in machinery and transport equipment.[111]

With regards to the restrictiveness variable, it displays the expected sign in all three instances. Interestingly, the coefficients are higher in all cases than in the aggregated imports column reported in Table 6.3 (-.032 for agriculture, -.046 for industrial products and -.035 for textiles). This indicates the possibility of the existence of certain sectors that are less sensitive to the restrictiveness of the rules of origin. Sectors like mineral products and fuels are prominent imports of developed countries from their developing partners and there is no incentive on the side of the importer to set stringent RoO. In fact, Eurostat (2010) reports that 59 percent of EU's imports from Chile are in fuels and mineral products; 65 percent of their imports from South Africa

[110] RoO restrictiveness in Estevadeordal and Suominen (2004bis) displays a coefficient of 1.48 in absolute terms.
[111] http://ec.europa.eu/trade/creating-opportunities/bilateral-relations/countries/mexico/

are either fuels and minerals or products not classified as agriculture, chemicals, machinery or textiles.

A number of studies have already documented the negative impact of rules of origin on textiles. In particular, Augier et al (2004) obtain evidence on RoO being particularly harming for EURO-MED countries in the absence of diagonal cumulation. They explain the harmful effect of RoO on textiles because they usually target the geographical sourcing of inputs, limiting their ability to source from the cheapest producer. Portugal-Pérez (2008) finds that African countries benefitting from a relaxation on the RoO requirements increase their exports by 300 percent. The case of the "double transformation" has been widely quoted as an example of harmful rule in the context of EU trade agreements. This rule requires two steps of production to be undertaken in a country to attain originating status, which is usually an onerous task. As a result, Brenton and Manchin (2003) report very low utilization rates for textiles from developing countries into the EU, suggesting their high sensitivity to RoO. The results in the present study sustain previous evidence. Developed country usually import low quality textiles from the South, which are manufactured in labor intense industries. Not being capital intense, these industries will probably have difficulties in adapting to more stringent rules of origin, considering their limited capacity to invest or to source themselves from more expensive inputs from the developed FTA partner.

As for agricultural products, the impact of the rules of origin was probably more difficult to predict. The European family of RoO relies on the "wholly obtained" criteria, which is a "take it or brake it" rule; either the animal is born and grown there or not and it is unlikely that a country without the conditions to grow a certain product becomes an exporter of such product. At the same time, processed agricultural products, including fisheries, are usually subject to controversy with regards their rules of origin. Naumann (2010) points to "onerous conditions" of EU RoO with regards to fisheries that prevented developing countries from exporting to the EU. Altogether the coefficient in Table 6.4 gives an indication that RoO are in fact sensitive to the stringency level of the rules. Another possible interaction with regards to agricultural products is that they are subject to another notable non-tariff barrier, such as Sanitary and Phitosanitary (SPS) measures, which can also be used as disguised protection (Iacovone, 2002). While these measures may reduce the effect of RoO on trade (the

same way that RoO served to reduce the effect of tariffs), further analysis needs to be conducted in order to ascertain this point.

Industrial products have usually been disregarded either by policy or empirical literature on rules of origin. The reason of the scarce interest in analyzing the impact on industrial products may reside in the supposed lesser importance of preferences for industrial products. Industrial tariffs are on average lower than agricultural tariffs and hence the impact of tariff preferences under FTAs is reduced. Cadot and de Melo (2007) calculate cost estimates of RoO compliance in the range of 3 percent. Together with similar calculations in previous studies, the authors establish in the range of three to five percent the preferential margin needed by developing country producers in order to export under the FTA. Industrial tariffs in the EU and the US amount to 3.3 and 4.1 percent respectively, according to the WTO Tariff Profiles (2009). In addition, tariff preferences in FTAs are normally topped with trade-facilitation provisions such as recognition of standards or fast-lanes for exports. This, which is not taken into account in the calculations by Cadot and de Melo (2007) may reduce the preferential margin needed to apply for FTA treatment. Therefore, it seems plausible that despite lower tariffs in industrial products (which are, in any case on the verge of the "participation constraint") exporters may have an incentive to channel the products under preferential conditions, hence using the FTA's RoO.

The impact showed by the restrictiveness variable indicates that in fact, it is the most sensitive sector of the three to changes in the rules. This may account to the fact that industrial goods exported from developing to developed countries must be produced by large enough companies which have the capacity to compete with developed country companies in their home market. If such is the case, these firms may have an optimized profit function and changes in cost, as caused by changes in the rules of origin, may entail a process of readaptation before being able to comply with the rule.

6.8. Conclusion

At present, empirical literature on RoO relies entirely on ex-ante indices, first developed in Estevadeordal (2000) and subsequently followed and augmented in a series of studies. The second main goal of this study is to provide a "real" index of RoO

restrictiveness, which can help gap the bridge identified in the literature in view of the following weaknesses of existing indices: a) Being an ex-ante observation rule, *ex-ante* indices are based on the author's subjectivity, therefore varying from author to author; b) Ex ante indices are based on unchecked premises; and c) in order to calculate the correct index, imports are more relevant than exports.

The way to construct a correct restrictiveness index is to do so using an *ex-post* observation rule, which is done from the estimates obtained in Chapter 5. In particular, from all the regressions conducted in Chapter 5, the ones used to compose the index are those of the import equation of Method 1. This choice is determined by two aspects. First, both theory and empirics suggest that RoO are in fact laid down by hegemonic importing countries; second, method 1 is the only one that allows for combination of rules.

The restrictiveness index, RI_k is defined as follows:

$$RI_k = (-.180)(\mathrm{CC}) + (-.039)(\mathrm{CTH}) + (-.143)(\mathrm{CTS}) + (.229)(\mathrm{RVC}) + (-.131)(RVCEU) + (-.210)(TT) + (.211)(WO) + (.178)(ALT) + (-.242)(EXC)$$

This equation, when combined all over the RoO included in origin protocols yields 70 different results. These 70 rules can now be ordered from 1 to 70 and an index would already be obtained. However, having 70 different values restricts the workability of the index, as there are many of these levels which rarely take place in protocols of origin. In order to develop a more verifiable index, these 70 instances are grouped into 20.

This index, which ranks from 1 to 20, being 20 the least restrictive, can now be used to assess stringency levels across agreements and is directly comparable to *ex-ante* indices.

Interestingly, despite the differences between *ex-ante* indices, and the *ex-post* index, they share common findings with respect to the restrictiveness of the agreements. For both of them, NAFTA is the most restrictive agreement, with the EU family presenting more facilitating rules and other US-based FTAs standing in between.

An analysis of the stringency of the RoO is also performed by sector using the *ex-post* restrictiveness index. It shows textiles as the sector with most restrictive rules. The one surprise in terms of sectoral restrictiveness is agriculture, being as it is a highly protected sector.

The ex-post index is subsequently used empirically to assess the sensitivity of exports from developing countries into developed countries to the stringency of RoO, by looking at three sectors in particular: textiles, agriculture and industrial products. The results of the estimation show significant results and the coefficients display the expect sign. The results show that trade in every sector reacts negatively to increases the stringency levels of the RoO, as should be the case. The one that shows a higher inclination to react negatively to RoO stringency is the industrial sector. It seems plausible that despite lower tariffs in industrial products (which are, in any case on the verge of the "participation constraint") exporters may have an incentive to channel the products under preferential conditions, hence using the FTA's RoO.

Chapter 7. Review Process of Rules of Origin

7.1. Historical Background on Rules of Origin

Rules of origin were initially devised as uncontroversial technical neutral devices to implement necessary trade policies, such as compiling statistics or labeling requirements (LaNasa, 1995). The author continues to describe how first attempts to harmonize rules of origin were turned down under the premises that defining origin was "inescapably bound to national economic policies".

As Forrester (1994) notes, they only began attracting attention after the signature of free trade agreements between the European Communities and the European Free Trade Area (EFTA) countries in the mid 1970s. Increased Japanese exports were feared by European policy-makers and consequently, by 1980, they started drafting strict rules to ensure that no unwanted Japanese (and American) components fled the European market through the partner EFTA countries.

Three other factors emerged at similar period. First, increasing internationalization of production. As Forrester (1994) indicates, original rules in the EU were designed as if production took place in one single country. Such a definition of origin was not valid anymore. Second, the intense increase of Free Trade Area (FTA) numbers after the uncertainty created by the outcome of the Uruguay Round; in 1991 there were 50 active RTAs in the world and by 2000 that number had increased to 200, according to figures of the Secretariat of the World Trade Organization (WTO).[112] Rules of origin are intrinsically more sensitive in FTAs than multilaterally as they go beyond their initial intended technical specification to be the devices through which preferences are granted. Third, Harilal and Beena (2003) highlight how, following several successful General Agreement on Trade and Tariffs (GATT) rounds of negotiations, countries had

[112] www.wto.org/english/tratop_e/region_e/regfac_e.htm

lost by the mid 1990s much of their power to conduct trade policy by the use of tariffs. They needed to restore to non-traditional trade policy mechanisms.

These four factors converged in a renewed interest by policymakers to gain control over rules of origin. As such, an Agreement of Rules of Origin emerged as part of the WTO during the Uruguay Round. By then, the other economic superpower at the time other than the EU, the US, had joined the regionalism trend. The North American Free Trade Area (NAFTA) came into force in 1994, providing for highly restrictive rules, as is shown in previous chapters. It then became ever clearer the potentially trade-disruptive effect of rules of origin. As a consequence, the main objective of the Agreement on Rules of Origin was to harmonize rules globally and to ensure that rules of origin did not become an obstacle to trade. It is based on the following principles:

- Equality among members, i.e. Most Favored Nation (MFN) treatment
- Based on wholly obtained or substantial transformation
- Rules should be objective, understandable and predictable
- Non-restrictiveness
- Easily administrable
- Coherence

The Agreement explicitly excludes preferential rules of origin from its scope, which is a sign of the countries' intention to retain this trade-policy mechanism under their control.

In parallel, FTAs started relying more on rules of origin. The first FTA officially containing provisions on rules of origin came into force in 1991.[113] Although this fact must be taken with caution, it reveals the fact that pre-WTO FTAs did not attach so much importance to rules of origin.[114] The reality is that many of them, such as the Economic Community of Western African States (ECOWAS), the South Asian Free Trade Area (SAFTA) or the Gulf Cooperation Council (GCC) based origin on an across-

[113] See Appendix 7.1 one for a list of RTAs containing provisions on rules of origin.
[114] This figure, though official, is misleading as there are some agreements that supersede others, such as the European Communities, which is currently considered to have entered into force in 2007 in account of the last enlargement. Also, some agreements may not be notified to the WTO.

the-board general requirement, either a Change in Tariff Classification (CTC) or a Regional Value Content (RVC). Only after the coming into force of the WTO or, more particularly, NAFTA, it was that the bulk of FTAs adopted the complex set of rules of origin we know today.[115]

7.2. Rules of Origin Around the World

According to the WTO, today there are 210 notified RTAs to the WTO of which, 172 are FTAs.[116] Most have their own system of origin determination, reproducing for this trade measure the so-called spaghetti bowl of FTAs.[117] The complexities of an overall analysis of each of them are thus enormous. However, many FTAs share common traits on their origin requirements, or are even identical, which allows to classify FTAs according to "families".[118] In account of their influence over other origin regimes in the world two most important ones are the Pan-European System of Rules of Origin (PANEURO) and NAFTA. Here follows a depiction of some of the most prevalent ones.

The rules applicable to agreements signed by the EU are highly complex, with a variety of combinations and alternatives between every type of rule (i.e. CTC, RVC, Technical Test (TT) or Wholly Obtained (WO)). RVC and CTC are the most commonly used rules, in many instances in combination with each other. WO are applied to agricultural products and textiles are normally subject to TT rules. As Estevadeordal and Suominen (2004bis) point out, the EU is extremely stiff in the application of its rules. In its attempt to harmonize rules across agreements, the EU established the single list of RoO, which is applied equally to all FTAs, with only minor modifications. Brenton and Manchin (2003) state that the EU has one way of negotiating rules with prospective partners: "you accept them or you accept them". At the same time, equal rules are employed across all the agreements in account of its willingness to promote diagonal cumulation.[119]

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[115] See Appendix 7.2 for a list of origin determination criteria in RTAs.
[116] See Appendix 1.1
[117] This term was first used by Bhagwati in 1995 to refer to the multiplicity of FTAs around the world.
[118] See Chapter 6 for a comparison of restrictiveness across selected FTAs.
[119] See Chapter 3 for a description of this provision.

NAFTA rules are characterized by being very restrictive. Product specific rules are extremely detailed, with more than 2,000 different entries. They are largely based on Change in Tariff Classification (CTC), whether a Change in Chapter (CC), a Change in Tariff Heading (CTH) or a Change in Tariff Subheading (CTS); exceptions to the CTS are common place. Also, in most cases they are either supplemented or complemented by a content requirement. TT rules are used too, essentially for textile products. Differing from EU's regime, agricultural products are usually subject to Change in Chapter (CC) rules.

In turn, the US has extended the NAFTA system to other agreements. Except US-Jordan and US-Israel, which rely on across-the-board rules for all products, all other agreements follow the NAFTA style. However, unlike the EU, the US is more flexible in allowing for certain departures from NAFTA rules. Lastly, regime-wide provisions of both PANEURO and NAFTA are listed in Table 7.1 below.

