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FRICTION COSTS OF TRADE IN LATIN AMERICA

COSTOS DE FRICCION DEL COMERCIO EN AMERICA LATINA

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Abstract

The barriers that arise in international trade are the costs that countries assume to export and import. These costs are called friction costs. They can be tangible, such as geographic and administrative barriers, and they can be intangible, such as institutional and cultural barriers. In this work, by using an augmented trade cost function, the friction costs of bilateral trade for Latin American countries are estimated, comparing them with the rest of the world during the period 1996-2014, and their effects are determined, as well as the effects of the four integration agreements in the region. Despite their theoretical complexity, tangible barriers have a greater effect on Latin American trade flows than intangible barriers.

Keywords: *Friction costs, Cost function, Integration Agreements, Latin America.*

JEL Classification: *F1, F14, F15.*

Resumen

Las barreras que surgen en el comercio internacional son los costos que los países asumen al exportar e importar. Estos costos se denominan costos de fricción. Pueden ser tangibles, como las barreras geográficas y administrativas,

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o intangibles, como las barreras institucionales y culturales. En este trabajo, mediante el uso de una función ampliada de costos comerciales, se estiman los costos de fricción del comercio bilateral de los países latinoamericanos, comparándolos con los del resto del mundo durante el período 1996-2014, y se determinan sus efectos, así como los efectos de los cuatro acuerdos de integración existentes en la región. A pesar de su complejidad teórica, las barreras tangibles tienen un mayor impacto en los flujos comerciales de América Latina que las barreras intangibles.

Palabras clave: *Costos de fricción, función de costos, acuerdos de integración, América Latina.*

Clasificación JEL: *F1, F14, F15.*

1. INTRODUCTION

Notably, the world has become more commercially integrated over the years, and this is largely due to the demand of countries for goods and services that favor their consumption rather than their production (Alessandria and Choi 2014). For Latin America, international trade inevitably becomes important as well, from the smallest economy characterized by its dependence on monocultures, such as Honduras, to the largest economies that have industrial prowess, such as Brazil and Mexico, characterizing the Latin American region as diverse in interests and resources (Tussie 2012).

In this sense, the analysis of the patterns that explain international trade between countries, and the profits they obtain thanks to access to less restricted markets, have been recurrent topics of study. The first studies come from classical economists such as Adam Smith (1776), David Ricardo (1817), and John Stuart Mill (1848), who define a type of trade, inter-industrial trade, based on comparative advantages between countries, under assumptions of perfect competitive markets and constant returns to scale. The neoclassical theory of international trade, perfected by David Ricardo's model based on the works of Hecksher (1919) and Ohlin (1933), explains that countries export goods that intensively use their relatively abundant factor and will import goods that intensively use the relatively scarce factor (Blanco 2011).

Since the 1970s, new theories of international trade have emerged that leave neoclassical assumptions behind, introducing dynamic elements in the explanation of international trade such as those initially proposed by Stuart Mill. Among these elements is the consideration of economies of scale, the presence of imperfectly competitive markets, or the existence of externalities, giving rise to a new type of trade: intra-industrial trade (Escribano 2004).

Thus, a large amount of research has focused on the factors that have allowed intra-industry trade to develop, such as access to information (Stigler 1961), geographic

proximity, or the existence of clear rules and respect for property rights (Grubel 1970) or transport costs (Krugman 1980). These factors become barriers for those countries that lack them. Krugman (1980) includes transport costs as a determining factor of international trade, stating that if international trade is costly, in the sense that it presents many barriers, this will cause goods to be concentrated internally, even if there is a great demand abroad.

In this way, trade barriers can be defined as the costs that countries assume in the face of obstacles that may exist in trade between them or within them (Nijkamp, Rietveld, and Salomon 1990). These barriers have been analyzed from a theoretical and empirical point of view. Anderson and Van Wincoop (2004) point out that the costs that arise from trade represent magnitudes and patterns that are sensitive to the economies of countries and regions, giving us the understanding that the presence of trade barriers can reduce trade flows between countries due to the friction they represent.

Additionally, trade barriers that can be observed and quantified through the costs they generate or by their effects on trade volume are often referred to as tangible trade barriers. These include transport, trade policy, and exchange rate barriers. These barriers cause trade to present higher transport costs, tariffs, fees, and currency conversion costs (Linders 2006).

However, other barriers are not directly observable in monetary terms or quantities and are also difficult to measure, "intangible barriers to trade" (Abedini 2015). Among others, we can mention problems of institutional quality, incomplete information, cultural barriers, and institutional barriers (Linders 2006). Country borders also represent an institutional barrier, since they delimit a jurisdiction of policies and legal norms, causing, in turn, a segmentation of markets (Rodrik 2000). The physical distance between countries not only causes higher transport costs but also increases communication costs, interaction and coordination costs, and other information costs (Frankel, Stein, and Wei 1997).

For Deardorff (2004), unobservable costs, which arise from intangible trade barriers, are those that mostly explain the patterns of international trade. Anderson and Van Wincoop (2004) mention that trade friction costs are significantly representative and these costs are directly linked to the policies that a country assumes, in addition to its geographic relationship. A reduction in trade friction costs undoubtedly increases the expectations of countries to export and expand the market for their production (Alessandria and Choi 2014).

Therefore, the signing of integration agreements in international trade becomes relevant in the study of barriers since they involve the elimination of multiple tangible and intangible barriers to trade (Helleiner 1975) (Rodrik 2000). In this sense, Latin America has experienced various processes of commercial integration since the mid-twentieth century since the creation of the GATT, to obtain benefits from trade by reducing trade barriers. Due to the competitive reality in the region, the sustainability of the internal market, the incentive to production, and the joint use of the resources of the member countries are sought, elements that have generated a scenario of protectionism

for their production and the internal trade of their goods and services (Aragão 1993). The problem with these protectionist policies is that it is not known what is ultimately encouraged (Ffrench-Davis 1986). The implementation of protectionism in Latin America sought import substitution without measuring a cost, such as quantitative restrictions such as tariffs and effective protection rates, and without identifying which industries should be developed and for what purpose (Tavares 1964). Ocampo (2003) also recognizes the attempts to implement liberalization policies, pointing out that in Latin America, the elimination of trade barriers through liberalization has been almost non-existent, even much more than industrialization. This led to integration becoming a kind of adjustment to this problem, which also failed given that intra-regional trade relations did not surpass inter-regional relations (Tussie 2012).

Ultimately, as Stiglitz and Charlton (2005) argue, the control and reduction of trade barriers have become a priority over the policies that each country adopts, although what is normally wanted to be shown is that countries are reducing these barriers, as developed countries supposedly do, through an integration strategy to benefit their products that can expand their market and not to benefit the products of developing countries that can enter their markets.

Against this background, this paper analyses the tangible and intangible barriers to trade between Latin American countries and the rest of the world between 1996 and 2014 to estimate a trade friction cost function and determine its effects on trade in the countries of the region.

This brings us to the specific questions of this research: what are the tangible and intangible barriers that represent friction costs for trade in Latin America? And what are the effects of economic integration between Latin American countries on trade? From these questions, which become the objectives of this thesis, the following hypothesis arises: tangible barriers are those that have had the greatest weight on the friction costs of trade between Latin American countries and the rest of the world during the period 1996-2014. Regional economic integration agreements have generally not had significant effects on reducing intangible barriers between Latin American countries.

To answer the research questions and achieve the objectives set, this paper is organized as follows. Section 2, Literature Review, reviews the literature that has contributed to the study of international trade and the study and definition of the barriers that are present in it. Section 3, Empirical and Methodological Framework describes in a general way the models used to analyze the friction costs of trade and details the results that these models discover. This section is divided into three parts: (1) Gravity Model, (2) Regional Integration Treaties (RTAs), and (3) Hausman-Taylor, where the composition of the model, the introduction and importance of regional integration treaties in the model are described, in addition to the description of the methodology for applying the Hausman-Taylor model in the gravity model in search of controlling the unobservable effects characteristic of the model. Section 4, entitled Effects of Friction Costs, describes the results obtained with the estimation

of the augmented friction cost function. Finally, in Section 5, entitled Conclusions, we analyze the results obtained in the development of this work.

