HAS WTO MEMBERSHIP PROMOTED TRADE SINCE ITS FOUNDATION?

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RESUMO

Este trabalho estima os impactos da OMC sobres os fluxos de comércio desagregados estimando o modelo gravitacional por meio do estimador de Pseudo Máxima Verossimilhança de Poisson e efeitos fixos. A amostra inclui importações bilaterais de 133 países nos setores primário, têxtil e manufatureiro para o período 1995-2014. As estimativas sugerem que a OMC conseguiu expandir o comércio internacional, o que difere de alguns resultados da literatura anterior. No entanto, esse crescimento ocorreu de maneira assimétrica entre os países desenvolvidos e em desenvolvimento, membros e não membros. No período em análise, os países desenvolvidos foram os que mais se beneficiaram do aumento do comércio mundial promovido pela OMC, semelhante aos resultados da literatura existente para o período 1950-2000. Embora os países desenvolvidos também tenham tido seus fluxos de comércio expandidos pela OMC nos setores têxtil e industrial, o maior crescimento ocorreu no setor primário, o que diverge de estudos anteriores. Da mesma forma, a abertura multilateral dos países em desenvolvimento impulsionou o crescimento do comércio apenas em produtos primários e industriais, mas em menor escala do que os países desenvolvidos. Finalmente, a significância estatística dos coeficientes estimados é sensível à estrutura do cluster utilizada.

Palavras-chave: Comércio Internacional; Organização Mundial de Comércio; Modelo Gravitacional.
Códigos JEL: F1, C23, C21.

ABSTRACT

This paper provides new evidences on the impact of the WTO on disaggregated trade flows using a gravity model estimated by the Pseudo Maximum Likelihood of Poisson (PPML) estimator and fixed effects. The sample includes bilateral imports from 133 countries in the primary, textile and manufacturing sectors for the period 1995-2014. Results suggest that the WTO has succeeded in expanding international trade, which differs from the results of the previous literature. However, this growth occurred asymmetrically between the developed and developing countries, members and non-members. In the period under review, developed countries benefited most from the increase in world trade promoted by the WTO, similar to the findings of the extant literature for the period 1950-2000. Although developed nations also had their trade flows expanded by the WTO in the textile and industrial sectors, the largest growth occurred in the primary sector, which is at odds with the literature. Similarly, the multilateral liberalization of developing countries has boosted trade growth only in primary and industrial products, but to a lesser extent than developed nations. Finally, the statistical significance of the estimated coefficients is sensitive to the cluster structure used.

Keywords: International Trade; World Trade Organization; Gravity Model.
JEL classification: F1, C23, C21.

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1. Introduction

The world trade system that emerged after World War II was regulated by the General Agreement on Tariffs and Trade (GATT) that was signed by 23 nations in 1947 and entered into effect in 1948. This agreement fostered several negotiation rounds that aimed to reduce trade barriers among GATT-member nations. The last completed round of negotiations was the Uruguay Round in 1994. Chief among its outcomes was the creation of the World Trade Organization (WTO). Since its foundation in 1995, the WTO brought changes to the world trade system, and at the same time, several countries have applied to become members. Currently, the WTO has over 164 members who account for 98 percent of world trade[4], and there are 20 countries interested in becoming members (WTO, 2019).

Such an interest in the WTO membership prompts the question of whether this membership promotes trade or not. The seminal work empirical of Rose (2004) utilized the gravity equation to estimate how much more GATT/WTO members traded relative to non-members. His results indicated that the GATT/WTO had not promoted trade among its members. This counter-intuitive result to many observers sparked an intense debate about the impact of these institutions on trade. Several studies also based upon the gravity equation contested Rose's results on the grounds of sample selection, econometric misspecification, and measurement error.

Roy (2011) also reached the same result and argued that the impact of the WTO on trade remains undefined, partly because of the failure of previous studies to address three aspects simultaneously: the inclusion of zero trade flows in the sample, to adequately control multilateral resistance and to appropriately define the members of the institution. Eicher and Henn (2011) also found no positive effects on world trade that could be attributed to these institutions even after correcting the omitted variable bias on two fronts: by including individual effects for the Preferred Trade Agreements (PTAs) and by multilateral resistance controls and unobserved bilateral heterogeneity. On the other hand, several authors have estimated a positive effect of the WTO on trade flows—see Tomz et al (2007), Subramanian and Wei (2007), Chang and Lee (2011) and Dutt et al (2013). To this date, the evidence on the effects of the WTO remains mixed.