Table 7.1 Regime-wide provisions in NAFTA and PANEURO

Agreement	De minimis	Absorption	Cumulation	Certification	Duty Drawback
NAFTA	7 percent, albeit subject to limitations for agriculture and Ch. 84	Yes, except automobiles	Bilateral	Self-certification	No, 7 years alter the entry into force of the agreement
PANEURO	10%	Yes	Bilateral	Public-private certification	No

Source: Origin Protocols from the Agreements

Other families of rules of origin tend to be highly influenced in their shape by either NAFTA or PANEURO. FTAs in the Americas share the same structure as NAFTA, particularly the "new generation" agreements (the ones signed after NAFTA). However, the rules applied are not necessarily the same and they are all less restrictive than NAFTA (Estevadeordal and Suominen, 2004bis).

By its part, the EU exerts its influence in Africa, with agreements like the Southern African Development Community (SADC) almost replicating EU rules. Similarly,

EFTA applies EU type of rules in all its agreements. As in the case of American countries with NAFTA, EFTA may vary the exact content of the rule, usually becoming somewhat more restrictive than the EU.

FTAs in Asia adopt a NAFTA-like approach, with a great deal of detail for every product. Estevadeordal and Suominen (2004bis) find that they rely more than NAFTA on CTH, hence becoming less restrictive.

To end, an additional family would be made of those agreements highlighted above that are part of the "old generation", most of which are South-South agreements. Examples of these are the Common Market of Eastern and Sothern Africa (COMESA), the Gulf Cooperation Council (GCC) or the Latin American Integration Association (LAIA).

7.3. Preferential Rules of Origin and the Multilateral Trading System

As mentioned above, the WTO Agreement on Rules of Origin explicitly excludes preferential rules of origin from its scope.[120] Therefore, the only WTO article that applies to preferential RoO is GATT Article XXIV. This article may be invoked by WTO members to allow them departing from the MFN principle if two or more members participate in an FTA. However, some conditions must be met. In particular, Article XXIV:5 states:

> *Accordingly, the provisions of this Agreement shall not prevent, as between the territories of contracting parties, the formation of a customs union or of a free-trade area or the adoption of an interim agreement necessary for the formation of a customs union or of a free trade area;* ***Provided*** *that:*
>
> *(b) with respect to a free-trade area, or an interim agreement leading to the formation of a free-trade area, the duties and* ***other regulations of commerce*** *maintained in each if the constituent territories and applicable at* ***the formation of such free-trade area*** *or the adoption of such interim agreement to the trade of contracting parties not included in such area or not parties to such agreement* ***shall not be*** *higher or* ***more restrictive*** *than the corresponding duties and other regulations of commerce existing in the same constituent territories* ***prior to the formation of the free-trade area****, or interim agreement as the case may be;*

[120] The only reference to preferential rules of origin in this agreement is made in the Common Declaration attached to it where it states that the rules should be transparent.

And Article XXIV:8.b:

> *A free-trade area shall be understood to mean a group of two or more customs territories in which the duties and* ***other restrictive regulations of commerce*** *(except, where necessary, those permitted under Articles XI, XII, XIII, XIV, XV and XX) are* ***eliminated on substantially all the trade*** *between the constituent territories in products originating in such territories.*

Preferential rules of origin are therefore not explicitly mentioned in WTO law. However, the term "other restrictive regulations of commerce" (ORRC) could apply to them. ORRC is not precisely defined in WTO and thus, has been suggested to include measures like Sanitary and Phitosanitary Measures (SPS) or Technical Barriers to Trade (TBT), although no final decision has been made (WTO, 2000). Even though the exact provisions of what belongs or not to "other restrictive regulations of commerce" are not defined, the WTO includes rules of origin as part of the *factual presentations* which are drafted to promote transparency of FTAs. *Factual presentations* are objective overviews of what are considered to be key provisions of the agreements.

Including or not RoO as part of the definition of "other restrictive regulations of commerce" is crucial. In order to be allowed preferential, discriminatory treatment under Article XXIV, an agreement must fulfill the conditions indicated above. If it does not, the agreement could be challenged before the WTO court. Article XXIV:5 is usually seen as the external requirement for FTAs, while Article XXIV:8 specifies the internal conditions under which an agreement may be considered an FTA. This means that FTAs have one external and one internal criterion they need to fulfill in order to qualify under Article XXIV.

In accordance to WTO (1997), rules of origin have been suggested by some member states to be included in the definition of "other restrictive regulations of commerce". If such were the case, and rules of origin were found to be "more restrictive than … prior to the formation of the free trade area", there could be a potential legal basis to challenge the agreement. In fact, preferential rules of origin are always more restrictive than multilateral rules of origin, i.e. prior to the formation of the agreement. Their potential for diverting trade is well documented in the literature, as has been shown in previous chapters. Moreover, diverting trade may actually be the very reason of their

existence, as suggest Duttagupta and Panagariya (2003). Therefore, imposing overly restrictive rules of origin could give rise to a WTO dispute.

In addition, the internal requirement specifies that "other restrictive regulations of commerce…are eliminated on substantially all the trade".[121] As has been seen before, restrictive rules can divert trade, but overly restrictive rules can actually suppress it, as noted by Augier et *al.* (2004). Again, this could encourage countries to challenge an FTA on the grounds that "other restrictive regulations of commerce" have not been eliminated.

Further complaints raised at the Committee on Regional Trade Agreements related to rules of origin include concerns about the issue of diagonal cumulation. Voices raised against this provision adduce that diagonal cumulation extends preferential treatment to members with whom there is no legal basis. Lastly, WTO (1997) details how some countries defend how, in order to calculate whether "substantially all trade" is liberalized between the parties of an FTA, account must be taken of the degree of restrictiveness of the rules. The extension of this reasoning is that tariff liberalization can be overwhelmed by restrictive rules of origin. This argument is in line with the theoretical and empirical literature in the vein of Anson et al. (2005) who defend that rules of origin undermine trade preferences.

In sum, as long as no decision on excluding RoO from the scope of the term "other restrictive regulations of commerce", any member imposing trade diverting rules of origin could potentially be challenged on the basis of Article XXIV.

No FTA itself has been challenged at the WTO.[122] Every WTO member except Mongolia is part of at least one Regional Trade Agreement (RTA). Thus, challenging one RTA could turn against itself. However, although unlikely, if any member were to depart from regionalism in favor of multilateralism, it could challenge RTAs on the basis of not liberalizing trade among the parties sufficiently (XXIV:8) or imposing additional barriers on third countries (XXIV:5). If rules origin maintain their current restrictive configuration, they could be a prime target of such challenge.

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[121] See WT/REG/W/37 for a discussion on the concept of "substantially all the trade".
[122] See WTO (2007b) for a summary of disputes at the WTO.

7.4. Voices in Favor of RoO Revision

Whether from a theoretical, empirical, or case-study perspective, there is broad consensus in the literature about the impediments that RoO can represent to trade.[123] The effects associated to them are countless. These are some of the most prominent flaws that are considered to be intrinsic to preferential RoO regimes:

a) RoO are costly:

Anson et al. (2005) estimate the costs of complying with NAFTA rules of origin and PANEURO at about 4 percent of the price of the final good. In a subsequent study, Cadot et al. (2005) add administrative costs to estimation and find them to increase by almost seven percent in the case of PANEURO and two percent in the case of NAFTA. Mattoo *et al.* (2003) argue that African exports to the US would have been five times higher if the African Growth Opportunity Act (AGOA) would have had a simpler RoO system. At the sectoral level, Portugal-Perez (2008) finds evidence that African exports to the US increased by 300 percent once the single transformation rule was adopted.

b) RoO distort trade:

Simplified at the limit, any alteration of the optimal combination of factors of production induces effects on trade. The alteration imposed by rules of origin is likely to require input sourcing from less competitive FTA partners. Therefore, rules of origin are commonly regarded as causing trade diversion. Rodriguez (2001) builds a theoretical model to conclude that RoO can not only divert trade but also cause *trade regression*, i.e. the inefficient allocation of trade resources among FTA partners. Similarly, Augier et al (2004) point out that RoO can lead to trade suppression, i.e. reallocating international inputs by local inputs.

c) RoO are drafted in the interest of developed countries:

[123] Theory shows how RoO decreases overall welfare. However, it has also been demonstrated how, under certain conditions RoO can improve overall welfare. See Chapter 2 – Literature Review for a summary of the different effects of RoO from a theoretical, empirical and policy oriented point of view.

If RoO can alter trade patterns, it is developed countries who grasp the benefits of these disruptions. Krueger (1993) shows theoretically how American intermediate good producers are the chief gainers of NAFTA. In the same fashion, Anson et al. (2005) obtain evidence that rules of origin become more restrictive as tariffs in the developed country drop, implying a protectionist use of RoO. The negotiations on rules of origin for the automobile sector are a widely quoted example of how the rules were drafted in order to protect local manufacturers in the US, (Deardorff, 2004).

Some authors have taken this argument a step further and affirm that the drafting of rules of origin is controlled by powerful sectoral lobbies in developed countries. Herilal and Beena (2003) call this the "privatization" of trade policy and take textile lobbies to have played an important role in the framing of restrictive NAFTA rules. Deardorff (2004) finds it a plausible explanation that the reduced size of the United States Trade Representative (USTR) makes it impossible to deal with the intricacies of all the rules of origin that are involved in FTA negotiations. As a consequence, trade negotiators duly accept assistance from willing industries.

d) RoO are obscure:

As a follow-up of the previous criticism, the process of setting the rules remains obscure. There is little scrutiny over the crafting of the rule. Brenton and Manchin (2003) highlight that current European rules of origin seem to be applied now because they were already used in the past. This leads the authors to suggest that original rules of origin reflected the interests of particular groups who intend to maintain the *status quo*. Flatters (2002) raises the same question about the modification of SADC rules of origin, which went from and across-the-board regional value content requirement to a set of rules that closely resembles that in the EU-South Africa agreement, although South African textile producers were against stricter rules.

e) RoO may differ widely across agreements

The multiplicity of agreements described above results in a multiplicity of rules among FTAs. These rules may or may not be similar; as a consequence, exporters in countries being part of several agreements may encounter added difficulties to export under each of the regimes. As Naumann (2010) notes, opposite rules may undermine the

capacity for exporters to achieve economies of scale, as different processes may need to be performed to export to different markets. The following example illustrates this issue:

Example of contradictory rules of origin		
Product	Chile-Costa Rica FTA	Chile US FTA
210690	A change to heading 2106 from any other heading, except from Chapter 17	A change to a single fruit or single vegetable juice of subheading 2106.90 from any other chapter, except from headings 08.05 or 20.09, or from fruit or vegetable juices of subheading 2202.90

A Chilean exporter could produce edible ice mixtures preparations (Harmonized System (HS) 210690) from ice cream and other edible ice (HS 2105) and export to Costa Rica.[124] The change in tariff classification required by the rule would be satisfied (from HS 2105 to HS 2106). However, this product was produced without a change in chapter. As a consequence, it would not enter the US under the preferential regime as it would not satisfy the rule.

In view of the problems that current RoOs pose as they stand, there are countless voices asking for their reform. Taken together, these voices pursue the same principles as those underlined above as guiding the WTO Agreement on Rules of Origin. In practical terms, they imply two general demands. First, rules should be less stringent and; second, administrative procedures should be less costly.[125]

In the first group of demands, proponents argue for a relaxation of the technical criteria involving RoO. Estevadeordal and Suominen (2004bis) even hope for their complete removal, although they see the political impossibility of this.

Making the rules less stringent is often associated to global harmonization. The Commission for Africa (2005) ("The Blair Report"), calls for an across-the-board rule of

[124] Supposing that no sugar (HS Chapter 17) was added

[125] One differing opinion is that of Harris (2009). He argues that developing countries benefit from extra protection under stringent rules of origin as they act as an incentive to attract investors and produce locally. In the absence of these rules, investors would shift to the cheapest country and only perform minor operations in the developing country FTA member before exporting to the larger market.

origin requiring just 10 percent value added for developing countries; the World Bank (2007) defends that attention should be given to ensure that RoO are identical across agreements. Cornejo and Harris (2007) endorse the creation of a General Origin Regime for the Americas for all existing FTAs, all sharing the same RoO. Estevadeordal and Suominen (2004bis) defend a multilateral harmonization of preferential rules, for which they see a political viability. In the same fashion, LaNasa (1995) suggests following the multilateral negotiations on the harmonization of rules of origin and adopting the resulting rules internationally. Garay and De Lombaerde (2004) agree with this opinion, although they consider it a second best alternative, the first one being establishing a CTC rule for all products.

Which general criteria to use, if any, is an aspect where there is no agreement among researchers. Cadot and de Melo (2007) suggest setting a global value content requirement while the World Bank (2007) follows Garay and De Lombaerde (2004) in calling for a harmonized CTC rule; in their view, it outperforms CTC because of its simplicity. In addition, calls for reform have also focused on specific sectors. After the relaxation of EU's criteria for granting origin for fisheries in the Pacific-Economic Partnership Agreement (EPA), authors such as Naumann (2010) call the EU to extend these new rules to all agreements.[126] However, most sectoral demands concentrate on the textile sector. One example is Portugal-Pérez (2008) who calls for the simplification of the double transformation rule into single transformation.

Other requests in favor of relaxing the technical aspects of the rules involve regime-wide provisions. In particular, the extension of cumulation is a common concern. Harris (2009), Augier et al (2004) and Naumann (2010), among others, defend the application of diagonal cumulation across all the agreements of a developed member, such as the EU or the US. This would allow developing countries with different comparative advantages to benefit each of them from one stage of production. This is of particular importance in countries with limited industrial basis and thus, reduced capacity to integrate vertically within the country itself.

[126] Under the new rules, Pacific Island fisheries exporters only need to have an on-shore factory for the good to qualify under the agreement, as opposed to the stringent nationality requirements applied previously.