2. LITERATURE REVIEW

The growing trade openness of countries and greater economic integration between them have contributed to the growth of their economies. The influence of openness to international markets on economic growth has been evidenced through various factors related to technological development, improved transport, investment in infrastructure, the reduction of tariffs and other administrative costs associated with trade, or the signing of trade agreements between countries, to name a few (Linders 2006). These factors demonstrate the efforts made by countries to reduce the barriers that hinder trade between them.

To understand the patterns of international trade between countries and their results, the first studies come from classical economists such as Adam Smith (1776), David Ricardo (1817), and John Stuart Mill (1848), with their contributions: absolute advantages, comparative advantages, real terms of trade (RTI), respectively. The neoclassical theory, based on the works of Hecksher (1919) and Ohlin (1933), extends David Ricardo's model to a two-country, two-factor, two-product model, concluding that a country will export a good that intensively uses its relatively abundant factor and will import the good that intensively uses the relatively scarce factor (Blanco 2011).

The neoclassical assumptions based on perfectly competitive markets and constant returns to scale were overcome in the 1970s, introducing dynamic elements into trade models, such as markets with imperfect competition and the presence of externalities, giving rise to the analysis of intra-industrial trade (Escribano 2004). Among the first authors to explain this trade is Stigler (1961), who considers the cost of acquiring information as a determinant of intra-industrial trade. Krugman (1979) argues that it is the consumer's preference for variety that determines intra-industrial trade, concluding that companies produce larger volumes by taking advantage of their economies of scale and consumers benefit from a wide variety of products at low prices thanks to greater international competition.

Grubel (1979) explains the presence of intra-industrial trade through various factors such as the geographical proximity between producers in one country and consumers in another, the presence of clear standards and legal security to be able to generate an international division in the production of certain goods, distortions in prices caused by government regulations or even seasonal fluctuations in production and consumption (Díaz-Delgado 1985).

For his part, Krugman (1980) assumes transportation costs as a variable that influences the behavior of international trade, concluding that if trade is expensive, it will cause the internal concentration of goods, even if there is significant external

demand. Precisely these new theories of international trade are those that will serve as a basis for the study of trade barriers.

Although Krugman is one of the most important authors in the field of trade, other authors before him are recognized within Economic Geography and have taken into account the variable "transport" as an incident in the costs that arise from economic-productive activities. As von Thünen (1826) does in the primary sector, analyzing the agricultural sector plays an important role in urban studies from the point of view of location competition. In the secondary sector, Weber (1909) analyzes the location of industries. In the tertiary sector, Christaller (1933) and Lösch (1940) define in their works that the distribution of agricultural land would dictate the distribution of manufacturing production in the form of a network or honeycomb, analyzing commercial and service activities. While the authors mentioned had a micro vision, Krugman (1991) transfers this variable "transport" to a more macro context, speaking of core and periphery, determining that the manufacturing industry seeks to locate itself where there is greater demand to achieve economies of scale and minimize transportation costs.

Therefore, trade barriers are defined as the costs that countries incur due to the difficulties that may exist between them or within them when exercising trade (Nijkamp, Rietveld, and Salomon 1990). Anderson and Van Wincoop (2004) define trade costs as magnitudes and patterns that are sensitive to the economies of countries and regions, so the presence of trade barriers reduces the trade flows of countries due to their friction. Trade barriers that are observable and quantifiable by the costs they generate or by their effects on the flow of trade are called tangible barriers. Examples include higher transportation costs, higher tariffs, and other types of trade policy barriers, as well as the cost of currency conversion (Linders 2006).

Other barriers are not observable and are also difficult to measure, which are called intangible trade barriers (Abedini 2015). To interpret the real friction that trade presents, it is not enough to take into account only traditional trade barriers or those that are easily observable (Anderson 2000). Likewise, Linders (2006) corroborates this statement by pointing out that tangible trade barriers are not sufficient to explain trade friction, since trade costs may not only vary depending on transportation, communication, or a protective tariff policy. Balistreri and Hillberry (2006) argue that by observing the components of GDP it is easy to identify bilateral trade costs of sectors such as transportation costs, but it is more difficult to assign other trade costs such as time, information, contracting, currency, and language, among others.

For all these reasons, intangible trade barriers must also be taken into account, such as the institutional quality of countries that can generate an increase in trade costs, resistance to trade, incomplete information, cultural barriers, and institutional barriers (Linders 2006). The World Trade Organization (2004), in a discreet defense of trade liberalization, mentions that institutional quality can affect the amounts of trade that trade liberalization can achieve in a country and that this can have consequences on the country's income. Linders (2006) defines institutional barriers as intangible,

although they can be partially interpreted as observable, as is the case with legal costs, but, for the most part, the costs are not observable at first sight, as is the case with contracting costs, monitoring costs, regulatory costs, the risk of expropriation and the costs assumed due to differences in institutional quality. To complement this analysis, Abedini (2015) adds that excellent institutionality reduces insecurity and instability in commercial activities, thereby causing a decrease in the costs assumed by exercising trade.

Country borders also represent an institutional barrier, since they delimit the jurisdiction of policies and legal norms; which in turn causes a segmentation of markets, in the same way that transportation costs and tariffs or border fees do (Rodrik 2000). The physical distance between countries not only causes higher transportation costs but is also considered an intangible barrier to trade, as Frankel, Stein, and Wei (1997) point out, since distance is related to several intangible barriers and generates an effect on trade greater than transportation costs, such as communication costs, interaction and coordination costs and other information costs.

Eaton and Kortum (2002) argue that distance does not only influence transport costs. These authors observed that trade decreases dramatically with distance because they work with different technologies, which causes prices to vary in each location, with greater differences as countries are further away, due to the remuneration of factors that are far from being equal between countries and the relative productivity of countries varies considerably between their industries.

Deardorff (2004) points out that intangible trade barriers are the ones that have the greatest effect on changes in the patterns followed by international trade. Anderson and Van Wincoop (2004) add that the friction costs of trade are linked to the policies adopted and the geography of the country and moving towards policies that seek to reduce the friction costs of trade seeking to increase the expectations of countries to export and expand their market (Alessandria and Choi 2014).

Another group of studies focused on the effects of the signing of integration agreements on international trade, as they entail the elimination of multiple barriers to trade. The growing commercial integration of economies has led to a reduction in the interference of countries' borders in the commercialization of goods, services and capital, being one of the conjectures that Rodrik (2000) uses regarding commercial integration; that is, a scenario where the transaction costs of trade would decrease. Perhaps the most advanced scenario that Rodrick (2000) uses to best exemplify how to build integration is federalism, practiced by the United States, where despite the existence of different regulations and standards between the states that make up the country, there is still a single constitution and a single government, but above all the existence of a federal judicial system that guarantees that the market is composed of only one, the national one, and not of several subnational markets. The European Union, on the other hand, is far from being a federal system, in this case of a global type, where national governments do not necessarily have to disappear; but a framework should be established above the national one of an executive, legislative and judicial

type. That is to say, the general objective, as mentioned by Rodrick (2000), is that there exists a world government that takes charge of the world market.

Ultimately, the control of trade barriers has become a priority over a country's political decisions (Stiglitz and Charlton 2005). Since the early 1960s, a large group of economists have focused on trade costs, which play a critical role in determining the volume and direction of trade flows. And, recently, the debate has focused on the importance of non-political barriers (such as inadequate transport and logistics infrastructure) and trade policies (such as trade agreements). Studies that have investigated the importance of these issues have relied on the gravity model as a basis for analysis (Turkson 2015).