The effect of WTO in international trade is crucial in a moment that multilateral negotiations (Doha Round) are paralyzed. And at the same time, countries are engaging in regional trade agreement negotiations, which may or may not be stumbling blocks towards multilateral liberalization. In this way, this paper contributes to the literature by providing new estimates of the effects of the WTO membership on trade flows specifically for the period between 1995 and 2014. To do so, we employ a gravity equation model that incorporates the most recent methodological and econometric advances by Santos Silva and Tenreyro (2006), Roy (2011), Eicher and Henn (2011) and Larch et al (2017). These innovations consist of using PPML estimator with fixed effects, zero trade observations, disaggregated trade flows at the product level, and multi-level standard error clustering.

Our results indicate that the WTO had no impact on total trade, for both developed and developing countries, confirming the estimates by Rose (2004) and Roy (2011), but in a more recent period (1995-2014). However, by analyzing sectoral trade flows, we find that the impacts of the WTO on trade are asymmetric between the developed and developing countries, members and non-members. In fact, they are positive and significant for trade in primary and textiles products, strongly differing from the estimates of Subramanian and Wei (2007). Thus, it shows the importance of using disaggregated trade data to make inferences about the impact of Regional and Multilateral liberalization on trade.

The remainder of this paper was organized as follows. Section 2 describes the empirical evidence of the effects of the WTO on trade. Section 3 presents the gravitational model. Section 4 describes the data, as well as the econometric methodology employed in this paper. Section 5 presents and discusses the results and section 6 concludes.

2. Empirical Evidence of the WTO impacts on the international trade flows

The first study to investigate the effects of GATT/WTO membership on trade volume was Rose (2004). He used panel and cross-sectional data and estimated the gravity equation using ordinary least squares (OLS) and fixed effects (FE) estimators. The fixed effects where at the country and year levels. The period analyzed was from

[4] In 1995, WTO members accounted for 88 per cent of world merchandise trade.

1950 to 1998 and the sample included 175 countries. Surprisingly, Rose (2004) found that the GATT/WTO membership had no effect on the increase in total trade volume among countries, where total trade flow means trade volume across all goods. Subsequently, reviewing his own article, Rose (2005) did find a positive impact of GATT/WTO membership on trade volume in empirical specifications that controlled for membership in Regional Trade Agreements (RTAs).

This result from Rose (2004) was deemed counter-intuitive by many observers. Accordingly, several researchers have been further scrutinizing it. Tomz et al (2007) highlighted that the GATT/WTO membership definition used by Rose (2004) was a *de jure* and not a *de facto* definition. This distinction is important because several former colonies enjoyed the GATT/WTO membership of their former colonizers. Once using a *de facto* measure of GATT/WTO membership, Tomz et al (2007) did find a positive effect of GATT/WTO membership on total trade flows using both a similar econometric approach to that employed by Rose (2004) and a specification using country-pair fixed effects.

Subramanian and Wei (2007) took a different route and focused on whether GATT/WTO membership effects were heterogeneous across types of goods and countries. These effects are likely to be different across types of goods because non-manufacturing and textiles goods were not part of the GATT liberalization process. The rationale for the second type of heterogeneity is that industrial countries would have benefited more because they participated more actively than the developing countries in the reciprocal trade negotiations. Also, bilateral trade was greater when both partners committed to liberalization when compared to a situation where only one partner effectively liberalized its economy. The dataset used by Subramanian and Wei (2007) excluded observations with import values of less than US$ 500,000. Their findings contradicted the results of Rose (2004) by providing evidence that the WTO generated an additional impact of about 120 percent in world trade in the year 2000, for instance.

The ensuing literature has continued to scrutinize these results. Many researchers decompose the changes in trade volume into two margins of adjustment. The first is the extensive margin, in which a country or does not trade with another country. Given that a pair of countries is trading a positive volume with each other, the intensive margin is the change in this volume of trade. Liu (2009) suggests that the GATT/WTO has not only fostered trade among members that already traded with each other (intensive margin), but also created new trade relationships among its members (extensive margin). Liu (2009) also points out that most of the literature studies that exclude zero trade observations simply ignore the extensive margin. Hence, the estimates effects of the GATT/WTO membership will be biased. He further argues that because of the violation of some assumptions, traditional log-linear regressions of gravity cannot uncover the role of the GATT/WTO even at the intensive margin. Liu (2009) estimated the gravitational model using three estimators: OLS (using a specification with a logarithmic transformation in the dependent variable and another considering only positive trade flows), Tobit, and the Poisson pseudo maximum likelihood (PPML). The last two estimators in different ways account for the zero trade flows. The sample used encompasses 210 countries over the years 1948-2003. His results imply that GATT/WTO members traded 60 percent more on average than non-members.