Administrative costs have been found to represent the order of two to seven percent depending on the agreement.[127] According to Cornejo and Harris (2007) one of the main determinants of administrative costs is the paper work entailed in proving origin. Related to the proof of origin is the issue of certification, i.e. the steps an exporter needs to undertake in order to get the product certified. Broadly, there are two models, private certification, and public certification. The first one consists of a declaration by the exporter himself while the second one involves inspection by public authorities.[128] According to Estevadeordal and Suominen (2004bis), self-certification as opposed to public certification is likely to lead to lower administrative costs for two reasons. First, it reduces the bureaucratic steps to attain origin, with the accompanying diminution in the amount of work and time involved for the exporter; and second, it places the burden of proof of origin on the importing country, rather than the exporting. For imports into Northern countries from developing partners, this is potentially an issue that may reduce substantially the administrative costs of the regime.

7.5. Current Efforts

Accounting for the calls for a revision of RoO, Garay and De Lombaerde (2004) explain how the European Commission launched in 2003 an effort to review rules of origin. Among other constraints, it was found that European business perceived the rules as complex, restrictive and burdensome. According to Naumann (2010), the European Commission issued two papers expressing preference for the value added approach. These papers confronted opposition by industry with regards to the technicalities of the calculations.[129] Since then, progress to undertake the reform slowed down. However, late in 2010, the Commission issued a new regulation simplifying the rules of origin for GSP countries.[130] One of the main aspects of these rules is the adoption of self-certification by 2017. However, this legislation includes one step from a public authority as it requests exporting countries to register their exporters. At the same time, other changes consist of a move to single transformation in textiles for LDCs as

[127] See Cadot et al. (2006) for a review of administrative costs across the literature on rules of origin.
[128] Empirical research so far has focused on any of these specific provisions has centred on the procedure to obtain the certificate. Estevadeordal and Suominen (2004bis) find a strong positive influence of self-certification on aggregate trade, as opposed to public certification.
[129] The proposal suggested a change to "net production cost" from the current "ex-works price" which according to PriceWaterhouseCoopers (2006) implied an increase in administrative costs.
[130] Commission Regulation (EU) No 1063/2010

well as improved cumulation conditions across regions. Also, RVC seems to be more and more the preferred option by the Commission, although there is still no official position on that respect (Thorstenten, 2008 and Steele, 2010)

In the US, attempts have also been made in order to harmonize rules of origin by the Customs and Border Protection (CBP), which is the agency responsible for determining origin. However, instead of seeking the utilization of one criterion across the spectrum of products, Jones and Martin (2011) highlight that there was an attempt to extend NAFTA rules of origin to all trade. This proposal was put forward in 2008 and it received considerable criticism from industry. No action has been taken so far. Regarding modifications in the rules of origin in FTAs, NAFTA saw an amendment aimed at "liberalizing rules of origin" in 2009 on products representing 140 $ billion in annual trilateral trade.[131].

Lastly, at the multilateral level, efforts to harmonize continue within the framework of the Harmonization Work Programme established by the Agreement on Rules of Origin. This programme started with the creation of the WTO and it was intended to complete its work within three years. As of 2010, the Chairman of the Committee on Rules of Origin announced that work harmonization had been agreed for 55 percent of the products. However, it must be noted that the Harmonized Work Programme (HWP) of the Committee requires harmonization of rules on 2,739 products when the usual universe of products in a medium size country is in the range of 4,500.[132]

This overview of the reform process at different levels reveals an interesting factor. Whether at national, regional, or multilateral level, it seems that RoO are extremely sticky; once they are set, it is very difficult to change them. This seems a logical conclusion when thinking that once exporters adapt to trade under one rule, it may be costly to change their processes to comply with a different rule.

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[131] http://www.international.gc.ca/trade-agreements-accords-commerciaux/agr-acc/nafta-alena/tech-rect.aspx?lang=en&menu_id=35

[132] http://www.twnside.org.sg/title2/wto.info/2010/twninfo100505.htm

7.6. Policy Proposal

A number of relevant facts stem from the present study. First, rules of origin are costly, distortive and complex as they stand. It follows that there is a need to review rules of origin, both legally and economically. This effort should be particularly addressed at the harmonization of rules. Second, the estimations of the impact on trade carried out in the previous two chapters show that RVC rules are the most trade-conducive type of rule.[133] Third, there is a reluctance to modify rules by the part of industry in developed countries.

Taking these elements into account, a recommendation for adoption of an across-the-board alternative RVC rule appears as the best choice. At the same time, agricultural (unprocessed) products would be left aside from the application of this rule; it is very difficult to add value on life beings. Agricultural products would, in turn, be provided with an alternative WO rule for all agricultural (and other WO) products, which is the second type of rule in the ex-post index in terms of its positive impact. Cadot and de Melo (2007) also argue in favor of an RVC general rule.

The amount of regional content required in this rule would have to be negotiated. However, the estimates on the positive performance of this rule obtained in previous chapters do not take into account different levels of value content but just the type of rule itself. The implication is that, within reason, changes in the regional content requirement should not imply large modifications in the ability to export under this criterion. In any case, there could be a possibility for countries to establish a different threshold within a range.

Setting this rule as an alternative would not change the current status-quo for all those producers willing to export under the current regime. Therefore, this proposal simplifies the multilateral efforts undertaken at the WTO in that industry would not have to readapt to a new rule; it would just add an alternative. Having the possibility to export under two different rules has also been found to have positive effects on trade, particularly on imports. Its application would then be straightforward.

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[133] See Tables 4.17-4.19

Additionally, allowing for self-certification is also recommended. This may prove to be more difficult to apply as it would mean that countries requesting public authorization would have to forego this prerogative. For those countries, a mixed system could be envisaged. Such system could afford speedier transit to those products having been publicly certified (nothing would prevent an exporter/importer to use public certification), while still declaring legal a self-certified document.[134] Provisions exempting (importing) developing countries/LDCs from adopting self-certification could also be drafted, as argued below. However, support for self-certification procedures is not unanimous in policy makers as it is in the literature. Steele (2010) warns against the main risk of self-certification, namely the fact that EU importers may resist importing from suppliers who are not used to self-certification.

Some researchers find the application of an RVC rule unadvisable. LaNasa (1995) argues extensively against it. His main criticisms are described below followed by the corresponding counterarguments:

a) The RVC test generates substantial compliance costs for companies:

Proving origin may indeed be more costly than under a CTC requirement. However, in today's world customs procedures are increasingly computerized, easing the process to trace down the value of materials. At the same time, having a multilateral binding agreement granting the application of this proposal, firms would have an incentive to invest in adapting to comply with these procedures. The returns from their investment would be justified on the grounds of long-term gains.

In addition, by relying on self-certification, the burden of proof would fall on the importing country administration, therefore liberating the developing country exporter from the extra costs associated with this rule. The extra amount of resources needed to deal with additional verification procedures would come from increased trade.

b) The RVC test generates substantial uncertainty for companies:

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[134] Developing countries/LDCs could find a difficulty on applying self-certification as their administrations could not comply with verification procedures. Alternatives for these countries such as additional resources to adapt administrations or even temporary exemptions from the regime could be envisaged.

This uncertainty is based on the fluctuations of exchange rates and the price of raw materials. Additionally, LaNasa argues that this would provoke identical goods varying their qualification of origin depending on the exchange rate relationship between the importer and the exporter.

With enough political will, there would certainly be alternatives to overcome this issue. For instance, a reference price could be set every year both for the exchange rate and for the raw materials. The spirit of this rule is to promote trade in a way that still prevents trade deflection. If at the beginning of the year a product made of a certain material was deemed to be originating, there is no reason to prevent that same product from retaining its originating status as the price of the material increases. In such way, fluctuations both across countries and time would be minimized.

c) The RVC test leads to inconsistent results for similar products:

The reason for this lies in that countries calculate regional content in different ways. For instance, the EU uses as reference the "ex-works" price while the US prefers the "transaction value".

Ideally, countries would adopt the same system, based on some internationally agreed "Best Practices". However, if they did not, it would still represent a clear improvement from today's standing point where countries not only differ on their calculation methods but they differ on the rules altogether.

d) The RVC test penalizes low cost operations:

The primary comparative advantage is cheap labor and cheap materials for a number of countries. Those countries would find more difficulties in attaining originating status than countries with capital-intensive facilities.

Today, such industries and countries can be clearly identified. This system could envisage a "development" package whereby two possibilities could occur: i) affording a lower regional content requirement for LDCs; and/or ii) affording a lower content requirement for certain industries/products.

In summary, all the caveats normally expressed against this sort of system could be resolved with enough will from the parties. At the same time, countries would retain their rightful control over preventing trade deflection and industry would not have to readapt unless voluntarily. In any case, problems caused by any technicalities related to this system would most likely be outweighed by the benefits from increased trade.

7.7. Conclusion

Rules of origin were initially devised as uncontroversial technical neutral devices to implement necessary trade policies. They only began attracting attention after the signature of free trade agreements between the European Communities and the European Free Trade Area (EFTA) countries in the mid 1970s. Three other factors emerged at similar period. First, increasing internationalization of production; second, the intense increase of Free Trade Area (FTA) numbers after the uncertainty created by the outcome of the Uruguay Round, and third, the power lost in tariffs after the conclusion of the Uruguay Round.

The FTAs that proliferated in mid 1990s were being accompanied by origin protocols. As the FTA number grew, powerful countries started to develop their own "template" of RoO, turning into what are now called families of RoO, the most notable being the PANEURO-type of RoO and NAFTA-type RoO. These rules, theoretically innocuous threaten to cause a problem to the WTO as they represent a potential violation of GATT Art.XXIV. Concerns at the WTO as well as within the signatories of FTAs have prompted the debate over the reform and harmonization of RoO. Those calling for this reform argue that RoO are: costly, trade distorting, in the interest of developed countries, obscure and show great dispersion across countries.

Some timid efforts are being made in this respect both in the US and the EU (as well as multilaterally). However, it is not an easy task. The overview of the reform process at different levels reveals an interesting factor. Whether at national, regional, or multilateral level, it seems that RoO are extremely sticky; once they are set, it is very difficult to change them. This seems a logical conclusion when thinking that once exporters adapt to trade under one rule, it may be costly to change their processes to comply with a different rule.

In view of the results of this study, as well as in account of current reform efforts, one policy proposal is suggested, namely the adoption of an across-the-board alternative RVC rule. At the same time, agricultural (unprocessed) products would be left aside from the application of this rule; it is very difficult to add value on life beings, which would be added an alternative WO rule to comply with in addition to the rule already in place.

This proposal simplifies multilateral efforts undertaken at the WTO in that industry would not have to readapt to a new rule; it would just add an alternative. The fact that it would be offered as an alternative disqualifies most criticisms received by this type of rule which would, on the contrary, add a great deal of transparency, predictability, implicating lower costs.

Chapter 8. Conclusion

8.1. Summary of main aspects

Literature on RoO can be broadly divided in theoretical and empirical. None of them was developed until the mid 1990s and has remained limited in scope thereafter.

Theoretical literature was largely influenced by the literature on local content protection started by Grossman (1981) and Mussa (1984). Most studies on this regard explore the impact of RoO on prices, production, trade flows, welfare and on the chain effects on intermediate and final goods. Most studies start their analysis by focusing on the alteration that the imposition of a RoO brings to the optimal combination of inputs of the pre-FTA equilibrium. From here, the overview of the economic literature on RoO reveals that these instruments can be powerful policy mechanisms in affecting a wide range of trade related aspects. In particular, there are five main observations. First, RoO tend to cause harmful effects on welfare although, under certain conditions, they can actually improve it; second, RoO are more likely to result in positive effects when compared to pre-FTA scenarios that contemplate tariffs rather than free trade; third, intermediate goods are likely to experience increased demand at the expense of final good producers; fourth, as the restrictiveness of the RoO increases, so does the probability that they produce harmful effects and; fifth, the details of each particular situation matter.

Empirical literature on RoO can be divided into *ex-ante* and *ex-post* literature. The former scrutinizes RoO protocols and assigns values to each type of RoO, as well as to the different regime wide provisions. This current of the literature was developed under the need to compare origin regimes across trade agreements and concentrates largely on the development of *ex-ante* indices of RoO restrictiveness. By its part, *ex post* literature focuses on the impact of RoO on different trade-related variables, such as trade volumes, tariff preferences or the cost of compliance with RoO. A majority of the work done uses the restrictiveness indices developed *ex-ante* as exogenous independent variables that explain the trade variable under scrutiny. Additionally,

there are a handful of studies that code RoO in different ways so as to assess the estimated impact on trade volumes, although these studies are usually quite limited in scope.

From the review of the empirical literature there are two main findings that become relevant in the present context. First, there is unanimity in that RoO impede trade when taken as a package. To my knowledge, no study has shown positive trade effects of RoO when looking at a representative selection of trade flows.[135] However, the second main finding is that when RoO are disaggregated into their different components, some of them that can actually increase trade. This is the case of some regime-wide trade facilitating measures, and some concrete types of product-specific RoO. The potential for further research to explore this latter finding is encouraged by the fact that only a handful of studies have looked at these questions.

Rules of origin are very complex trade policy mechanisms that lay down a series of conditions a product needs to meet in order to be considered originating in a particular geographical area.

A first distinction of RoO families must be done between preferential and multilateral, or non-preferential, RoO. Often, the general public is mistaken by thinking that the types of rules used in these two groups are different, while they are not. The distinction between them relates then to whether they are used in a multilateral or preferential context. In the context of the present analysis, the focus will concentrate on preferential RoO.