Based on this information, this work is based on the use of "The workhorse of international trade", that is, the gravity model, named as such by Turkson (2015). This model, as will be reviewed in the empirical and methodological framework section, has been used by most studies to establish what the costs of trade are and what their effect is on trade flows. The gravity model allows us to analyze and estimate the effects of various factors that can affect trade, and Baldwin and Taglioni (2006) mention several of these factors such as the impact that can be generated by the signing of trade agreements, the presence of high exchange rate volatility, the use of a common currency, the effects of borders, the benefits that can arise from the use of a similar language, and even a similar religion, in addition to the impact that a war factor can have on bilateral trade flows.

3. EMPIRICAL AND METHODOLOGICAL FRAMEWORK

The study of trade friction costs has been carried out from both a theoretical and empirical point of view. Helpman and Krugman (1985) propose a general equilibrium model with monopolistic competition markets between symmetrical companies, which allows predicting what the level of trade flows would be if trade barriers did not exist, but with an emphasis on the variations presented by legislation on intellectual property or patents. Maskus and Penubarti (1995) carry out a study for 77 countries, which include OECD countries and developing countries, with data from 1984 and based on the Helpman and Krugman model (1985), they demonstrate that there is empirical evidence on how trade barriers, with a particular focus on the different levels of patent protection that countries have, influence bilateral trade flows. Montenegro and Soto (1996) use the gravity model to explore the distortion of Cuba's trade structure and predict its evolution, assuming that the Cuban economy were to be liberalized. This econometric study uses data from 101 developed and developing countries over a period of 1980-1991, summarizing that Cuba would leave its trading partners Canada and Japan for the United States, for reasons of reducing both transport and transaction costs.

Lee and Swagel (1997) determine the effects of trade barriers on trade flows between developed and developing countries in 41 countries in the world for 1988, identifying their production sectors and differentiating between tariff barriers and

non-tariff barriers such as distance and the presence of black markets. The authors conclude that these countries have a political economic framework geared towards protection; that is, they have not only sought to protect their weak production, threatened by competition from imports, but they also tend to give greater protection to more industrialized or large sectors.

Rose and Van Wincoop (2001), considering that the exchange rate is a barrier to international trade, carry out an analysis to determine the effects in 200 countries during 1970 and 1995, among which there are countries that have decided to use either the strategy of a common currency or the strategy of dollarization, so that they can determine what the effect is on trade flows before and after. The authors conclude that these strategies have reduced trade barriers and have generated growth in international trade flows, eliminating the monetary barrier.

Abedini (2015), in a study of OECD countries, shows that trade costs, although they have decreased on average, this decrease is increasingly smaller. Abedini (2015) also shows how geographic, administrative, institutional and cultural friction costs influence trade in these countries. He finds that, while administrative costs have a continuous decrease, there is an increase in geographic, institutional and cultural friction costs; which the author interprets in his research as indicating that future trade barriers will be institutional and cultural, after overcoming geographic barriers.

Other studies have put emphasis on trade agreements between groups of countries. Martínez-Zarzoso (2003) evaluates the determinants of international trade flows for 47 countries, analyzing the effect of preferential agreements, such as the European Union - EU, the North American Free Trade Agreement - NAFTA, the Caribbean Community - CARICOM, the Central American Common Market - MCCA, and Mediterranean countries, within the period 1980-1999, applying the gravity model of trade, taking into account also the distance, the income level, the population and the cultural similarity as determinants of bilateral trade flows. The results obtained show that the income elasticity of the exporter is greater than that of the importer, which highlights the importance of promoting production for export; the relationship with the population is indirect, which shows an absorption effect, as does the distance.

Martínez-Zarzoso and Nowak-Lehmann (2003) evaluate the potential trade arising from the treaties signed between the European Union and Mercosur (which includes Chile), using the gravity model for 20 countries. The authors recommend that the gravity model with fixed effects is preferable to the random effects model, arguing that variables such as infrastructure, income differences and the exchange rate are decisive in understanding bilateral trade flows.

Carrillo-Tudela and Li (2004) apply the gravity model to examine the effects of the Andean Community - CAN - and Mercosur on intra-regional and intra-industrial trade within the period 1980-1997, taking into account distance and competitiveness effects as trade barriers, and define that in the CAN there is a significant effect on reference products but only a differential effect on differentiated products, particularly

on capital-intensive goods, while in Mercosur there was only a significant effect on the capital-intensive subcategory of reference products.

Klagges (2007) analyzes the effects of trade integration in Latin America on its bilateral flows within the period 1996-2001 for 11 countries and their main trading partners, showing that the quality of infrastructure is an important significant variable, as is having a common border, cultural similarity and maritime access, as well as belonging to blocks, that is, intra-regional trade.

As has been shown, there is a vast amount of empirical and theoretical research on the determinants of international trade, with the most widely used methodological strategy being the econometric estimation of the gravity model. This model has been used to identify the barriers that limit trade. In this thesis, we aim to establish a friction cost function that allows us to estimate its effects on international trade in Latin America.

3.1. Gravity model

This study analyses the effects on trade of tangible and intangible barriers, such as cultural similarities, as well as the effects of macroeconomic variables such as the exchange rate. The theoretical basis of this work is based on the use of the gravity model.

The gravity model, dubbed by Turkson (2015) as the workhorse of international trade, has been used by most studies seeking to determine trade costs and how they affect trade volume, international trade patterns, and countries' trade performance. The use of gravity models, and the inclusion of intangible trade costs, has been subject to criticism; however, theoretical refinements to the gravity model, and the use of intangible trade costs with improved estimation techniques, have improved the understanding of trade costs and expanded research opportunities for new studies on the effects of a policy to reduce trade costs (Turkson 2015).

The gravity model allows us to analyze and estimate the effects of various measures on the bilateral trade of countries, such as the impact generated by the signing of trade agreements, the volatility of the exchange rate, the use of a common currency, the effects of borders, the benefits that may arise from the use of a similar language, and even a similar religion, or the impact that being a country with a probability of a war event may have on trade flows (Baldwin and Taglioni 2006).

Baldwin and Taglioni (2006) identify the main errors that have been made in the literature on gravity models. The authors define three fundamental pillars that give the model sufficient popularity. First, they consider that economies demand to know how normal their trade flows should be, because these are a basic tool on which they can make decisions based on their interests for economic relations with other countries; second, a very relevant and important point for researchers, the information is freely and easily accessible for the application of this model; and, as a third pillar, they consider that there is a high number of high-level works that talk about and use the gravity model, which allows researchers to be better guided on its use.

Tinbergen (1962), Poyhonen (1963) and Linnemann (1966) began to use the gravity model of trade in eminently empirical studies. At the beginning of the 1970s, Learmer and Stern (1976) defined in their book that bilateral trade is proportional to the product of their GDP, which is also called the "potluck assumption", which consists of countries producing their goods and placing them in a basket and then each country consuming in proportion to its income. Anderson (1979) was the one who began to give micro foundations to the theory behind the gravity model of trade, but based on very strong assumptions for current reality, since it assumed that each country produced a good that was irreplaceable with the goods of other countries. Between the 1970s and 1980s, the model lost relevance, coming to be called by authors such as Deardorff (1984) a model with an ambiguous theoretical legacy.

Bergstrand (1985) sought to provide more foundations to the model, improving the theoretical connection between factor endowment and bilateral trade, although he did not take into account the condition of prices. Between the 1980s and 1990s, the new trade theory emerged with Krugman (1979) (1980) (1981) and Helpman (1981). These authors provided the gravity model with sufficient foundations allowing it to have the desired strength for use in the empirical analysis of the determinants and barriers of international trade. Later, Anderson and Van Wincoop (2001) present a recognized effort to provide microeconomic foundations to the gravity equation, adding the estimation of parameters on cross-sectional data and also the use of country dummies.