Roy (2011) makes the point that the previous studies failed to address several econometric issues. Roy (2011) address these issues by including zero-trade observations in the sample, controlling for multilateral resistance terms, and using an appropriate definition of GATT/WTO membership. Roy (2011) employed Liu (2009)'s data from 1950 to 2000, and included zero trade flows. Differently from previous studies that employed annual data, Roy (2011) used five-year interval data. Another difference is the use of two transformations of the dependent variable to address the zero trade flows. Let m_{ijt} be the imports of country *i* from country *j*, at time *t*. The first transformed dependent variable is $(1 + m_{ijt})$ and the second is $(m_{ijt} + \sqrt[2]{{m_{ijt}}^2 + 1})$. Roy (2011) estimates provide evidence that the GATT/WTO membership did not promote trade.

Eicher and Henn (2011) employed data from Subramanian and Wei (2007) and used the econometric specifications of Rose (2004) and Tomz et al (2007). They found that the GATT/WTO effects on trade flows are not statistically significant, whereas RTA membership had a strong but uneven effect on the trade. Additionally, by modifying the econometric model to estimate the possible channels in which the WTO may have affected trade flows, the estimates suggest that accession to the GATT/WTO membership increased trade not only prior to the formation of RTAs, but also trade among the geographically closest developing countries at the expense of trade with more distant countries. In addition, they showed that the countries with the greatest incentives to

negotiate tariff reductions during the WTO accession negotiations are those that experienced positive and significant trade effects of GATT/WTO membership on their trade flows.

Dutt et al (2013) employed 6-digit HS bilateral trade data for 190 exporters and 168 importers in the period 1988-2006 to further examine the roles of the intensive and extensive margin using the two-part econometric model proposed by Helpman et al (2008). Their findings indicate that the impact of GATT/WTO membership takes place almost exclusively on the extensive margin of trade. More precisely, WTO accession is estimated to increase the extensive margin of exports by 25 percent, while at the same time, GATT/WTO membership has a negative impact on the intensive margin.

There are also two other papers that employed alternative econometric methodologies relative to that of the previously mentioned studies. Chang and Lee (2011) used non-parametric methods, including pair-matching, permutation tests, and a sensitivity analysis to assess the way the GATT/WTO affected trade flows. These methods allow for general forms of heterogeneous effects and their results suggest that the GATT/WTO has significantly expanded world trade and its estimates are robust to a number of restricted matching criteria, alternative GATT/WTO membership definitions, the non-random incidence of positive trade flows and the inclusion of multilateral terms of resistance. Figueiredo et al (2014) employed a censored quantile regression and a sample encompassing 194 countries over the years 1949-2006. The effects of the WTO are positive at the lower quartiles, positive at the median and negative at the upper quantiles. Moreover, WTO membership expands the mean trade flows by 9 percent and the median flow by approximately 6.3 percent. This, this means that WTO membership shift the trade flow distribution to increase trade.

Table 1 provides a summary of existing estimates of the effects of the WTO on trade. The database used in this article covers the period from 1995 to 2014 and is more recent than those used in previous studies. Thus, it comprises only the WTO period, therefore it cannot be used to measure the effects of the GATT on trade.

Table 1: Summary of the GATT/WTO effects on international trade flows

Authors	**GATT/WTO Effect**	**Period**
Rose (2004)	Zero	1950–1998
Rose (2005)	+	1950–1998
Tomz et al (2007)	+	1950–1998
Subramanian and Wei (2007)*	+	1950–2000
Liu (2009)	+	1948–2003
Roy (2011)	Zero	1950–2000
Eicher and Henn (2011)	Zero	1950–2000
Chang and Lee (2011)	+	1948–1999
Dutt et al (2013)*	+	1988–2006
Figueiredo et al (2014)*	+	1949–2006

Note: * Asymmetrical effects among WTO members and non-members, sectors or quantiles of the distribution.

This study now turns to discussion of the empirical methodology used to assess the effects of the WTO membership.