A second clarification between RoO refers to whether a condition applies to the entire spectrum of products or it details the characteristics a specific product must meet. The former are known as regime-wide provisions and although subject to variation, they estipulate the provisions regarding the procedural requirements needed to demonstrate origin, the possibility to accumulate production in other countries or *de minimis* rules, among others. By its part, the rules that apply to a specific product are called product-specific rules of origin, which are traditionally the main focus of study when RoO are considered.

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[135] Estevadeordal and Suominen (2004bis) concentrate on selected intermediates.

Product-specific rules of origin lay down the conditions a product must meet to become originating. They can be broadly divided into Wholly Obtained (WO) rules and Substantial Transformation criteria. WO rules require a product to be originating in a particular area to achieve originating status. Substantial transformation rules refers to those rules that require the product to undergo "substantial transformation" in order to become originating. They are divided in three main groups: i) Change in Tariff Classification (CTC), when the rule requires the product to change its HS tariff classification to become originating. Depending on the level at which the change is required (chapter, heading or subheading), the change in tariff classification is called change in chapter, change in tariff heading or change in tariff subheading; ii) percentage rules, which require the product incorporate a certain percentage of local content in its total value; and iii) technical test (TT) rules, which set any particular action in order to confer originating status. The WO rules together with the groups of substantial transformation rules are the main four "families" of RoO, as exemplified in Table 8.1.

Table 8.1. Different Types of Product Specific Rules of Origin

Wholly obtained (WO)		
Substantial Transformation	Change in Tariff Classification (CTC)	Change in Chapter (CC)
		Change in Tariff Heading (CTH)
		Change in Tariff Subheading (CTS)
	Regional Value Content (RVC)	
	Technical Test (TT)	

These four families are usually subsequently combined among themselves in origin protocols. One or more rules can be provided as either alternatives or as a supplementary requirement for a good to obtain originating status. A further type of rule relates to exceptions added to the CTC rule, whereby the rule allows an exception to main required change in tariff classification.

This thesis attempts to provide an estimate of the impact on trade of product specific rules of origin (RoO) and regime-wide provisions, as well as to construct an *ex-post*

restrictiveness index on the basis of the results found in the estimations. Therefore, the driving force behind the choice of methodology is how to assess the *ex-post* trade impact of RoO, as opposed to forecasting. The framework chosen for such analysis is the gravity equation, which has been widely used in order to assess different policy variables.

The gravity equation has become in the last decades one of the most popular empirical devices to analyze trade flows, having been used to control for practically any factor potentially influencing trade flows. Two main reasons stand out to place the gravity model as the preferred method of estimation in the context of this study. First, the gravity equation provides a relatively acceptable theoretical framework for the use of RoO. A second crucial reason for choosing gravity modeling as the preferred framework is its good empirical fit. Additionally, a number of theoretical considerations are explored in order to correctly: i) whether the gravity equation suits the desired data sample, consisting of North-North and North-South trade flows; ii) whether the model can evaluated at the disaggregated level; iii) which trade flow can be theoretically sound to be explored. These three questions are looked into by reviewing the theory about the gravity model, which confirms each of the issues. A final theoretical consideration provides a justification to perform the analysis using panel data.

Under the conditions provided for the theoretical aspects, the general equation to be estimated is laid down:

$$TF_{kijt} = \alpha_0 + \beta_1(\eta X_{kit} + \lambda X_{kjt}) + \beta_2(\eta M_{kjt} + \lambda M_{kit}) + \beta_3 d_{ij} + \beta_4 \sum_{i=1}^{I}\sum_{j=1}^{J} D_{ij}$$
$$+ \sum_{k=1}^{K}\sum_{i=1}^{I}\sum_{j=1}^{J} \gamma_{kij} + \sum_{i=1}^{I}\sum_{j=1}^{J} \zeta_{ij} + \sum_{i=1}^{I} \delta_i + \sum_{j=1}^{J} \phi_j + \sum_{t=1}^{T} \chi_t + \varepsilon_{ijt}$$

which will be estimated for total trade, exports and imports.

Subsequently, the approach for modeling the RoO is described. The underlying logic beneath it is to transform the product-specific RoO in dummy variables that can be plugged into the equation and their coefficients estimated. However, the intrinsic complexity of rules the rules of origin calls for the elaboration of four different types of

analysis in order to ensure their correct study, each of them requiring its own way of introducing the product-specific RoO. The first method considers all possible interactions of the four families of rules, including combinations, alternatives and exceptions to the main rule; the second method attempts to identify the individual impact of each of the main four families; the third method is an extension of the second, with the difference that divides the main CTC family into its subcomponents (CC, CTH and CTS); and the fourth method assigns an individual value to every possible combination of rules, classifying each of them as a different dummy variable.

One implication of this methodology is that it considers RoO as being exogenous, which may give rise to potential endogeneity bias. The usual way to correct this bias is the use of fixed effects at the individual level. This option is discarded regarding the time-invariant nature of the key variables of interest.

The study analyzes total trade, exports and imports at the 6-digit level for four reporting countries and 16 partner countries for the period between 2005 and 2008, yielding 1,224,833 observations. Trade data is obtained from COMTRADE. Data for rules of origin is obtained directly from the protocols of origin of each FTA. Considering that EU-based protocols amount to around 800 product specific rules and US-based to around 2,000, it yields a total of close to 24,000 rules that need to be coded.

The most frequent rule in origin protocols is CTH, followed by RVC, although these two rules are less commonly used individually and rather are combined or supplemented with other rules. Additionally, these two rules are, on average, represent a higher proportion of total rules present in origin protocols than the trade channeled through them on total trade.

Prior to estimating the equations, a number of clarifications need to be made. First, a poolability tests performing a Wald test on the coefficients of the estimated equation confirms the validity of pooling the data. Second, a choice has to be made between the use of fixed effects and random effects. Theoretically, fixed effects are preferred because using random effects requires the assumption of the observations being randomly drawn from a population and that the individual effects are not correlated with the regressors. This, in principle is a hard assumption to maintain in trade

settings. This decision is confirmed econometrically by the Hausman test and country fixed effects are included, which help solve an eventual heterogeneity problem; this positive outcome is however likely to be jeopardized by the fact that fixed effects are not included at the individual level but a country level. Third, collinearity diagnosis reveals a problem of multicollinearity, which is solved after some transformations in the data, notably combining EFTA countries into one unique country and grouping reporting country fixed effects in two groups, developed (EU and US) and developing (Mexico and Chile).

Subsequently, a Least Squares Dummy Variable (LSDV) method is chosen to perform the regressions. However, the Breusch-Pagan and the Breusch-Godfrey test reveal the presence of heteroscedasticity and autocorrelation, respectively, inducing estimation by Generalized Least Squares (GLS), which yields unbiased estimators. Lastly, the variables are transformed in logarithms in order to reduce the dispersion of the data. This comes at the price of dropping zero values, which, although the way of dealing with them has still not been properly settled in the theory, may lead to selection bias.

The regressions show very interesting results, with most variables being significant across each method of estimation and showing the expected sign of the coefficients. The specification of the RoO does matter. An RVC type of rule can increase trade by 22.9 percent whereas a TT can reduce it by 21 percent. Each of the methods of estimation show interesting results, except method four, where most variables are insignificant. The one clear-cut fact about the regressions is that RVC type of rule is by and large the most trade-conducive rule. Two *a priori* counterintuitive results – the fact that a combination of rules favors export trade and that CTS reveals clearly more trade-obstructing than CC for imports – lead to the argument that rules of origin are clearly devised by importing hegemonic countries. Their exporters do not really "care" about them but the importers ensure that protection is granted to the home market. Lastly, gravity variables show the expected sign and coefficient.

At present, empirical literature on RoO relies entirely on ex-ante indices, first developed in Estevadeordal (2000) and subsequently followed and augmented in a series of studies. The second main goal of this study is to provide a "real" index of RoO restrictiveness, which can help gap the bridge identified in the literature in view of the

following weaknesses of existing indices: a) Being an ex-ante observation rule, *ex-ante* indices are based on the author's subjectivity, therefore varying from author to author; b) Ex ante indices are based on unchecked premises; and c) in order to calculate the correct index, imports are more relevant than exports.

The way to construct a correct restrictiveness index is to do so using an *ex-post* observation rule, which is done from the estimates obtained in Chapter 5. In particular, from all the regressions conducted in Chapter 5, the ones used to compose the index are those of the import equation of Method 1. This choice is determined by two aspects. First, both theory and empirics suggest that RoO are in fact laid down by hegemonic importing countries; second, method 1 is the only one that allows for combination of rules.

The restrictiveness index, RI_k is defined as follows:

$$RI_k = (-.180)(\mathrm{CC}) + (-.039)(\mathrm{CTH}) + (-.143)(\mathrm{CTS}) + (.229)(\mathrm{RVC}) + (-.131)(RVCEU) + (-.210)(TT) + (.211)(WO) + (.178)(ALT) + (-.242)(EXC)$$

This equation, when combined all over the RoO included in origin protocols yields 70 different results. These 70 rules can now be ordered from 1 to 70 and an index would already be obtained. However, having 70 different values restricts the workability of the index, as there are many of these levels which rarely take place in protocols of origin. In order to develop a more verifiable index, these 70 instances are grouped into 20.

This index, which ranks from 1 to 20, being 20 the least restrictive, can now be used to assess stringency levels across agreements and is directly comparable to *ex-ante* indices.

Interestingly, despite the differences between *ex-ante* indices, and the *ex-post* index, they share common findings with respect to the restrictiveness of the agreements. For both of them, NAFTA is the most restrictive agreement, with the EU family presenting more facilitating rules and other US-based FTAs standing in between.

An analysis of the stringency of the RoO is also performed by sector using the *ex-post* restrictiveness index. It shows textiles as the sector with most restrictive rules. The one

surprise in terms of sectoral restrictiveness is agriculture, being as it is a highly protected sector.

The ex-post index is subsequently used empirically to assess the sensitivity of exports from developing countries into developed countries to the stringency of RoO, by looking at three sectors in particular: textiles, agriculture and industrial products. The results of the estimation show significant results and the coefficients display the expect sign. The results show that trade in every sector reacts negatively to increases the stringency levels of the RoO, as should be the case. The one that shows a higher inclination to react negatively to RoO stringency is the industrial sector. It seems plausible that despite lower tariffs in industrial products (which are, in any case on the verge of the "participation constraint") exporters may have an incentive to channel the products under preferential conditions, hence using the FTA's RoO.

Rules of origin were initially devised as uncontroversial technical neutral devices to implement necessary trade policies. They only began attracting attention after the signature of free trade agreements between the European Communities and the European Free Trade Area (EFTA) countries in the mid 1970s. Three other factors emerged at similar period. First, increasing internationalization of production; second, the intense increase of Free Trade Area (FTA) numbers after the uncertainty created by the outcome of the Uruguay Round, and third, the power lost in tariffs after the conclusion of the Uruguay Round.

The FTAs that proliferated in mid 1990s were being accompanied by origin protocols. As the FTA number grew, powerful countries started to develop their own "template" of RoO, turning into what are now called families of RoO, the most notable being the PANEURO-type of RoO and NAFTA-type RoO. These rules, theoretically innocuous threaten to cause a problem to the WTO as they represent a potential violation of GATT Art.XXIV. Concerns at the WTO as well as within the signatories of FTAs have prompted the debate over the reform and harmonization of RoO. Those calling for this reform argue that RoO are: costly, trade distorting, in the interest of developed countries, obscure and show great dispersion across countries.

Some timid efforts are being made in this respect both in the US and the EU (as well as multilaterally). However, it is not an easy task. The overview of the reform process at different levels reveals an interesting factor. Whether at national, regional, or multilateral level, it seems that RoO are extremely sticky; once they are set, it is very difficult to change them. This seems a logical conclusion when thinking that once exporters adapt to trade under one rule, it may be costly to change their processes to comply with a different rule.

In view of the results of this study, as well as in account of current reform efforts, one policy proposal is suggested, namely the adoption of an across-the-board alternative RVC rule. At the same time, agricultural (unprocessed) products would be left aside from the application of this rule; it is very difficult to add value on life beings, which would be added an alternative WO rule to comply with in addition to the rule already in place.

This proposal simplifies multilateral efforts undertaken at the WTO in that industry would not have to readapt to a new rule; it would just add an alternative. The fact that it would be offered as an alternative disqualifies most criticisms received by this type of rule which would, on the contrary, add the following advantages:

- Provide an alternative, not an obligation. Therefore, exporters or producers not willing to adapt are free to do so;
- Harmonization of rules would be straightforward, thereby reducing the costs of complying with the rules;
- Costs derived by the added complications of tracing the value of goods are be reduced in the presence of computerized customs, which is more and more the case in today's world;
- Even if such costs remain high, producers would have an incentive in investing to overcome them; legally binding simplified rules across the world seems to justify such investment;
- Predictability is assured; and
- It still guarantees countries' right to prevent trade deflection through rules of origin

8.2. Main contributions

The review of the literature had identified four main gaps in the empirical analysis of RoO so far. In view of these gaps, the main aims of the thesis were: i) to provide further evidence on the impact on trade of product-specific preferential rules of origin; ii) develop a restrictiveness index based on empirical findings; iii) open the path for the impact of the rules of origin on particular sectors other than textiles; and iv) to contribute with further evidence on regime-wide provisions.

The first aim is tackled in Chapter 4, where several estimations are performed on an ample data set to provide further evidence of the impact of each type of rule of origin. To my knowledge, this is only the third study doing so and the first one on such a an broad dataset.

The second aim is achieved by the development of an ex post restrictiveness index. By being based on the coefficients of previous estimations, this index overcomes the problems related to existing indices in the literature.

The consistency of the ex post index is tested on three different sectors: agriculture, textiles and industrial products. To my knowledge, no study had looked at whether these sectors were affected by different degrees of stringency level of the RoO.