The gravity model is inspired by physics and Newton's law of gravity, which states that the force of gravity between two bodies is proportional to the product of their masses divided by the distance between the bodies squared. In trade, the mass of bodies will now be expressed in terms of the GDP of the countries being analyzed (Baldwin and Taglioni 2006), while the distance would be the separation in kilometers between two countries. In order to estimate the trade friction cost function for Latin America, including tangible and intangible barriers, it is necessary to take into account the gravity approach to international trade, given that the theoretical gravity model includes friction costs as trade costs.

The Anderson and Van Wincoop (2004) model studies trade costs. This model assumes that each country specializes in the production of a single good, which acquires a differentiation by having a place of origin, allowing to describe the bilateral nominal trade flows from a country i to a country j; expressed as follows (x_{ij}):

$$x_{ij} = \frac{y_i \times y_j}{y^W} \left(\frac{\tau_{ij}}{P_i P_j} \right)^{1-\sigma} \tag{1}$$

where y_i and y_j correspond to the exports of all products of countries i and j, y^W the world's exports, τ_{ij} represents the friction costs of bilateral trade between countries i and j, P_iP_j represents the interaction of the price indices of countries i and j, and σ represents the elasticity of substitution of all goods. Equation 1 has been analyzed

through log-linear models. Following the recommendation of Abedini (2015), the gravity equation of Anderson and Van Wincoop (2004) with respect to trade flows x_{ij} is added to a time index (t), which will represent the total exports from country i to country j in each t year of study, in order to extend to a panel dimension model. This leads us to a specific equation:

$$\ln\left(x_{ijt}\right)=\alpha_0+\alpha_1\ln\left(y_{it}\right)+\alpha_2\ln\left(y_{jt}\right)+\alpha_3\ln\left(g_{ijt}\right)+\beta_1\ln\left(d_{ij}^{G}\right)+\beta_2 c_{ij}+\beta_3 s_{ij}+$$
$$\beta_4\ln\left(m_{ijt}\right)+\beta_5\ln\left(f_{jt}\right)+\beta_6 u_{ijt}+\beta_7 q_{it}+\beta_8 q_{jt}+\beta_9\ln\left(d_{ijt}^{I}\right)+\beta_{10} l_{ij}+\beta_{11} r_{ij}+ \quad (2)$$
$$\beta_{12} h_{ij}+\beta_{13}\ln\left(d_{ijt}^{C}\right)+\theta_i+\vartheta_j+\omega_{ij}+\varphi_t+\varepsilon_{ijt}$$

where t represents annual data, y_{it} and y_{jt} represent the gross domestic products of countries i and j, respectively, at each time period t. g_{ijt} is the absolute difference in per capita incomes of countries i and j. The model further specifies 4 geographic barriers: d_{ij}^{G} is the geographic distance between countries i and j, c_{ij} is a dummy that takes value 1 if there is a common border between the two countries, s_{ij} is a dummy variable that takes value 1 if there is a maritime connection between the countries, and m_{ijt} represents whether there is a good communication infrastructure between the countries.

The model also introduces two administrative barriers. The first is the degree of ease of exporting (f_{jt}), an index that measures the degree to which government j (importer) impedes the flow of trade through tariffs and other means including corruption, taking higher values the less bureaucratic obstacles hinder trade. The index of economic freedom is based on 10 quantitative and qualitative factors, grouped into four categories: the first is the Rule of Law (property rights, absence of corruption); the second is the Size of the State (fiscal freedom, government spending); the third is Regulatory Efficiency (trade freedom, labor freedom, monetary freedom); and the fourth is Market Openness (trade freedom, investment freedom, financial freedom). Each of these ten factors is scored on a scale of 0 to 100 and a country's overall score is derived by averaging them, with equal weighting to each (Miles, *et al.* 2004). In short, the model postulates having a common currency (u_{ijt}), which is equal to 1 if both countries maintain trade relations in the same currency.

Intangible trade barriers are controlled by institutional barriers and culture barriers. Institutional barriers will be specified by q_{it}, q_{jt} and d_{ijt}^{I}, where q_{it} and q_{jt} represent an arithmetic average of six governance indicators[1] calculated by the World Bank. The six indicators are an estimate that gives the country's score on the aggregate indicator, this means that they will be those of a standard normal random variable,

[1] (1) voice and accountability, (2) political stability and absence of violence, (3) government effectiveness, (4) regulatory quality, (5) rule of law, and (6) control of corruption.

that is, with zero mean, one standard deviation, and ranging from approximately -2.5 to 2.5 (Kaufmann, Kraay and Mastruzzi 2010). d^{I}_{ijt} represents the difference in institutional quality measured as the sum of the previous six governance indicators between the two countries where bilateral trade takes place[2].

Cultural factors are controlled by the following variables: l_{ij}, r_{ij}, h_{ij} and d^{C}_{ijt}. The first three are dummy variables, taking the value 1 if the two countries *i* and *j* share a common language, a common religion and a common history or if they belong to the same colony respectively. d^{C}_{ijt} represents the extent to which social norms and values are similar in the two countries, taking into account four values[3] and taking an arithmetic average similar to the institutional distance[4]. The variables θ_i and ϑ_j are the unobservable fixed effects including the price level of both the exporter and the importer, while ω_{ij} and φ_t control for bilateral effects (exporter by importer) and time-specific effects.

3.2 Regional Integration Treaties (RTAs)

In recent years, regional integration treaties have had a greater emergence; however, Kurihara (2011) is very clear in specifying that their effects on international trade have not yet been studied in the depth that it deserves.

For this reason, it is important for this work to include the effect of four integration agreements in the region. Guatemala, Honduras, El Salvador, Nicaragua and Costa Rica formed the Central American Common Market – MCCA in 1962. In 1991, Argentina, Brazil, Paraguay and Uruguay created the Southern Common Market – MERCOSUR. In 1993, the Andean Pact took a step forward, establishing the area of its member countries as a free trade area (except for the area of Peru). This agreement has been known as the Andean Community – CAN since 1997. The most recent agreement in the area is made up of North American countries: the United States, Canada and Mexico, called the North American Free Trade Agreement – NAFTA (Martin-Mayoral, Morán Carofilis and Cajas Guijarro 2016).

The inclusion of the four integration agreements to know their effects on international trade in Latin America redefines our equation 2, with β_{14}, β_{15}, β_{16} and β_{17} describing the effects corresponding to the NAFTA, MERCOSUR, MCCA and CAN agreements, respectively, as described in equation 3:

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2 $d^{I}_{ijt} = \frac{1}{6}\sum_{k=1}^{6}(I_{kit} - I_{kjt})^2 / V^{I}_{kt}$ where I_{kit} represents the value of governance indicator k (k=1,…,6), for country i at period j. And V^{I}_{kt} represents the variance of the indicator across all countries at time t (Kogut and Singh 1988).

3 (1) trust, (2) tolerance, (3) individual self-determination, and (4) obedience. Four fundamental values from the World Values Survey (WVS) (Dutta and Mukherjee 2012).

4 $d^{C}_{ijt} = \frac{1}{4}\sum_{k=1}^{4}(C_{kit} - C_{kjt})^2 / V^{C}_{kt}$ where C_{kit} represents the value of cultural indicator k (k=1,…,4), for country i at period j. And V^{I}_{kt} represents the variance of the indicator across all countries at time t (Dutta and Mukherjee 2012).

$$\ln(x_{ijt}) = \alpha_0 + \alpha_1 \ln(y_{it}) + \alpha_2 \ln(y_{jt}) + \alpha_3 \ln(g_{ijt}) + \beta_1 \ln(d_{ij}^G) + \beta_2 c_{ij} + \beta_3 s_{ij} + \beta_4 \ln(m_{ijt}) + \beta_5 \ln(f_{jt}) + \beta_6 u_{ijt} + \beta_7 q_{it} + \beta_8 q_{jt} + \beta_9 \ln(d_{ijt}^I) + \beta_{10} l_{ij} + \beta_{11} r_{ij} + \beta_{12} h_{ij} + \beta_{13} \ln(d_{ijt}^C) + \beta_{14} nafta + \beta_{15} mercosur + \beta_{16} mcca + \beta_{17} can + \theta_i + \vartheta_j + \omega_{ij} + \varphi_t + \varepsilon_{ijt} \quad (3)$$

This paper uses a model explicitly with variables that are constant over time, also called fixed effects, in this case, observable in the panel data analysis, and these effects must be treated as random variables (with a constant mean but with a non-zero variance) (Wooldridge 2010). On the contrary, unobservable effects must be treated as variables that do not change over time (Montero 2011). The problem with assuming all independent variables as observable is that when t represents different periods for each country (in this paper), the unobserved effect is often interpreted as characteristics that are given and not as characteristics that change or can change over time (Wooldridge 2010).