3. The Gravity Model

The gravity equation has been the workhorse of empirical trade economists interested in estimating the effects of multilateral and regional trade agreements (Limão, 2016). The idea behind the gravity equation - shown in Equation (1) - is that the imports (m_{ij}) of country i from country j is directly proportional to the size of their economies (Y_i and Y_j) and inversely proportional to the transportation cost (τ_{ij}) between them, usually proxied by physical distance.

$$m_{ij} = \alpha_0 \frac{Y_i^{\beta_1} Y_j^{\beta_2}}{\tau_{ij}^{\gamma}} \quad (1)$$

This model is typically estimated by regressing the log of imports on variables like exporter's and importer's GDP and log of distance between them. In the mid-1990s, estimates using this specification have come under fire due to its sensitivity to the sample of countries included in the analysis (Haveman and Hummels, 1998) and to the variables included in the estimated specification (Ghosh and Yamarik, 2004). In fact, Wei (1996), Deardorff (1998) and Anderson and van Wincoop (2003) argued that this traditional gravitational model may present specification problems by ignoring multilateral resistance to trade and remoteness of countries.

Anderson and van Wincoop (2003) were the first to provide a theoretical framework for the gravity equation that precisely depicted the role of multilateral resistance terms and showed that their omission from the estimated model leads to inconsistent estimates. Most important, these multilateral resistance terms are country specific and change over time. Without loss of generality, let's focus on a simplified version of the theoretical model proposed by Anderson and van Wincoop (2003):

$$m_{ij} = \frac{Y_i Y_j}{Y_w}\left(\frac{\tau_{ij}}{P_i P_j}\right)^{(1-\sigma)} \varepsilon_{ij} \qquad (2)$$

where Y_w is the world GDP, $(1-\sigma)$ is the elasticity of substitution, P_j is external multilateral resistance, which captures the fact that exports from country to country *i* depend on trade costs in all possible export markets, and finally, P_i is the internal multilateral resistance that captures the dependence of the country *j* of imports from country *i* on the commercial costs of all possible suppliers in the world. Taking the logarithm of Equation (2), we obtain a log-linearized version of the gravitational model as demonstrated by Equation (3).

$$\log m_{ij} = \log Y_i + \log Y_j - \log Y_w + (1-\sigma)\left[\log \tau_{ij} - \log P_i - \log P_j\right] + \log \varepsilon_{ij} \qquad (3)$$

Feenstra (2003) suggested the use of exporter and importer countries to address the effects of remoteness and isolation. These effects in panel data change over time (Baldwin and Taglioni, 2006; Magee, 2008). In this case, the importer-year (α_{it}) and exporter-year (α_{jt}) fixed effects will account for the control multilateral resistance and the isolation of countries terms. In addition, Magee (2008) argues that annual fixed effects for each importing and exporting country also control the effects of changes in GDP, per capita income, population, and other variables usually included in the gravitational model. This econometric specification is depicted by Equation (4).

$$\log m_{ijt} = \alpha_0 + \alpha_{it} + \alpha_{jt} + \boldsymbol{x}_{ijt}\boldsymbol{\beta} + \log \varepsilon_{ij} \qquad (4)$$

where α_0 is the common intercept to all years and country pairs (*ijt*), $\boldsymbol{x}_{ijt}$ is a 1×K vector of the explanatory variables of the model including those that will capture the effects of WTO membership on trade flows, and $\boldsymbol{\beta}$ is a K×1 vector of parameters of the variables to be estimated. In this case, the WTO indicator variables are identified by the within and between variation of country-pair imports over time. This means that these indicators will capture the average effects of WTO membership on the countries that were already members in 1995 and those experienced by countries that joined the WTO later.

This study follows Eicher and Henn's (2011) methodology to assess the effects of WTO membership on trade flows. The variables that capture the effects of the WTO membership are constructed according to Subramanian and Wei (2007), as also used by Eicher and Henn (2011). Subramanian and Wei (2007) created a single dummy variable to represent the preferential trade arrangements, separating its trade impacts from WTO membership.[5] Eicher and Henn (2011) stressed the need to account for the heterogeneous effects of RTAs, since many WTO members are also part of RTAs. To address this confounding effect, we control for the world's 24 most important RTAs. It should be noted that this number is well above the number of RTAs considered by Eicher and Henn (2011), which attenuates the omitted variable bias.[6]

[5] The variable *rta_wto* is a dummy that assumes the value of one if importer *i* is a member of an RTA and the WTO, but the exporter is a member of the WTO and non-member of this RTA, and zero otherwise. The variable *rta_nwto* is a dummy that taking the value of one if the importer *i* is a member of an RTA and the WTO, but the exporter is not member of the agreement and is non-member of the WTO, and zero otherwise.