The fourth aim, contributing to expand the literature on regime-wide provisions has been limited by econometric considerations. However, this thesis does provide further evidence on the effects of one of these provisions, self-certification.

Finally, a policy proposal is put forward with the intention of contributing to the debate on the reform of rules of origin.

8.3. Directions for future research

In view of the still incipient empirical work on rules of origin, there are a number of directions that can be explored. The comprehension of the effects of the rules continues to be limited. The findings in this thesis regarding the impact of each type of specific

rule suggest that further research is needed in this area. It would be interesting to assess if the rules have a similar impact on trade for different sectors. In particular, the impact on the agricultural sector would be interesting to assess in view of the large share of GDP and employment it represents in developing countries.

Equally, regime-wide provisions appear to have a considerable effect on trade and not only from the perspective of easing compliance with the rules, as it is the case of the certification procedures. In particular, voices raised against this so-perceived facilitating policy measure should encourage research on this regard.

Finally, rules of origin have been used to model other economic aspects, such as tariff preferences or investment flows. The ex post index developed here could be used to improve the understanding of these questions.

Bibliography

Aiello, F., Cardamone, P. and Agostino, M.R. (2008). "Evaluating the Impact of Non-Reciprocal Trade Preferences Using Gravity Models". *Applied Economics* 42, 29.

Anderson, J. (1979). "A Theoretical Foundation for the Gravity Equation". The American Economic Review, Vol. 69

Anderson, J. (2010). "The Gravity Model". NBER Working Paper 16576

Anderson, J. and van Wincoop, E. (2001). "Gravity with Gravitas: A Solution to the Border Puzzle". NBER Working Paper 8079

Anderson, J. and van Wincoop, E. (2004)."Trade Costs". *Journal of Economic Literature*, Vol. 42

Andrews, M., Schank, T. and Upward, R. (2007). "Practical Fixed Effects Estimation for the Three-Way Error Components Model". *Stata Journal*, 6-4

Anson, J., Cadot, O., Estevadeordal, A., de Melo, J., Suwa-Eisenmann, A. and Tumurchudur, B. (2005). "Rules of Origin in North-South Preferential Trading Agreements with an Application to NAFTA". *Review of International Economics,* 13(3)

Antonucci, D. and Manzocchi, S. (2006). "Does Turkey Have a Special Trade Relation with the EU? A Gravity Model Approach". *Econ Syst*, 30(2)

Aparicio, J. and Márquez, J. (2005). "Diagnóstico y Especificación de Modelos Panel en Stata 8.0". División de Estudios Políticos, CIDE.

Augier, P., Gasiorek, M. and Lai-Tong, C. (2004). "Rules of Origin and the EU-MED Partnership: The Case of Textiles". *The World Economy. Vol.27.* "

Augier, P., Gasiorek, M. and Lai-Tong, C. (2005). "The Impact of Rules of Origin on Trade Flows", *Economic Policy, Vol.20, No. 43.*

Baier, S. L. and Bergstrand, J. H. (2001), "The Growth of World Trade: Tariffs, Transport Costs and Income Similarity". *Journal of International Economics* 53

Baier, S. L. and Bergstrand, J. H. (2005), "Do Free Trade Agreements Actually Increase Members' International Trade?". Federal Reserve of Atlanta, Working Paper 2005-3

Baldwin, R., Skudelny, F. and Taglioni, D.(2005)."Trade Effects of the Euro: Evidence from Sectoral Data". European Central Bank, Working Paper Series, N.446

Bergstrand, J.H. (1985). "The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence". *The Review of Economics and Statistics,* 67

Bergstrand, J.H. (1989). "The Generalized Gravity Equation, Monopolistic Competition and the Factor-Proportion Theory in International Trade" *The Review of Economics and Statistics* 71

Brenton, P. (2003). "The Rules of Origin in Free Trade Agreements". The World Bank Group, International Trade Department, Trade Note 4

Brenton, P., and M. Manchin (2003). "Making EU Trade Agreements Work: The Role of Rules of Origin". *The World Economy*, Vol. 26

Breuss, F. and Egger P. (1999). "How Reliable Are Estimations of East-West Trade Potentials Based on Cross-Section Gravity Analysis?". *Empirica* 26

Burger, M., van Oort, F. and Linders, G-J. (2009). "On the Specification of the Gravity Model of Trade: Zeroes, Excess Zeroes and Zero Inflated Estimation". *Spatial Economic Analysis,* Vol. 4.

Cadot, O., Carrere, C., de Melo, J., Suwa-Eisenmann, A. and Tumurchudur, B (2006) "Product-specific Rules of Origin in EU and US Preferential Trading Arrangements: an Assessment". *World Trade Review* 5:2

Cadot, O., DeMelo, J., Estevadeordal, A., Suwa-Eisenmann, A. and Tumurchudur, B. (2002) "Assessing the Effect of NAFTA's Rules of Origin"

Cadot, O., De Melo, J., Estevadeordal, A. and Suwa-Eisenmann, A . (2005). "Rules of Origin as Export Subsidies". CEPR Discussion Paper 4999.

Cadot, O. and De Melo, J. (2007). "Why OECD Countries Should Reform Rules of Origin". UNIL-CREA-Institut de macroéconomie appliqué.

Cadot, O., Estevadeordal, A. and Suwa-Eisenmann, A. (2004) "Rules of Origin as Export Subsidies", IADB Research Programme.

Cadot, O., Estevadeordal, A. and Suwa-Eisenmann, A.. (2006) "Rules of Origin as Export Subsidies" (2006) in Cadot, O., Estevadeordal, A., Suwa-Eisenmann, A. and Verdier T. (*eds.*) *The Origin of Goods: Rules of Origin in Regional Trade Agreements*, Oxford University Press

Commission for Africa (2005)."Our Common Interest: Report of the Commission for Africa".

Commission for Africa (2010). "Still Our Common Interest: Commission for Africa".

Cheng, I-H. and Wall, H.J. (2004). "Controlling for Heterogeneity Models of Trade and Integration". Federal Reserve of St. Louis, Working Paper 1999-010E

Cheong, I. and Cho, J. (2006). "Market Access in FTAs: Assessment Based on Rules of Origin and Agricultural Trade Liberalization". RIETI Discussion Paper Series 07-E-016

Cooper, W.H. (2006). "Free Trade Agreements: Impact on US Trade and Implications for US Trade Policy". CRS Report to Congress.

Cornejo, R. and Harris, J. (2007)."Convergence in the Rules of Origin Spaghetti Bowl: A Methodological Approach". INTAL-INT Working Paper 34.

Deardorff, A.(1995) "Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?" NBER Working Paper 5377

Deardorff (2004)."Who Makes the Rules of Globalization?". CESifo Working Paper No. 1301

Dee, P. and M. Ferrantino (eds) (2005) Quantitative Methods for Assessing the Effects of Non Tariff Measures and Trade Facilitation, World Scientific Publishing Co.

DeRosa, D.A.(2007)."The Trade Effects of Preferential Arrangements: New Evidence from the Australia Productivity Commission", Peter G. Peterson Institute for International Economics, Working Paper 07-01

Develin, R. Estevadeordal, A. and Suominen, K (forthcoming). "Sequencing Regional Trade Integration and Cooperation Agreements". Integration and Regional Programs Department, Inter-American Development Bank.

Dixit, A.K. and Grossman, G.M. (1982). "Trade and Protection with Multistage Production", NBER Working Papers 0794

Duttagupta, R. and Panagariya, A. (2003). "Free Trade Areas and Rules of Origin: Economics and Politics". IMF Working Paper WP/03/229

Eaton, J. and Kortum, S. (2002)."Technology, Geography and Trade". Econometrica, Vol 70.

Egger, P. (2000). "A Note on the Proper Econometric Specification of the Gravity Model". *Economic Letters* 66

Egger, P. (2002). "An Econometric View on the Estimation of Gravity Models and the Calculation of Trade Potentials"

Egger, P. (2005). "Alternative Techniques for Estimation of Cross-Section Gravity Models", *Review of International Economics* 13(5)

Estevadeordal, A. (2000). "Negotiating Preferential Market Access: The Case of NAFTA"

Estevadeordal, A. and Suominen, K (2003). "Rules of Origin in the World Trading System". Integration and Regional Programs Department Inter-American Development Bank

Estevadeordal, A. and Suominen, K. (2004). "Rules of Origin in FTAs in Europe and in the Americas: Issues and Implications for the EU-MERCOSUR Inter-Regional Agreement". INTAL-ITD, Working Paper 15.

Estevadeordal, A. and Suominen, K. (2004bis). "Rules of Origin: A World Map and Trade Affects", APEC 2004 Economic Outlook Symposium, Chile, 2004/AEOIS/003

Estevadeordal, A. and Suominen, K (2005). "What are the Effects of Rules of Origin on Trade?" Mimeograph

Estevadeordal, A. and Suominen, K. (2006). "Mapping and Measuring Rules of Origin around the World" in *The Origin of Goods – Rules of Origin in Regional Trade Agreements*, edited by Cadot, O., Estevadeordal, A., Suwa-Eisenmann, A. and Verdier, T.

Estevadeordal, A., Suominen, K. and López Córdova, J.E. (2006)."How Do Rules of Origin Affect Investment Flows? Some Hypothesis and the Case of Mexico". INTAL-ITD, Working Paper 22.

Estevadeordal, A., Harris, J. and Suominen, K. (2007)."Multilateralizing Rules of Origin around the World". Prepared for the WTO/HEI/NCCR Trade/CEPR Conference, Geneva, September 2007.

Evenett, Simon J (2002). "The Impact of Economic Sanctions on South African Exports". *Scottish Journal of Political Economy*, Vol 49

Evenett, S. and Keller, W. (1998)."On the Theories Explaining the Success of the Gravity Equation". NBER Working Paper 6529.

European Commission (2011), TAXUD/240554/11, Working Document

EUROSTAT (2010)."External and Internal EU Trade-Statistical Yearbook", 2010 Edition, European Commission.

Falvey, R. and Reed, G. (2002). "Rules of Origin as Commercial Policy Instruments" *International Economic Review* Vol. 43

Feenstra, R.C. (2002). "Border Effects and the Gravity Equation: Consistent Methods of Estimation". *Scottish Journal of Political Economy*, Vol 49

Feenstra, R.C. (2004). "Advanced International Trade: Theory and Evidence". *Princeton University Press*

Feenstra, R.C., Markusen, J.A. and Rose, A.K. (1998). " Understanding the Home Market Effect and the Gravity Equation: The Role of Differentiating Goods". NBER Working Paper 6804.

Feenstra, R.C., Markusen, J.A. and Rose, A.K. (2001). "Using the Gravity Equation to Differentiate Among Alternative Theories of Trade". *The Canadian Journal of Economics,* Vol. 34.

Flatters, F. (2002)."SADC Rules of Origin: Impediments to Regional Integration and to Global Competitiveness", mimeo

Forrester, I. (1994)."The End of Innocence", in E. Vermulst, P. Waer and J. Bourgeois (eds.), Ann Arbor University of Michigan Press.

Francois, J. (2005). "Preferential Trade Arrangements and the Pattern of Production and Trade when Inputs are Differentiated". CEPR Discussion Paper No. 5144

Frankel, J., Stein, E. and Wei, S.-J. (1995)."Trading Blocks and the Americas: the Natural, the Unnatural and the Supernatural". *Journal of Development Economics*, Vol.47

Garay, J.L. and Estevadeordal, A. (1996). "Protection, Preferential Tariff Elimination and Rules of Origin in the Americas". Integration and Trade Nº0, Vol 1.

Garay, J.L. and Cornejo, R. (2001). "Metodología para el Análisis de Regímenes de Origen: Aplicación para el Caso de las Américas". INTAL Documento de Trabajo 8

Garay, J.L. and De Lombaerde, P. (2004). "Preferential Rules of Origin: Models and Levels of Rulemaking". Paper prepared for UNU-CRIS/LSE Workshop on *The Interaction between Levels of Rulemaking in International Trade and Investment*.

Georges, P. (2007)."Modeling the Removal of NAFTA Rules of Origin: A Computable General Equilibrium Analysis". Department of Finance, Working Paper 2007-06

Greene, W.H. (2003). "Econometric Analysis". Fifth Edition. Upper Saddle River, New Jersey: Prentice Hall.

Greenaway, D. and Milner, C. (2002)."Regionalism and Gravity". *Scottish Journal of Political Economy*, Vol. 49(4).

Gretton, P. and Gali, J. (2005). "The Restrictiveness of Rules of Origin in Preferential Trade Agreements". Productivity Commission, Australia.

Grossman, Gene (1981). "The Theory of Domestic Content Protection and Content Preference". *The Quarterly Journal of Economics*, Vol. 96, Issue 4.

Harilal, K.N. and Beena, P.L. (2003). "The WTO Agreement on Rules of Origin". Center for Development Studies, Working Paper 353.