Hausman (1978) proposes a chi-square test that determines whether the differences are systemic and significant between two estimates; that is, he proposes a test based on the difference between the fixed effects estimators and the random effects estimators. The Hausman test tests whether the loss of efficiency obtained with fixed effects estimators is compensated by the elimination of the biases of the random effects estimators. However, the problem is that the fixed effects estimators eliminate all variables (observable and non-observable), not allowing the estimation of the effect of variables such as language or having a common border on bilateral trade. Furthermore, Hausman and Taylor (1981) propose controlling for non-observable effects that could be correlated with exogenous explanatory variables that vary over time and between individuals but also for observable endogenous variables that do not vary over time (both assumed to be orthogonal to the idiosyncratic error). The method used is the following: through fixed effects estimators, the observable variables that change over time are estimated, obtaining the residual. This residual is used as an instrument for the endogenous variables that do not vary over time (regressing the residuals on the variables that do not vary over time and using as instruments the exogenous variables that vary over time and the exogenous variables that do not vary over time) (Amemiya and MaCurdy 1986). The Hausman-Taylor method has been proven to be more efficient and produces estimates of the coefficients of the variables that do not vary over time, which allows us to trust in the consistency of our final results. In this path, the Hausman–Taylor method offers an efficient way to estimate models where:

- Some regressors are correlated with the unobserved country-pair effects (endogeneity issue).

- Time-invariant regressors, which would be eliminated under standard fixed effects, need to be retained for interpretation (e.g., distance, common language, common border).

Technique and instrumentation:

Following Hausman and Taylor (1981) and Amemiya and MaCurdy (1986), we classify the regressors into four groups:

- Time-varying exogenous variables (e.g., GDP of exporter and importer, communication infrastructure).
- Time-varying endogenous variables (e.g., trade openness index).
- Time-invariant exogenous variables (e.g., common language, maritime connection).
- Time-invariant endogenous variables (e.g., institutional quality difference, common currency).

The estimation proceeds in two steps:

- Within transformation (fixed effects) is applied to the time-varying variables to obtain consistent estimates and residuals.
- Instrumental variables stage:

The time-invariant endogenous variables are instrumented using the exogenous time-varying variables (and their deviations from group means) as internal instruments.

The time-varying endogenous variables are instrumented using deviations of the exogenous time-invariant variables from their group means.

This approach allows us to control for correlation between unobserved country-pair effects and the explanatory variables, while still estimating coefficients for time-invariant regressors—something not possible with the standard fixed-effects estimator.

Once the model, its variables, inclusions and methodology to be used have been described, we can apply the tools mentioned here to generate the results that these friction costs have on Latin American international trade and review them in the following section. In order to then, finally, be able to analyze and generate conclusions about these costs and their effects on Latin American international trade.

4. RESULTS

This section shows the results obtained after applying the tools described in the empirical and methodological framework section. In the first part, the composition of the data and the observations finally taken by the model are described. In the second part, the estimators obtained as a result of the regressions carried out in order to support which methodology is the most robust are shown. And in the third part, once it has been defined that the methodology described in the empirical and methodological

framework is the most robust, we discuss the Hausman-Taylor regression, we analyze the model in each division and subdivision of the trade barriers described in this work.

To estimate the friction costs of bilateral trade for the 19 Latin American countries, including the United States (see Annex 1), with the rest of the world in the period 1996-2014, we use equation 3 described in the methodological framework. The sample includes 3,854 country pairs and thus 48,255 observations in total, describing the bilateral trade of the 19 Latin American countries. However, the number of observations decreases to 32,372 after excluding observations with missing values. The sample contains 18 variables as described in equation 2, including the dependent variable.

To verify the composition of the sample, the descriptive statistics of the variables and the correlation between the independent variables can be reviewed in Annex 4. In the multicollinearity test, presented in Annex 4, the results of the variance inflation factor (VIF) test can be observed, with values that do not exceed 3.52; that is, all the results are less than the minimum acceptable value of 10, as suggested by Kennedy (2003), which reveals that there is no multicollinearity in the model in equation 2. The Hausman test shows a chi-square of 241.04 and a Prob>chi-square equal to 0.0000 (less than 0.05), which leads us to reject the null hypothesis in favor of the fixed effects estimator, which we show in the results of Table 1.

TABLE 1

ESTIMATED COEFFICIENTS OF THE TRADE FRICTION COST FUNCTION - LATIN AMERICA 1996-2014.
(Dependent variable: bilateral trade flows per year x_{ijt})

Variable	OLS (1)	OLSfe (2)	OLSre (3)	Hausman-Taylor (4)
$\ln(y_{it})$	0.372***	0.501***	0.372***	0.480***
	(16.69)	(23.09)	(26.97)	(23.11)
$\ln(y_{jt})$	0.437***	0.535***	0.437***	0.525***
	(23.25)	(26.37)	(34.76)	(27.14)
$\ln(g_{ijt})$	-0.155***	0.00249	-0.155***	-0.0243
	(-7.29)	(0.16)	(-11.76)	(-1.63)
$\ln(d_{ij}^{G})$	-1.735***	0	-1.735***	-1.753***
	(-20.13)	(.)	(-19.12)	(-7.96)
c_{ij}	0.817*	0	0.817*	0.935
	(3.59)	(.)	(2.48)	(1.47)
s_{ij}	0.644***	0	0.644***	1.070***
	(6.38)	(.)	(6.93)	(5.82)
$\ln(m_{ijt})$	0.769***	0.0217	0.769***	0.294***
	(17.90)	(0.51)	(27.18)	(7.96)
$\ln(f_{jt})$	0.639***	0.366***	0.639***	0.341***
	(8.32)	(6.81)	(12.84)	(6.57)
u_{ijt}	1.210***	1.269**	1.210**	1.235**

Variable	OLS (1)	OLSfe (2)	OLSre (3)	Hausman-Taylor (4)
q_{it}	(7.56) 0.835***	(3.17) 0.877***	(3.12) 0.835***	(3.19) 0.907***
q_{jt}	(12.10) 0.806***	(12.57) 0.358***	(18.02) 0.806***	(15.40) 0.613***
$\ln\left(d_{ijt}^{I}\right)$	(13.83) -0.0266	(6.12) -0.0314	(20.61) -0.0266	(12.38) -0.0243
l_{ij}	(-0.90) 0.680***	(-1.51) 0	(-1.48) 0.680***	(-1.25) 0.432
r_{ij}	(4.60) 0.243*	(.) 0	(4.36) 0.243*	(1.36) 0.528*
h_{ij}	(2.20) 1.716***	(.) 0	(2.28) 1.716***	(2.49) 2.860**
nafta	(5.23) 1.423***	(.) 0	(3.32) 1.423	(2.86) 1.951
mercosur	(6.59) 0.163	(.) -0.143	(0.96) 0.163	(0.68) -0.0951
mcca	(0.65) 0.486	(-0.21) 0	(0.34) 0.486	(-0.16) 0.0244
can	(1.55) 0.728*	(.) 0.690**	(0.93) 0.728**	(0.02) 0.778**
α_0	(2.06) -5.992***	(2.75) -15.72***	(3.14) -5.992***	(3.25) -4.482*
	(-6.47)	(-28.57)	(-6.74)	(-2.12)
sigma_u	2.043	3.479	2.043	4.106
sigma_e	1.331	1.331	1.331	1.331
rho	0.702	0.872	0.702	0.905
Adj R-squared		0.192		
F		646.3		442.7
Observations	32372	32372	32372	32372

t-statistic in parentheses. * p<0.05, ** p<0.01, *** p<0.001
Source: Results obtained from a database prepared by the authors from various sources (See Annex 3).

Table 1 describes the results estimated using a robust regression (column 1), taking into account the fixed effects (column 2), taking into account the random effects (column 3) and, finally, because the sample contains variables that are kept constant within the panel, it is recommended to use the Hausman-Taylor estimators (1981), where it is specified that the variables d_{ij}^{G}, c_{ij}, s_{ij}, l_{ij}, r_{ij}, h_{ij} and u_{ij} are constant within the panel. The results of the regression analysis on equation 3 show that the cultural distance variable d_{ijt}^{C} absorbs the effects of variables such as Common Currency u_{ijt} and common history h_{ij} (Yeyati 2003). For this reason, these last two variables have been maintained and it has been decided to leave cultural distance out of the analysis.

Column 1 shows the estimators of equation 2, in a robust regression, where we can observe that the cultural barriers are significant enough, both the language dummy l_{ij} and the common history h_{ij}. The institutional distance, one could say, would

be expected to be significant; however, due to the similarity of the Latin American countries, as it is a region with very similar cultural characteristics in this study, it can be concluded that these are acceptable coefficients.

Columns 2 and 3 show the coefficients of the regressions with fixed effects and random effects. In column 2 we can see that the coefficients of the variables that are practically invariant over time are eliminated and variables such as the difference in GDP per capita g_{ijt} and the variable m_{ijt}, which defines whether there is a good communication infrastructure between countries, lose significance, and also that the institutional distance remains insignificant. In column 3, the random effects estimators are very similar to the estimators of the robust regression in column 1, unlike the common currency dummy variable u_{ijt}, which loses significance in the model.

In column 4 we observe the results of the Hausman-Taylor estimators, which is the most robust estimate when taking into account variability. We can see how the economic size represented by the gross domestic products of countries i and j, respectively, in each time period t, has a clear positive effect on bilateral trade. The absolute difference in per capita income between countries i and j seems to have a negative effect, although of little magnitude and not significant, which would show a lower sensitivity of trade in Latin American countries to differences in productive specialization associated with the different degrees of development of the countries, and a greater degree of complementarity in trade could be behind this result. Among the tangible barriers, the geographical barriers, distance $\left(d_{ij}^{G}\right)$ has a clear negative effect on bilateral trade, while having a common border, c_{ij} does not seem to have a significant effect. This result could be countered by the level of technology represented by the communication infrastructure between each pair of countries (m_{ijt}), with a clear positive effect, and having a common maritime space s_{ij}. The second subgroup of tangible barriers are those of an administrative nature. The index of import barriers (f_{jt}) has a clear positive effect on bilateral trade, while using the same currency in trade relations also has a positive, although less significant, effect on bilateral trade.

Intangible trade barriers are controlled by institutional barriers and cultural barriers. Institutional barriers, q_{it}, q_{jt}, which represent an arithmetic average of six governance indicators calculated by the World Bank for the exporting country and for the importing country, have a clear positive effect on bilateral trade, being almost fifty percent higher in the case of the exporting country, which could be interpreted as meaning that importers prioritize the institutional security of the countries where they sell their products, even when coming from countries with poorer governance. This statement is reinforced by observing the coefficient of the difference in institutional quality between the two countries where bilateral trade takes place $\left(d_{ijt}^{I}\right)$, which, as theoretically expected, does have a negative and statistically significant relationship for the trade of the countries. However, the effect is very low, which would also show that importing companies establish commercial relations with exporting companies and do not pay as much attention to the institutional conditions of the country of origin of the merchandise. Regarding cultural barriers, common language has a

clear positive but non-significant effect, while having a common religion (r_{ij}) and a common history (h_{ij}) have a statistically significant but low effect. When including the effects of the RTAs, we observe that of the four trade agreements only the Andean Community – CAN – has a positive and significant effect, while NAFTA and MCCA have positive but not statistically significant effects and MERCOSUR has a negative and not significant effect.

Now, let us move on to a more specific analysis, reviewing the individual effects by type of trade barriers, as defined in this paper theoretically, with the aim of avoiding that some effects can be offset by others due to multicollinearity problems. Table 2 shows the effects that the barriers have on the level of trade of Latin American countries with the rest of the world. In columns 1 and 2 we can observe the estimators that result from the regression assuming that only Tangible Barriers exist as independent variables, by their sub-groups, Geographic and Administrative Barriers, and in column 5 as a single group. Similarly, in columns 3 and 4 the estimators resulting from the model are detailed, taking into account this time only the Intangible Barriers as independent variables by their sub-groups Institutional and Cultural Barriers, and in column 6 as a group, while in column 7 the estimators resulting from the Hausman-Taylor regression with both the tangible barriers and the intangible barriers as explanatory variables of the trade flow in the region.

TABLE 2

HAUSMAN-TAYLOR ESTIMATORS BY TYPE OF BARRIERS TRADE FRICTION COST FUNCTION - LATIN AMERICA
(Dependent variable: bilateral trade flows per year x_{ijt})

Variable	Tangible barriers		Intangible barriers		Tangible barriers	Intangible barriers	Trade barriers
	Geographical (1)	Administrative (2)	Institutional (3)	Cultural (4)	(5)	(6)	(7)
$\ln(y_{it})$	0.480***	0.528***	0.580***	0.472***	0.445***	0.552***	0.480***
	(25.27)	(36.79)	(45.46)	(24.85)	(22.38)	(28.89)	(23.11)
$\ln(y_{jt})$	0.544***	0.474***	0.536***	0.590***	0.535***	0.545***	0.525***
	(32.86)	(36.65)	(48.37)	(32.14)	(30.50)	(30.04)	(27.14)
$\ln(g_{ijt})$	-0.0113	-0.128***	-0.168***	0.0203	-0.0216	0.0120	-0.0243
	(-0.85)	(-9.87)	(-13.88)	(1.40)	(-1.57)	(0.82)	(-1.63)
$\ln(a_{ij}^{G})$	-3.099***				-2.475***		-1.753***
	(-10.85)				(-13.32)		(-7.96)
c_{ij}	-1.279				-0.347		0.935
	(-1.66)				(-0.51)		(1.47)
s_{ij}	1.109***				1.343***		1.070***
	(5.73)				(7.10)		(5.82)
$\ln(m_{ijt})$	0.256***				0.298***		0.294***
	(7.50)				(8.85)		(7.96)
$\ln(f_{jt})$		0.559***			0.238***		0.341***
		(11.90)			(4.99)		(6.57)