Harrigan, J. (2001)."Specialization and the Volume of Trade: Do the Data Obey the Laws?". Mimeo

Harris, J. (2007)."Measurement and Determinants of Rules of Origin in Preferential Trade Agreements", PhD Dissertation, University of Maryland, College Park

Harris, J. (2009)."Rules of Origin for Development: From GSP to Global Free Trade", IDB Working Paper Series No.135

Haveman, J. and Hummels, D. (2004). "Alternative Hypothesis and the Volume of Trade: The Gravity Equation and the Extent of Specialization". *Canadian Journal of Economics*, Vol. 37

Head and Mayer (2002). "Illusory Border Effects: Distance Measurement Inflates Estimates of Home Bias in Trade". CEPII Working Paper 2002-1

Helliwel, J. and Verdier, G. (2001). "Measuring Internal Distances: A New Method Applied to Estimate Provincial Border Effects in Canada". *Canadian Journal of Economics 34(4).*

Helpman, E. (1987). "Imperfect Competition and International Trade: Evidence from Fourteen Industrial Countries". *Journal of the Japanese and International Economies* 1(1):

Hilberry, R. and Hummels, D. (2003). "International Home-Bias: Some Explanations". *The Review of Economics and Statistics* 85

Hoekman, B. (1993). "Rules of Origin for Goods and Services". *Journal of World Trade, Vol.3*

Hummels, D. and Levinson, J. (1995)."Monopolistic Competition and International Trade: Reconsidering the Evidence". *The Quarterly Journal of Economics*, Vol 110

Hutchinson, W.K.(2002)."Does Ease of Communication Increase Trade? Commonality of Language and Bilateral Trade". *Scottish Journal of Political Economy*, Vol. 49, N.5.

Iacovone, L. (2002)."Analysis and Impact of Sanitary and Phitosanitary Measures". mimeo

Ishikawa, J., Mukunoki, H. and Mizoguchi, Y.(2007)."Economic Integration and Rules of Origin under International Oligopoly", *International Economic Review*, Vol. 48(1)

ITC (2001)."Rules of Origin and Export Credit Insurance", International Trade Forum, Issue 1/2001.

Iwanow, T. and Kirkpatrick, C. (2007). "Trade Facilitation, Regulatory Quality and Export Performance" *Journal of International Development*, 19(6).

Jakab, M., Kovacs, A. and Oszlay, A. (2001). "How Far Has Trade Integration Advanced?: An Analysis of the Actual and Potential Trade of Three Central and Eastern European Countries". *Journal of Comparative Economics*

Jones, V.C and Martin, M.F. (2011). "International Trade: Rules of Origin". Congressional Research Service 7-5700.

Ju, J. and Krishna, K. (1995)."Market Access and Welfare Effects of Free Trade Areas without Rules of Origin". NBER Working Paper No. 5480

Ju, J. and Krishna, K. (1998)."Firm Behavior and Market Access in a Free Trade Area with Rules of Origin". NBER Working Paper No. 6857.

Kisu, S. (2010)."An Empirical Evaluation of Trade Potential in Southern Africa Development Community". MPRA Paper N.15894

Krishna, K. (2005). "Understanding Rules of Origin", NBER Working Paper No. 11150

Krishna, K. and Krueger, A.O. (1995). "Implementing Free Trade Areas: Rules of Origin and Hidden Protection" NBER Working Paper Series No. 4983

Krueger, A.O. (1993). "Free Trade Agreements as Protectionist Devices: Rules of Origin". NBER Working Paper Series No. 4352

Kunst, R.M. (2010). "Econometric Methods for Panel Data". University of Vienna and Institute for Advanced Studies Vienna.

LaNasa, J.A. (1995)."An Evaluation of the Uses and Importance of Rules of Origin, and the Effectiveness of the Uruguay Round's Agreement on Rules of Origin in Harmonizing and Regulating Them". Jean Monet Center for International and Regional Economic Law & Justice, Working Paper 1/96.

Lázaro, D.C. and Medalla, E.M.(2006)."Rules of Origin: Evolving Best Practices for RTAs/FTAs". Philippine Institute for Development Studies, Discussion Paper Series No 2006-01.

Linders, G.-J. M and De Groot, H.L.F. (2006) "Estimation of the Gravity Equation in the Presence of Zero Flows, Tinbergen Institute Discussion Papers, 05/023-3

Linders, G.-J. (2006)."Intangible Barriers to Trade: The Impact of Institutions, Culture and Distance on Trade Barriers", PhD Thesis, Vrije Universiteit Amsterdam

Linemann, H. and Verbruggen, H. (2002)."GSTP Tariff Reduction and its Effect on South-South Trade". *World Development,* Vol.19, Issue 5.

Lloyd, P.J. (2002). "Country of Origin in the Global Economy". *World Trade Review, Vol.1, Issue 2.*

Low, L. (1998)."Jobs, Technology and Skills Requirements in a Globalized Economy: Country Study of Singapore". Employment and Training Papers 13.

Marchetti, J. (2009)."Do Economic Integration Agreements Lead to Deeper Integration of Services Markets?", mimeo

Martin, W. and Pham, C.S. (2008) "Estimating the Gravity Model when Zero Trade Flows Are Frequent". MPRA Working Paper 9453.

Martínez-Zarzoso, I., Novak-Lehman, F. and Vollmer, S. (2007). "The Log of Gravity Revisited". CeGe Discussion Paper 64.

Martínez-Zarzoso, I. and Novak-Lehman, F. (2003). "Augmented Gravity Model: An Empirical Application to Mercosur-EU trade flows". International Trade 0309019, EconWPA.

Mattoo, A., Roy, D. and Subramanian, A (2003). "The Africa Growth and Opportunity Act and its Rules of Origin: Generosity Undermined?" World Bank Policy Research Working Paper 2908

Matyas, L. (1997). "Proper Econometric Specification of the Gravity Model". *The World Economy,* 20.

McCallum, J. (1995)."National Borders Matter: Canada-US Regional Trade Patterns". *American Economic Review*, Vol. 85(3)

Molinari, A. (2003). "Sectoral Border Effects: Analyzing Implicit EU Trade Integration", presented at the 5th annual meeting ETSG, Madrid, available: http://www.etsg.org/ETSG2003/papers/molinari.pdf

Mussa, Michael. (1984). "The Economics of Content Protection". NBER Working Paper N. 1457

Naumann, E. (2010). "Rules of Origin in EU-ACP Economic Partnership Agreements". ICTSD Issue Paper No. 7.

Ogueldo, V.I. and Macphee, C.R. (1994)."Gravity Models: A Reformulation and a Application to Discriminatory Trade Arrangements". *Applied Economics*, Vol. 26

OECD (2002). "The Relationship between Regional Trade Agreements and Multilateral Trading System. Rules of Origin" Working Party on the Trade Committee, TD/TC/WP(2002)33/FINAL

Palmeter, N.D. (1987)."Rules of Origin or Rules of Restriction? A Commentary on a New Form of Protectionism". *Fordham International Law Journal*, Volume 11(1)

Pastore, F., Ferragina, A.M. and Giovanetti, G. (2009). "A Tale of Parallel Integration Processes: A Gravity Analysis of EU Trade and Mediterranean and Central European Countries". *Review of Middle East Economics and Finance*, Vol.5 N.2

Pelzman, J. and Shoham, A. (2010)."Measuring the Welfare Effects of Country of Origin Rules: A Suggested Methodology", *Global Economic Journal*, Vol.10

Portugal-Pérez, A. (2008)."The Costs of the Rules of Origin in Apparel: African Preferential Exports to the United States and the European Union". Policy Issues in International Trade and Commodities, Study Series No.39

Portugal-Pérez, A. (2009)."Assessing the Impact of Political Economy Factors on Rules of Origin under NAFTA", The World Bank Group, Policy Research Working Paper 4848

Polak, J.J. (1996). "Is APEC a Natural Trading Region? A Critique of the "Gravity Model" of International Trade". *The World Economy,* 19

PriceWaterhouseCoopers (2006). "Sustainability Impact Assessment of the EU-ACP Economic Partnership Agreements - Phase Three. Rules of Origin in the Southern African Development Community Group (SADC Group). Final Report".

Rahman, M., Wasel, B.S. and Narayan, C.D. (2006)."Trade Potential in SAFTA: An Application of Augmented Gravity Model", Center for Policy Dialogue, Working Paper 61.

Rauch, J.E: (1999)."Networks versus Markets in International Trade", *Journal of International Economics*, Vol. 48

Redding, S and Venables, A. (2000)."Economic Geography and International Inequality", CEPR Discussion Paper 2568.

Rodriguez, P.L. (2001). "Rules of Origin with Multistage Production". *The World Economy, Vol. 24, Issue 2.*

Rudolph, S. (2009). "Estimating Gravity Equations with Endogenous Trade Costs". Available at SSRN: http://ssrn.com/abstract=1550065

Santos-Silva, J.M.C and Tenreyro, S. (2006). "The Log of Gravity", *The Review of Economics and Statistics,* 88.

Steele, P.J.B. (2010). "EC/EAC EPA Negotiations: Rules of Origin", presentation, Rules of Origin Second Regional Workshop, available: http://eabc.info/epa/attachments/019_06%20-%20Rules%20of%20Origin%20(P.J.%20Steele).pdf

Tapp, S. (2007). "Understanding Rules of Origin: A Critical Review of the Literature", mimeo

Thorstenten, V. (2008)."With or Without Doha: The Last Opportunity to Reach an Agreement EU-MERCOSUR?", speech 2008, MERCOSUR Chair of Science Po, available: http://www.iadb.org/intal/intalcdi/PE/2011/07860en.pdf

Tinbergen, J. (1962). "Shaping the World Economy; Suggestions for an International Economic Policy". The Twentieth Century Fund, (Appendix VI).

UCLA: Academic Technology Services, Statistical Consulting Group (2011). "Introduction to Stata" from http://www.ats.ucla.edu/stat/sas/notes2/ (accessed November 12, 2010).

Van Bergeijk, P.A.G. and Brakman, S. (2010). "The Comeback of the Gravity Model" in Van Bergeijk, P.A.G. and Brakman, S. (*eds*) *The Gravity Model in International Trade: Advances and Applications.* Cambridge University Press

Vermulst, E. (1992). "Rules of Origin as Commercial Policy Instruments-Revisited", in E. Vermulst, P. Waer and J. Bourgeois (eds.), Ann Arbor University of Michigan Press.

Wagner, D, Head, K.C. and Ries, J.C. (2002)."Inmigration and the Trade of Provinces" *Scottish Journal of Political Economy*, Vol. 49.

Wall, H.J. (2000). "Gravity Model Specification and the Effects of the Canada-US Border". Federal Reserve of Saint Louis, Working Paper 2000-024A.

Wooldridge, (2002)."Econometric Analysis of Cross-Section and Panel Data". Cambridge, Massachusetts. MIT Press.

WTO (1997). "Annotated Checklist of Systemic Issues". WT/REG/W/16, Committee on Regional Trade Agreements.

WTO (2000). "Synopsis of "Systemic" Issues Related to Regional Trade Agreements". WT/REG/W/47, Committee on Regional Trade Agreements.

WTO (2007). "Free Trade Agreement Between the EFTA States and Chile (Goods). Report by the Secretariat". Committee on Regional Trade Agreements, WTO Secretariat.

WTO (2007b)."WTO Analytical Index: Guide to WTO Law and Practice". 2nd Edition. Cambridge University Press.

WTO Tariff Profiles (2009), available at http://stat.wto.org/TariffProfile/WSDBTariffPFHome.aspx?Language=E

World Bank (2007)."Trade Issues in East Asia. Preferential Rules of Origin". East Asia and Pacific Region, Poverty Reduction and Economic Management.

Yamarki, S. and Gosh, S. (2005). "A Sensitivity Analysis of the Gravity Model". *The International Trade Journal*, Vol 19, Issue 1.

Appendix 1.1. List of RTAs in force

RTA Name	Coverage	Type	Date of entry into force
Andean Community (CAN)	Goods	CU	25-may-88
Armenia – Kazakhstan	Goods	FTA	25-Dec-2001
Armenia – Moldova	Goods	FTA	21-Dec-1995
Armenia - Russian Federation	Goods	FTA	25-mar-93
Armenia – Turkmenistan	Goods	FTA	07-jul-96
Armenia – Ukraine	Goods	FTA	18-Dec-1996
ASEAN - Australia - New Zealand	Goods & Services	FTA & EIA	01-Jan-2010
ASEAN – China	Goods & Services	PSA & EIA	01-Jan-2005(G) / 01-Jul-2007(S)
ASEAN – India	Goods	FTA	01-Jan-2010
ASEAN – Japan	Goods	FTA	01-Dec-2008
ASEAN - Korea, Republic of	Goods & Services	FTA & EIA	01-Jan-2010(G) / 01-May-2009(S)
ASEAN Free Trade Area (AFTA)	Goods	FTA	28-Jan-1992
Asia Pacific Trade Agreement (APTA)	Goods	PSA	17-jun-76
Asia Pacific Trade Agreement (APTA) - Accession of China	Goods	PSA	01-Jan-2002
Australia – Chile	Goods & Services	FTA & EIA	06-mar-09
Australia - New Zealand (ANZCERTA)	Goods & Services	FTA & EIA	01-Jan-1983(G) / 01-Jan-1989(S)
Australia - Papua New Guinea (PATCRA)	Goods	FTA	01-feb-77
Brunei Darussalam - Japan	Goods & Services	FTA & EIA	31-jul-08
Canada – Chile	Goods & Services	FTA & EIA	05-jul-97
Canada - Costa Rica	Goods	FTA	01-nov-02
Canada – Israel	Goods	FTA	01-Jan-1997
Canada – Peru	Goods & Services	FTA & EIA	01-Aug-2009
Caribbean Community and Common Market (CARICOM)	Goods & Services	CU & EIA	01-Aug-1973(G) / 01-Jul-1997(S)
Central American Common Market (CACM)	Goods	CU	04-jun-61
Central European Free Trade Agreement (CEFTA) 2006	Goods	FTA	01-may-07
Chile – China	Goods & Services	FTA & EIA	01-Oct-2006(G) / 01-Aug-2010(S)
Chile – Colombia	Goods & Services	FTA & EIA	08-may-09
Chile - Costa Rica (Chile - Central America)	Goods & Services	FTA & EIA	15-feb-02
Chile - El Salvador (Chile - Central America)	Goods & Services	FTA & EIA	01-jun-02
Chile – India	Goods	PSA	17-Aug-2007
Chile – Japan	Goods & Services	FTA & EIA	03-sep-07
Chile – Mexico	Goods & Services	FTA & EIA	01-Aug-1999
China - Hong Kong, China	Goods & Services	FTA & EIA	01-Jan-2004
China - Macao, China	Goods & Services	FTA & EIA	01-Jan-2004
China - New Zealand	Goods & Services	FTA & EIA	01-oct-08
China – Singapore	Goods & Services	FTA & EIA	01-Jan-2009
Colombia – Mexico	Goods & Services	FTA & EIA	01-Jan-1995