Variable	Tangible barriers		Intangible barriers		Tangible barriers (5)	Intangible barriers (6)	Trade barriers (7)
	Geographical (1)	Administrative (2)	Institutional (3)	Cultural (4)			
u_{ijt}		1.187***			0.744*		1.235**
		(3.61)			(2.28)		(3.19)
q_{it}			0.986***			0.796***	0.907***
			(21.79)			(13.62)	(15.40)
q_{jt}			0.779***			0.568***	0.613***
			(21.23)			(11.97)	(12.38)
$\ln\left(d^{I}_{ijt}\right)$			-0.0227			-0.0570**	-0.0243
			(-1.31)			(-3.00)	(-1.25)
l_{ij}				2.025***		2.113***	0.432
				(6.98)		(7.46)	(1.36)
r_{ij}				2.009***		1.705***	0.528*
				(9.23)		(8.00)	(2.49)
h_{ij}				2.110		1.684	2.860**
				(1.89)		(1.56)	(2.86)
nafta	2.584	7.111***	5.338***	5.229	2.658	4.426	1.951
	(1.16)	(4.64)	(4.01)	(1.60)	(1.21)	(1.40)	(0.68)
mercosur	-0.473	1.900***	2.417***	0.330	-0.329	0.616	-0.0951
	(-0.78)	(3.53)	(4.68)	(0.54)	(-0.55)	(1.01)	(-0.16)
mcca	-2.975*	5.923***	6.568***	4.152***	-1.783	4.489***	0.0244
	(-2.47)	(8.62)	(11.00)	(3.92)	(-1.63)	(4.36)	(0.02)
can	1.082***	1.117***	1.115***	1.123***	1.055***	0.832***	0.778**
	(4.52)	(4.76)	(4.70)	(4.58)	(4.51)	(3.40)	(3.25)
α_0	9.401***	-14.52***	-14.87***	-16.82***	3.405	-17.57***	-4.482*
	(3.40)	(-40.79)	(-44.46)	(-43.12)	(1.91)	(-44.70)	(-2.12)
sigma_u	4.491	3.007	2.592	4.681	4.420	4.544	4.106
sigma_e	1.331	1.302	1.328	1.366	1.302	1.360	1.331
rho	0.919	0.842	0.792	0.922	0.920	0.918	0.905
Adj R-squared							
F	835.0			779.9	666.7	624.3	442.7
Observaciones	39962	35705	39821	35676	35580	35456	32372

t-statistic in parentheses. * p<0.05, ** p<0.01, *** p<0.001.
Source: Results obtained from a database prepared by the authors from various sources (See Annex 3).

The above results are corroborated in Table 2, which gives robustness to the aggregate analysis. The main differences we find are the following. The difference in GDP per capita between exporters and importers only has a significant and negative effect when we analyse only the tangible administrative barriers. Continuing with the tangible barriers, having a common currency has a positive effect that, although its significance decreases, remains statistically significant in its effect on bilateral trade. On the other hand, the level of governance seems to equalise in both countries as factors that promote international trade, but the differences in governance between countries

seem to continue to have a very low negative effect. Another interesting aspect is observed in the variables common language and a common religion, which seem to have a clearer positive effect on bilateral trade, but which cease to be significant in the second case when all the variables are taken into account, in particular distance, with which they have a high correlation; which means that, when these three variables are taken into account, distance absorbs the positive effect of the two cultural variables, reducing its effect from -3.099 in estimation 1, where only distance is taken into account, to -1.753 in estimation 7, where all three barriers are taken into account simultaneously. The common history, on the other hand, apparently recovers its effect when the effects of common language and common religion are absorbed, and in estimation 7 it has a positive and significant effect.

Regarding integration agreements (RTAs), the greatest effect on bilateral trade is observed when only administrative barriers are included, which are significant in all integration agreements. To a lesser extent, this occurs when only institutional barriers are taken into account. However, when we consider only geographical barriers, distance seems to absorb the effect of all integration agreements except in the case of the CAN. When all trade barriers are included, this effect remains significant only for the CAN. These results show that the greatest achievement of integration agreements is associated with the elimination of geographical barriers, allowing countries that are closer to each other to have greater possibilities of trading. However, in the case of the CAN, it would seem that there are other additional factors that have positively affected the trade of its countries with the rest of the world.

5. CONCLUSIONS

This research has aimed to examine the effects of tangible and intangible barriers on bilateral trade between Latin American countries and the rest of the world during the period 1996-2014, using a cost function based on the Gravity Trade Model to measure the friction that the barriers represent in the commercial activity of these countries.

The barriers that occur in international trade and that generate friction with negative effects on it can be classified into two groups: some barriers are considered tangible, due to their characteristic of being observable and quantifiable due to the cost they generate; the other barriers are considered intangible, as they are not easily observable and difficult to quantify. The tangible barriers are the geographic barriers and the administrative barriers, while the intangible barriers are the institutional barriers and the cultural barriers.

Geographic barriers include the distance between countries, the sharing of a common border, or a maritime connection that facilitates or hinders trade between them, and their communication infrastructure. Administrative barriers include, for example, the commercial openness of a country through a ranking, or the fact that

countries use the same type of currency, which would facilitate trade as it would not be influenced by the exchange rate.

Institutional barriers have to do with the levels of governance that exist within countries and whether there is a difference between them, which would make trade difficult. Finally, we have cultural barriers, which are evident when countries have a different type of language, a different type of religion, or a different colonial history, which also affects the differences that may arise between countries with respect to their social norms and values that they practice. On the other hand, the signing of integration agreements between groups of countries, in theory, allows the elimination of multiple barriers to trade, both tangible and intangible, leading to increases in bilateral trade between the countries that are part of the agreement.

In order to empirically analyze the effect of tangible and intangible barriers to trade, a gravity model of trade has been chosen because it is the analysis tool frequently used following the pioneering contributions of Tinbergen (1962) and Linnemann (1966). Subsequently, as reviewed, there are studies by Bergstrand (1985) (1989), Bröcker and Rohweder (1990), Montenegro and Soto (1996), Martinez-Zarzoso (2003), Carrillo-Tudela and Li (2004), Klagges (2007) and Abedini (2015) who explore trade flows within the world's trade blocs and identify their determinants; therefore, the gravity model will help to estimate the effects of friction costs on international trade flows.

The main results obtained through the Hausman-Taylor estimators allow us to affirm that, when considering all the barriers together, the tangible barriers tend to be more significant than the intangible barriers, confirming the first part of the hypothesis raised in this thesis. The economic size represented by the gross domestic products of countries i and j, respectively, in each period t, has a clear positive effect on bilateral trade. The absolute difference in per capita income between countries i and j has a negative effect of little magnitude and is not significant, which shows a low sensitivity of trade in Latin American countries to differences in productive specialization associated with the different degrees of development of the countries.

Among the tangible barriers, the geographical barriers, distance has a clear negative effect on bilateral trade, while having a common border, does not seem to have a significant effect; a result that is counterbalanced by the level of technology represented by the communication infrastructure between each pair of countries which has a clear positive effect, and having a common maritime space. As for the tangible administrative barriers, the index of import obstacles has a positive effect on bilateral trade, just as using the same currency in trade relations also has a positive effect although less significant.

Intangible trade barriers have had a smaller effect on bilateral trade between Latin American countries and with the rest of the world, but it has nevertheless been significant and therefore needs to be mentioned. Institutional barriers which represent an average of six governance indicators for the exporting country and the importing country, have a clear positive effect on bilateral trade, being almost fifty percent higher in the case of the exporting country, which could be interpreted as meaning

that importers prioritize the institutional security of the countries where they sell their products. This statement is reinforced by observing the coefficient of the difference in institutional quality between the two countries where bilateral trade takes place, which has a negative and statistically significant relationship for the countries' trade; However, its effect is very low. Regarding intangible cultural barriers, the common language has a clear positive but not significant effect, while having a common religion and a common history have a statistically significant but low effect.

Finally, the inclusion of trade agreements through dummy variables allows us to determine that, of the four trade agreements, only the Andean Community – CAN – has a positive and significant effect, while NAFTA and MCCA have positive but not statistically significant effects, and MERCOSUR has a negative and not significant effect; this is because its effects have been absorbed by geographical and cultural barriers.

In this work we have been able to determine and analyze each of the barriers that are present in international trade for Latin America, in addition to defining what their effects are on trade; on the other hand, we were also able to know the effects of the RTAs that exist in Latin American countries in this friction cost model.

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ANNEXES

ANNEX 1

THE LATIN AMERICAN COUNTRIES INCLUDED IN THE STUDY, PLUS THE UNITED STATES

TABLE 3 LIST OF LATIN AMERICAN COUNTRIES

ISO code 3166 numeric	Country
32	Argentina
68	Bolivia
76	Brazil
124	Canada
152	Chile
170	Colombia
188	Costa Rica
218	Ecuador
222	El Salvador
320	Guatemala
340	Honduras
484	Mexico
558	Nicaragua
591	Panama
600	Paraguay
604	Peru
840	USA
858	Uruguay
862	Venezuela

Source: Country codes under study in database prepared by the author from various sources (See Annex 3).