Common Economic Zone (CEZ)	Goods	FTA	20-may-04
Common Market for Eastern and Southern Africa (COMESA)	Goods	FTA	08-Dec-1994
Commonwealth of Independent States (CIS)	Goods	FTA	30-Dec-1994
Costa Rica – Mexico	Goods & Services	FTA & EIA	01-Jan-1995
Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR)	Goods & Services	FTA & EIA	01-mar-06
East African Community (EAC)	Goods	CU	07-jul-00
EC – Albania	Goods & Services	FTA & EIA	01-Dec-2006(G) / 01-Apr-2009(S)
EC – Algeria	Goods	FTA	01-sep-05
EC – Andorra	Goods	CU	01-jul-91
EC - Bosnia and Herzegovina	Goods	FTA	01-jul-08
EC – Cameroon	Goods	FTA	01-oct-09
EC - CARIFORUM States EPA	Goods & Services	FTA & EIA	01-nov-08
EC – Chile	Goods & Services	FTA & EIA	01-Feb-2003(G) / 01-Mar-2005(S)
EC - Côte d'Ivoire	Goods	FTA	01-Jan-2009
EC – Croatia	Goods & Services	FTA & EIA	01-Mar-2002(G) / 01-Feb-2005(S)
EC – Egypt	Goods	FTA	01-jun-04
EC - Faroe Islands	Goods	FTA	01-Jan-1997
EC - Former Yugoslav Republic of Macedonia	Goods & Services	FTA & EIA	01-Jun-2001(G) / 01-Apr-2004(S)
EC – Iceland	Goods	FTA	01-Apr-1973
EC – Israel	Goods	FTA	01-jun-00
EC – Jordan	Goods	FTA	01-may-02
EC – Lebanon	Goods	FTA	01-mar-03
EC – Mexico	Goods & Services	FTA & EIA	01-Jul-2000(G) / 01-Oct-2000(S)
EC – Montenegro	Goods & Services	FTA & EIA	01-Jan-2008(G) / 01-May-2010(S)
EC – Morocco	Goods	FTA	01-mar-00
EC – Norway	Goods	FTA	01-jul-73
EC – Overseas Countries and Territories (OCT)	Goods	FTA	01-Jan-1971
EC - Palestinian Authority	Goods	FTA	01-jul-97
EC - South Africa	Goods	FTA	01-Jan-2000
EC - Switzerland - Liechtenstein	Goods	FTA	01-Jan-1973
EC – Syria	Goods	FTA	01-jul-77
EC – Tunisia	Goods	FTA	01-mar-98
EC – Turkey	Goods	CU	01-Jan-1996
EC (10) Enlargement	Goods	CU	01-Jan-1981
EC (12) Enlargement	Goods	CU	01-Jan-1986
EC (15) Enlargement	Goods & Services	CU & EIA	01-Jan-1995
EC (25) Enlargement	Goods & Services	CU & EIA	01-may-04
EC (27) Enlargement	Goods & Services	CU & EIA	01-Jan-2007
EC (9) Enlargement	Goods	CU	01-Jan-1973
EC Treaty	Goods & Services	CU & EIA	01-Jan-1958

Economic and Monetary Community of Central Africa (CEMAC)	Goods	CU	24-jun-99
Economic Community of West African States (ECOWAS)	Goods	CU	24-jul-93
Economic Cooperation Organization (ECO)	Goods	PSA	17-feb-92
EFTA – Albania	Goods	FTA	01-nov-10
EFTA – Canada	Goods	FTA	01-jul-09
EFTA – Chile	Goods & Services	FTA & EIA	01-Dec-2004
EFTA – Croatia	Goods	FTA	01-Jan-2002
EFTA – Egypt	Goods	FTA	01-Aug-2007
EFTA - Former Yugoslav Republic of Macedonia	Goods	FTA	01-Jan-2001
EFTA – Israel	Goods	FTA	01-Jan-1993
EFTA – Jordan	Goods	FTA	01-Jan-2002
EFTA - Korea, Republic of	Goods & Services	FTA & EIA	01-sep-06
EFTA – Lebanon	Goods	FTA	01-Jan-2007
EFTA – Mexico	Goods & Services	FTA & EIA	01-jul-01
EFTA – Morocco	Goods	FTA	01-Dec-1999
EFTA - Palestinian Authority	Goods	FTA	01-jul-99
EFTA – SACU	Goods	FTA	01-may-08
EFTA – Serbia	Goods	FTA	01-oct-10
EFTA – Singapore	Goods & Services	FTA & EIA	01-Jan-2003
EFTA – Tunisia	Goods	FTA	01-jun-05
EFTA – Turkey	Goods	FTA	01-Apr-1992
EFTA accession of Iceland	Goods	FTA	01-mar-70
Egypt – Turkey	Goods	FTA	01-mar-07
EU - San Marino	Goods	CU	01-Apr-2002
EU – Serbia	Goods	FTA	01-feb-10
Eurasian Economic Community (EAEC)	Goods	CU	08-oct-97
European Economic Area (EEA)	Services	EIA	01-Jan-1994
European Free Trade Association (EFTA)	Goods & Services	FTA & EIA	03-May-1960(G) / 01-Jun-2002(S)
Faroe Islands – Norway	Goods	FTA	01-jul-93
Faroe Islands - Switzerland	Goods	FTA	01-mar-95
Georgia – Armenia	Goods	FTA	11-nov-98
Georgia – Azerbaijan	Goods	FTA	10-jul-96
Georgia – Kazakhstan	Goods	FTA	16-jul-99
Georgia - Russian Federation	Goods	FTA	10-may-94
Georgia – Turkmenistan	Goods	FTA	01-Jan-2000
Georgia – Ukraine	Goods	FTA	04-jun-96
Global System of Trade Preferences among Developing Countries (GSTP)	Goods	PSA	19-Apr-1989
Gulf Cooperation Council (GCC)	Goods	CU	01-Jan-2003
Honduras - El Salvador and the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu	Goods & Services	FTA & EIA	01-mar-08
Hong Kong, China - New Zealand	Goods & Services	FTA & EIA	01-Jan-2011
Iceland - Faroe Islands	Goods & Services	FTA & EIA	01-nov-06

India – Afghanistan	Goods	PSA	13-may-03
India – Bhutan	Goods	FTA	29-jul-06
India – Nepal	Goods	PSA	27-oct-09
India – Singapore	Goods & Services	FTA & EIA	01-Aug-2005
India - Sri Lanka	Goods	FTA	15-Dec-2001
Israel – Mexico	Goods	FTA	01-jul-00
Japan – Indonesia	Goods & Services	FTA & EIA	01-jul-08
Japan – Malaysia	Goods & Services	FTA & EIA	13-jul-06
Japan – Mexico	Goods & Services	FTA & EIA	01-Apr-2005
Japan – Philippines	Goods & Services	FTA & EIA	11-Dec-2008
Japan – Singapore	Goods & Services	FTA & EIA	30-nov-02
Japan – Switzerland	Goods & Services	FTA & EIA	01-sep-09
Japan – Thailand	Goods & Services	FTA & EIA	01-nov-07
Japan - Viet Nam	Goods & Services	FTA & EIA	01-oct-09
Jordan – Singapore	Goods & Services	FTA & EIA	22-Aug-2005
Korea, Republic of – Chile	Goods & Services	FTA & EIA	01-Apr-2004
Korea, Republic of – India	Goods & Services	FTA & EIA	01-Jan-2010
Korea, Republic of - Singapore	Goods & Services	FTA & EIA	02-mar-06
Kyrgyz Republic - Armenia	Goods	FTA	27-oct-95
Kyrgyz Republic - Kazakhstan	Goods	FTA	11-nov-95
Kyrgyz Republic - Moldova	Goods	FTA	21-nov-96
Kyrgyz Republic - Russian Federation	Goods	FTA	24-Apr-1993
Kyrgyz Republic - Ukraine	Goods	FTA	19-Jan-1998
Kyrgyz Republic - Uzbekistan	Goods	FTA	20-mar-98
Lao People's Democratic Republic – Thailand	Goods	PSA	20-jun-91
Latin American Integration Association (LAIA)	Goods	PSA	18-mar-81
Melanesian Spearhead Group (MSG)	Goods	PSA	01-Jan-1994
MERCOSUR – India	Goods	PSA	01-jun-09
Mexico - El Salvador (Mexico - Northern Triangle)	Goods & Services	FTA & EIA	15-mar-01
Mexico - Guatemala (Mexico - Northern Triangle)	Goods & Services	FTA & EIA	15-mar-01
Mexico - Honduras (Mexico - Northern Triangle)	Goods & Services	FTA & EIA	01-jun-01
Mexico – Nicaragua	Goods & Services	FTA & EIA	01-jul-98
New Zealand – Singapore	Goods & Services	FTA & EIA	01-Jan-2001
Nicaragua and the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu	Goods & Services	FTA & EIA	01-Jan-2008
North American Free Trade Agreement (NAFTA)	Goods & Services	FTA & EIA	01-Jan-1994
Pacific Island Countries Trade Agreement (PICTA)	Goods	FTA	13-Apr-2003
Pakistan – China	Goods & Services	FTA & EIA	01-Jul-2007(G) / 10-Oct-2009(S)
Pakistan – Malaysia	Goods & Services	FTA & EIA	01-Jan-2008
Pakistan - Sri Lanka	Goods	FTA	12-jun-05
Panama – Chile	Goods & Services	FTA & EIA	07-mar-08
Panama - Costa Rica (Panama -	Goods & Services	FTA & EIA	23-nov-08

Central America)			
Panama - El Salvador (Panama - Central America)	Goods & Services	FTA & EIA	11-Apr-2003
Panama - Honduras (Panama - Central America)	Goods & Services	FTA & EIA	09-Jan-2009
Panama – Singapore	Goods & Services	FTA & EIA	24-jul-06
Panama and the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu	Goods & Services	FTA & EIA	01-Jan-2004
Pan-Arab Free Trade Area (PAFTA)	Goods	FTA	01-Jan-1998
Peru – China	Goods & Services	FTA & EIA	01-mar-10
Peru – Singapore	Goods & Services	FTA & EIA	01-Aug-2009
Protocol on Trade Negotiations (PTN)	Goods	PSA	11-feb-73
Singapore – Australia	Goods & Services	FTA & EIA	28-jul-03
South Asian Free Trade Agreement (SAFTA)	Goods	FTA	01-Jan-2006
South Asian Preferential Trade Arrangement (SAPTA)	Goods	PSA	07-Dec-1995
South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA)	Goods	PSA	01-Jan-1981
Southern African Customs Union (SACU)	Goods	CU	15-jul-04
Southern African Development Community (SADC)	Goods	FTA	01-sep-00
Southern Common Market (MERCOSUR)	Goods & Services	CU & EIA	29-Nov-1991(G) / 07-Dec-2005(S)
Thailand – Australia	Goods & Services	FTA & EIA	01-Jan-2005
Thailand - New Zealand	Goods & Services	FTA & EIA	01-jul-05
Trans-Pacific Strategic Economic Partnership	Goods & Services	FTA & EIA	28-may-06
Turkey – Albania	Goods	FTA	01-may-08
Turkey - Bosnia and Herzegovina	Goods	FTA	01-jul-03
Turkey – Chile	Goods	FTA	01-mar-11
Turkey – Croatia	Goods	FTA	01-jul-03
Turkey - Former Yugoslav Republic of Macedonia	Goods	FTA	01-sep-00
Turkey – Georgia	Goods	FTA	01-nov-08
Turkey – Israel	Goods	FTA	01-may-97
Turkey – Jordan	Goods	FTA	01-mar-11
Turkey – Montenegro	Goods	FTA	01-mar-10
Turkey – Morocco	Goods	FTA	01-Jan-2006
Turkey - Palestinian Authority	Goods	FTA	01-jun-05
Turkey – Serbia	Goods	FTA	01-sep-10
Turkey – Syria	Goods	FTA	01-Jan-2007
Turkey – Tunisia	Goods	FTA	01-jul-05
Ukraine – Azerbaijan	Goods	FTA	02-sep-96
Ukraine – Belarus	Goods	FTA	11-nov-06
Ukraine - Former Yugoslav Republic of Macedonia	Goods	FTA	05-jul-01
Ukraine – Kazakhstan	Goods	FTA	19-oct-98

Ukraine – Moldova	Goods	FTA	19-may-05
Ukraine - Russian Federation	Goods	FTA	21-feb-94
Ukraine – Tajikistan	Goods	FTA	11-jul-02
Ukraine – Uzbekistan	Goods	FTA	01-Jan-1996
Ukraine –Turkmenistan	Goods	FTA	04-nov-95
US – Australia	Goods & Services	FTA & EIA	01-Jan-2005
US – Bahrain	Goods & Services	FTA & EIA	01-Aug-2006
US – Chile	Goods & Services	FTA & EIA	01-Jan-2004
US – Israel	Goods	FTA	19-Aug-1985
US – Jordan	Goods & Services	FTA & EIA	17-Dec-2001
US – Morocco	Goods & Services	FTA & EIA	01-Jan-2006
US – Oman	Goods & Services	FTA & EIA	01-Jan-2009
US – Peru	Goods & Services	FTA & EIA	01-feb-09
US – Singapore	Goods & Services	FTA & EIA	01-Jan-2004
West African Economic and Monetary Union (WAEMU)	Goods	CU	01-Jan-2000

Source: WTO

Appendix 5.1. Random Effects and OLS Estimation

	OLS			**RANDOM EFFECTS**		
	All Trade	*Exports*	*Imports*	*All Trade*	*Exports*	*Imports*
ltotimports	0.377	0.364	0.357	0.378	0.362	0.404
	(334.15)***	(202.56)***	(124.13)***	(332.04)***	(196.25)***	(144.75)***
ltotalexp	0.571	0.594	0.587	0.571	0.606	0.559
	(569.76)***	(269.97)***	(314.48)***	(569.12)***	(272.86)***	(302.91)***
ldistw	-0.579	-0.502	-0.770	-0.695	0.144	-0.927
	(58.47)***	(32.48)***	(54.56)***	(28.13)***	(4.11)***	(51.54)***
comlang_off	0.411	0.778	0.186	0.806	1.296	0.296
	(42.12)***	(60.75)***	(12.30)***	(7.13)***	(13.72)***	(10.38)***
contig	1.191	1.120	0.880	1.292	2.034	1.189
	(70.20)***	(53.16)***	(27.57)***	(35.20)***	(43.59)***	(30.00)***
Selfcer	0.451	0.359	0.983	0.264	0.332	0.734
	(26.09)***	(18.26)***	(30.40)***	(11.15)***	(13.14)***	(30.82)***
cc	-0.214	-0.260	-0.123	-0.223	-0.225	-0.298
	(12.84)***	(12.99)***	(4.56)***	(13.28)***	(11.19)***	(10.95)***
cth	-0.150	-0.258	-0.020	-0.157	-0.237	-0.182
	(10.85)***	(16.01)***	(0.86)	(11.31)***	(14.72)***	(7.76)***
cts	-0.193	-0.301	-0.120	-0.200	-0.258	-0.280
	(12.37)***	(16.16)***	(4.70)***	(12.67)***	(13.79)***	(10.94)***
rvc	-0.009	-0.095	0.164	-0.012	-0.105	0.068
	(0.63)	(5.57)***	(6.62)***	(0.83)	(6.17)***	(2.72)***
rvceu	-0.096	-0.055	-0.170	-0.106	-0.046	-0.312
	(4.31)***	(2.15)**	(4.51)***	(4.77)***	(1.79)*	(8.17)***
tt	-0.298	-0.327	-0.206	-0.299	-0.313	-0.225
	(18.79)***	(17.65)***	(7.77)***	(18.81)***	(16.92)***	(8.48)***
comb	-0.007	0.196	-0.193	-0.004	0.163	-0.048
	(0.53)	(12.71)***	(8.61)***	(0.31)	(10.55)***	(2.14)**
alt	0.146	0.058	0.161	0.147	0.061	0.220
	(11.86)***	(4.10)***	(7.61)***	(11.91)***	(4.32)***	(10.30)***
exc	-0.184	-0.159	-0.207	-0.189	-0.135	-0.263
	(19.05)***	(13.27)***	(13.85)***	(19.49)***	(11.27)***	(17.43)***
wo	-0.203	-0.389	0.256	-0.191	-0.401	0.534
	(10.61)***	(17.33)***	(7.91)***	(9.50)***	(17.47)***	(16.72)***
Constant	0.181	0.347	2.615	1.654	-6.423	3.476
	(2.16)**	(1.98)**	(15.31)***	(7.15)***	(20.03)***	(20.56)***
Observations	437101	240193	196908	437101	240193	196908
R-squared	0.63	0.67	0.59			

Absolute value of t-statistics in parentheses

*** significant at 10%; ** significant at 5%; *** significant at 1%**

Appendix 6.1. List of Rules Ordered by Restrictiveness According to the Ex-Post Index

B	Type of Rule	RI Level	Type of Rule
1	CCex&TT	36	CC OR CTS
2	CTSex&TT	37	CTS
3	CC&TT	38	WO&RVCEU
4	CTS&TT	39	CC OR CTS&RVC
5	TT&RVCEU	40	CTS&RVC
6	CCex OR CC&RVC	41	RVCEU
7	CTH&TT	42	RVC&RVCEU
8	CCex OR TT	43	CTH OR TT
9	CTH OR CTS&TT	44	CTH&TT OR RVC
10	TT&TT	45	CTH&WO
11	CCex	46	CTH
12	CTHex&RVCEU&WO	47	CC OR CTH&RVC
13	CTSex OR TT	48	TT OR TT
14	CTH&RVCEU	49	CTH&RVC
15	CTSex	50	CCex OR RVC
16	CCex OR CTS&RVC	51	WO&WO
17	CTHex&RVC	52	CTH OR TT
18	TT&RVCEU	53	CTH OR CTS&RVC
19	CTHex OR TT	54	CTSex OR RVC
20	CCex OR CC&RVC	55	CTS OR CTS&RVC
21	CTHex&WO	56	RVC&RVCEU OR RVC
22	CTHex	57	CTHex OR RVC
23	CCex OR CTH&RVC	58	CTH&RVC OR RVC
24	CTHex&RVC	59	TT OR WO
25	CTHex OR CTS&RVC	60	WO OR TT&RVC
26	TT&WO	61	RVC OR TT
27	CC OR TT	62	WO
28	TT	63	WO&RVC
29	RVC&TT	64	CC OR RVC
30	CTSex OR CTS&RVC	65	RVC
31	CC	66	CC&WO
32	CTH&WO&RVCEU	67	CTS OR RVC
33	CTS OR TT	68	RVC OR RVCEU
34	CC&RVC	69	CTH OR RVC
35	CTS&WO	70	RVC OR RVC

Appendix 6.2. Developed and Developing Countries in the Sample

Developed Reporters	**Developing Reporters**
EU	Chile
US	Mexico
Developed Partners	**Developing Partners**
Australia	Chile
Canada	Egypt
EU	Israel
Iceland	Jordan
Japan	Mexico
Norway	Tunisia
Switzerland	South Africa
US	

Appendix 7.1. List of Agreements Containing Provisions on Rules of Origin, by date of entry into force

RTA Name	Date of entry into force
EC – Andorra	01-jul-91
Southern Common Market (MERCOSUR)	29-Nov-1991(G) / 07-Dec-2005(S)
EFTA – Israel	01-Jan-1993
Faroe Islands – Norway	01-jul-93
Economic Community of West African States (ECOWAS)	24-jul-93
Melanesian Spearhead Group (MSG)	01-Jan-1994
North American Free Trade Agreement (NAFTA)	01-Jan-1994
Common Market for Eastern and Southern Africa (COMESA)	08-Dec-1994
Costa Rica – Mexico	01-Jan-1995
Faroe Islands - Switzerland	01-mar-95
Kyrgyz Republic - Armenia	27-oct-95
South Asian Preferential Trade Arrangement (SAPTA)	07-Dec-1995
Armenia – Moldova	21-Dec-1995
EC – Turkey	01-Jan-1996
Georgia – Ukraine	04-jun-96
Kyrgyz Republic – Moldova	21-nov-96
Armenia – Ukraine	18-Dec-1996
Canada – Israel	01-Jan-1997
Turkey – Israel	01-may-97
Canada – Chile	05-jul-97
Kyrgyz Republic – Ukraine	19-Jan-1998
EC – Tunisia	01-mar-98
Mexico – Nicaragua	01-jul-98
Georgia – Armenia	11-nov-98
Chile – Mexico	01-Aug-1999
EFTA – Morocco	01-Dec-1999
West African Economic and Monetary Union (WAEMU)	01-Jan-2000
EC – Morocco	01-mar-00
EC – Israel	01-jun-00
EC – Mexico	01-Jul-2000(G) / 01-Oct-2000(S)
Israel – Mexico	01-jul-00
East African Community (EAC)	07-jul-00
Southern African Development Community (SADC)	01-sep-00
Turkey - Former Yugoslav Republic of Macedonia	01-sep-00
New Zealand – Singapore	01-Jan-2001
EFTA - Former Yugoslav Republic of Macedonia	01-Jan-2001
Mexico - Guatemala (Mexico - Northern Triangle)	15-mar-01
Mexico - El Salvador (Mexico - Northern Triangle)	15-mar-01
Mexico - Honduras (Mexico - Northern Triangle)	01-jun-01
EC - Former Yugoslav Republic of Macedonia	01-Jun-2001(G) / 01-Apr-2004(S)
EFTA – Mexico	01-jul-01
Ukraine - Former Yugoslav Republic of Macedonia	05-jul-01
India - Sri Lanka	15-Dec-2001
US – Jordan	17-Dec-2001
Asia Pacific Trade Agreement (APTA) - Accession of China	01-Jan-2002

EFTA – Jordan	01-Jan-2002
EFTA – Croatia	01-Jan-2002
Chile - Costa Rica (Chile - Central America)	15-feb-02
EC – Croatia	01-Mar-2002(G) / 01-Feb-2005(S)
EC – Jordan	01-may-02
Chile – El Salvador (Chile - Central America)	01-jun-02
Canada - Costa Rica	01-nov-02
Japan – Singapore	30-nov-02
EFTA – Singapore	01-Jan-2003
EC – Chile	01-Feb-2003(G) / 01-Mar-2005(S)
Panama - El Salvador (Panama - Central America)	11-Apr-2003
Turkey – Croatia	01-jul-03
Singapore – Australia	28-jul-03
China - Macao, China	01-Jan-2004
China - Hong Kong, China	01-Jan-2004
US - Singapore	01-Jan-2004
US - Chile	01-Jan-2004
Panama and the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu	01-Jan-2004
Korea, Republic of - Chile	01-Apr-2004
EFTA - Chile	01-Dec-2004
Thailand - Australia	01-Jan-2005
US - Australia	01-Jan-2005
ASEAN - China	01-Jan-2005(G) / 01-Jul-2007(S)
Japan - Mexico	01-Apr-2005
Ukraine - Moldova	19-may-05
EFTA - Tunisia	01-jun-05
Pakistan - Sri Lanka	12-jun-05
Thailand - New Zealand	01-jul-05
Turkey - Tunisia	01-jul-05
India - Singapore	01-Aug-2005
Jordan - Singapore	22-Aug-2005
Turkey - Morocco	01-Jan-2006
US - Morocco	01-Jan-2006
Korea, Republic of - Singapore	02-mar-06
Trans-Pacific Strategic Economic Partnership	28-may-06
Japan - Malaysia	13-jul-06
Panama - Singapore	24-jul-06
EFTA - Korea, Republic of	01-sep-06
Chile - China	01-Oct-2006(G) / 01-Aug-2010(S)
EC - Albania	01-Dec-2006(G) / 01-Apr-2009(S)
EC (27) Enlargement	01-Jan-2007
Egypt – Turkey	01-mar-07
Pakistan – China	01-Jul-2007(G) / 10-Oct-2009(S)
EFTA – Egypt	01-Aug-2007
Chile – India	17-Aug-2007
Chile – Japan	03-sep-07
Japan – Thailand	01-nov-07
Pakistan – Malaysia	01-Jan-2008
Nicaragua and the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu	01-Jan-2008
Panama – Chile	07-mar-08

Turkey – Albania	01-may-08
EFTA – SACU	01-may-08
Japan – Indonesia	01-jul-08
Brunei Darussalam – Japan	31-jul-08
China - New Zealand	01-oct-08
Turkey – Georgia	01-nov-08
Panama - Costa Rica (Panama - Central America)	23-nov-08
Japan – Philippines	11-Dec-2008
US – Peru	01-feb-09
Australia – Chile	06-mar-09
Chile – Colombia	08-may-09
EFTA – Canada	01-jul-09
Peru – Singapore	01-Aug-2009
Canada – Peru	01-Aug-2009
Japan – Switzerland	01-sep-09
Peru – China	01-mar-10

Appendix 7.2. List of RTAs According to the Criteria Used in Origin Determination

RTAs	Criterion		
	CTH	Percentage	Technical test
EC - Cyprus Association	√		
EC - Malta Association	√		
PANEURO (50)	√	√	√
PE- (15)	√	√	√
EC - Morocco EuroMed.	√		
EC - Tunisia EuroMed.	√		
EC - Algeria Co-operation	√		
EC- Egypt Co-operation	√		
EC- Jordan Co-operation	√		
EC- Lebanon Co-operation	√		
EC – OCTs	√		
EC- Syria Co-operation	√		
EC – Mexico	√	√	√
EC - South Africa	√	√	√
EFTA – Israel	√		
EFTA – Morocco	√		
Estonia-Ukraine	√		
Canada – Chile	√	√	√[136]
Mexico-Chile	√	√	√[4]
NAFTA	√	√	√[4]
Canada – Israel	√		
Mexico – Israel	√	√	√[4]
United States-Israel		√	
ANZCERTA		√	√[137]
SPARTECA		√	√[138]
AFTA		√	√[139]
CACM	√		
CARICOM	√		
COMESA	√	√	
MERCOSUR	√	√	

[136] Used in fewer tariff items than the other two methods.
[137] The test - which is in fact a "geographical" test - requires that the last process of manufacture (excluding minimal operations) be performed in either Australia or New Zealand.
[138] The test requires that the last process of manufacture (excluding minimal operations) be performed in South Pacific Islands.
[139] The test requires that the last process of manufacture be performed in exporting ASEAN member State.