ANNEX 2

GROUP AND SUBGROUPS OF BARRIERS

TABLE 4 BARRIER GROUPS AND SUBGROUPS

Barriers		Variable	Description
Tangibles	Geographical	d_{ij}^{G}	Spacial distance
		c_{ij}	Common frontier
		s_{ij}	Maritime connection
		m_{ijt}	Communication Infrastructure
	Administrative	f_{jt}	ranking heritage
		u_{ijt}	same currency
	Institutional	q_{it}	average 6 indicators governance in country *i*
		q_{jt}	average 6 indicators governance in country *j*
		d_{ijt}^{I}	institutional quality difference
Intangibles	Cultural	l_{ij}	same language
		r_{ij}	same religion
		h_{ij}	same colonial history
		d_{ijt}^{C}	Cultural difference social norms values

Source: Country codes under study in database prepared by the author from various sources (See Annex 3).

ANNEX 3

SOURCES AND DETAILS OF VARIABLES

TABLE 3: SOURCES AND DETAILS OF VARIABLES

Variable	Description	Source
$\ln(x_{ijt})$	Total exports of the country *i* to *j* in year *t*	UN Comtrade database http://comtrade.un.org/data/
$\ln(y_{it})$	GDP of country *i* in year *t*	World Development Indicators, World Bank - GDP and GDP per cápita (current LCU) http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#
$\ln(y_{jt})$	GDP of country *j* in year *t*	World Development Indicators, World Bank - GDP and GDP per cápita (current LCU) http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#
$\ln(g_{ijt})$	Difference in GDP per capita between countries *i* and *j* in year *t*	World Development Indicators, World Bank - GDP and GDP per cápita (current LCU) http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#

Variable	Description	Source
$\ln\left(d_{ij}^{G}\right)$	Spatial distance between the country *i* and *j*	CEPII, DIST database http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6
c_{ij}	Common border between *i and j*	CEPII, DIST database http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6
s_{ij}	Maritime connection between *i and j*	Access to the Pacific and Atlantic Oceans, Own elaboration
$\ln\left(m_{ijt}\right)$	Infrastructure Communication between *i and j* in year *t*	World Development Indicators, World Bank - the minimum number of fixed telephone lines http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators
$\ln\left(f_{jt}\right)$	Ranking Heritage from country *j* in year *t*	Heritage Foundation, trade freedom database http://www.heritage.org/index/explore?view=by-region-country-year
u_{ijt}	Same Currency between *i and j* in year *t*	de Sousa, J. (2012), "The currency union effect on trade is decreasing over time", Economics Letters http://dx.doi.org/10.1016/j.econlet.2012.07.009 http://jdesousa.univ.free.fr/data.htm
q_{it}	Average of 6 country governance indicators *i* in year *t*	Worldwide Governance Indicators, World Bank http://databank.worldbank.org/data/reports.aspx?source=worldwide-governance-indicators
q_{jt}	Average of 6 country governance indicators *j* in year *t*	Worldwide Governance Indicators, World Bank http://databank.worldbank.org/data/reports.aspx?source=worldwide-governance-indicators
$\ln\left(d_{ijt}^{I}\right)$	Difference in Institutional Quality between *i and j* in year *t*	Worldwide Governance Indicators, World Bank http://databank.worldbank.org/data/reports.aspx?source=worldwide-governance-indicators
l_{ij}	Same Language between *i and j*	CEPII, DIST database http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6
r_{ij}	Same Religion between *i and j*	Association of Religion Data Archieves http://www.thearda.com/Archive/Files/Downloads/ECON11_DL.asp
h_{ij}	Same History or Colony between *i and j*	CEPII, DIST database http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6
$\ln\left(d_{ijt}^{C}\right)$	Similarity in Social Norms and Values between *i and j* in year *t*	World Value Survey, Data and Documentation http://www.worldvaluessurvey.org/WVSDocumentationWVL.jsp

Source: Sources of the variables used in the database prepared by the author (See Annex 3).

ANNEX 4

DESCRIPTIVE STATISTICS, CORRELATION AND COLLINEARITY

TABLE 4: DESCRIPTIVE STATISTICS, CORRELATION AND COLLINEARITY

Variable	Median	Standar Deviation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	VIF
1.$\ln(x_{it})$	14.76	3.61	1.00																				
2. $\ln(y_{it})$	28.11	2.75	0.18	1.00																			0.39
3. $\ln(y_{jt})$	26.69	3.29	0.22	-0.01	1.00																		0.40
4. $\ln(g_{ijt})$	11.96	2.78	-0.03	0.55	0.46	1.00																	0.31
5. $\ln(d_{ij}^{G})$	8.92	0.76	-0.20	0.11	0.24	0.10	1.00																0.34
6. c_{ij}	0.03	0.16	0.21	-0.02	0.04	-0.00	-0.43	1.00															0.61
7. s_{ij}	0.44	0.50	0.21	0.02	-0.03	-0.08	-0.21	0.07	1.00														0.83
8. $\ln(m_{ijt})$	15.98	1.51	0.55	0.32	0.20	-0.05	0.22	-0.01	0.14	1.00													0.57
9. $\ln(f_{jt})$	4.22	0.27	0.15	0.03	0.08	0.05	0.07	0.01	0.00	0.06	1.00												0.79
10.u_{ijt}	0.00	0.07	0.04	-0.03	-0.08	-0.05	-0.08	-0.01	0.03	0.02	-0.09	1.00											0.98
11.q_{it}	0.15	0.80	0.25	0.29	-0.06	0.07	0.10	-0.06	0.07	0.40	-0.06	0.03	1.00										0.86
12.q_{jt}	0.08	0.92	0.15	-0.08	-0.17	-0.08	-0.02	-0.05	0.11	0.02	0.38	0.02	-0.08	1.00									0.66
13.$\ln(d_{ijt}^{I})$	0.01	1.25	0.02	0.10	0.03	0.08	0.19	-0.13	-0.05	0.17	0.02	0.01	0.20	0.07	1.00								0.86
14.l_{ij}	0.21	0.41	0.26	-0.02	-0.03	-0.05	-0.46	0.20	0.15	0.05	-0.00	0.07	0.17	-0.10	-0.11	1.00							0.52
15.r_{ij}	0.37	0.48	0.19	-0.04	-0.10	-0.07	-0.42	0.18	0.12	-0.05	0.15	0.01	-0.04	0.11	-0.07	0.42	1.00						0.69
16.h_{ij}	0.01	0.10	0.12	-0.00	0.00	-0.05	0.02	-0.02	0.05	0.09	0.07	-0.01	0.01	0.10	0.01	0.19	0.10	1.00					0.90
17. ***nafta***	0.00	0.04	0.09	0.02	0.03	-0.04	-0.07	0.12	0.04	0.06	0.03	-0.00	0.04	0.03	0.01	0.03	0.04	-0.00	1.00				0.98
18. ***mercosur***	0.00	0.07	0.10	0.01	0.04	0.04	-0.19	0.36	0.01	0.02	-0.00	-0.00	-0.02	-0.02	-0.03	0.05	0.11	-0.01	-0.00	1.00			0.81
19. ***mcca***	0.01	0.09	0.09	-0.06	-0.02	-0.03	-0.36	0.27	0.10	-0.12	0.03	-0.01	-0.04	-0.03	-0.10	0.18	0.05	-0.01	-0.00	-0.01	1.00		0.76
20. ***can***	0.01	0.08	0.09	-0.03	0.01	-0.02	-0.18	0.28	-0.00	-0.03	-0.00	-0.01	-0.07	-0.06	-0.10	0.17	0.12	-0.01	-0.00	-0.01	-0.01	1.00	0.86

Source: Results obtained from a database prepared by the author from various sources (See Annex 3)