[6] The analyzed blocks were as follows: Common Market for Eastern and South Africa (COMESA), Economic Community of West

Egger (2005) pointed out a relevant specification issue of Equation (4): the bilateral heterogeneity of the exporter and the importer. These country-pair characteristics - like similar legal system - are likely to affect bilateral trade flows and to bias estimates if left unaccounted. This issue can be addressed with the inclusion of country-pair fixed effects (α_{ij}) in Equation (4). According to Magee (2008), the fixed effect (α_{ij}) controls all observed and unobserved characteristics that are constant over time and influence trade flows. In this sense, this approach considers the possibility of natural trading partners, cultural and institutional aspects, as well as all other characteristics that are also not measurable that affect trade flows. In other words, these effects will absorb the effects of time-invariant country-pair variables like distance between countries adjacency, common currency, and common language indicators for instance.[7]

The inclusion of country-pair fixed effects into Equation (4) changes the interpretation of the estimated coefficients of the WTO variables. Now, these coefficients are identified only by the within country-pair variation over time. As a result, these estimated coefficients reflect the average effect of WTO membership enjoyed by the new members only. Moreover, the effects of WTO membership on countries that were already members at the start year of our sample will be absorbed by the country-pair effects. In light of these remarks, we will estimate specifications with and without country-pair effects.

On the other hand, there are two fundamental econometric issues with the log-linear specification like that in Equation (4). First, log-linearized models cannot deal with zero trade observations, since the natural logarithm of zero is not defined. These observations are usually dropped, or a transformation is applied to the dependent variable to make it positive. The most usual transformation adopted by the literature is to add one to all values of the dependent variable ($1 + m_{ijt}$), to take the logarithm of the data, as Eichengreen and Irwin (1995) suggested.

The second issue is the presence of heteroskedasticity since the expected value of the logarithm of the error ($\log \varepsilon_{ij}$) depends on the higher moments of ε_{ij}, including its variance. As Santos Silva and Tenreyro (2006) point out, it is very likely that a model with bilateral trade flows has a heteroskedastic error term. This means that the regressors will be correlated with the error term, and this renders the estimates biased and inconsistent. Note that this type of heteroskedasticity cannot be addressed simply by using a robust covariance matrix estimator because this form of heteroskedasticity biases the estimates of both coefficients and standard errors. Therefore, the presence of heteroskedasticity under the assumption of a multiplicative error term in the theoretical specification of the nonlinear gravitational model requires a completely different estimation methodology from the one that was being used by the traditional approach.

Santos Silva and Tenreyro (2006) proposed estimating the gravity model using the Poisson Pseudo Maximum Likelihood estimator because as long as the gravitational model is correctly specified, the PPML estimator will provide consistent parameter estimates even with heteroskedastic errors also provides a natural way to deal with zero values of the dependent variable. To compare the PPML performance relative to other estimators, Santos Silva and Tenreyro (2006) conducted several Monte Carlo simulations for the gravitational model estimated using the following estimators: OLS, Nonlinear Least Squares (NLS), Tobit, and PPML. They found that the PPML performance was considerably better and they considered it to be the most reliable. These results were corroborated by Magee (2008), Siliverstovs and Schumacher (2009), and Westerlund and Wilhelmsson (2009).

Nevertheless, the interpretation of the coefficients estimated by the PPML is direct and follows exactly the same pattern of the OLS estimator.[8] Moreover, according to Santos Silva and Tenreyro (2015), the HMR estimator is valid only under strong assumptions regarding the distribution assumed by Helpman et al (2008).

African States (ECOWAS), Southern African Development Community (SADC), European Union (EU), North American Free Trade Agreement (NAFTA), Southern Common Market (MERCOSUR), ASEAN Free Trade Area (AFTA), Arab Mediterranean Free Trade Agreement (AGADIR), The Australia New Zealand Closer Economic Agreement (ANZCERTA), Asia Pacific Trade Agreement (ARTA), Central American Common Market (CACM), Andean Community (CAN), Central European Free Trade Agreement (CEFTA), Common Economic Zone (CEZ), Commonwealth of Independent States (CIS), East African Community (EAC), Economic Cooperation Organization (ECO), European Free Trade Association (EFTA), Gulf Cooperation Council (GCC), Latin American Integration Association (LAIA), Pan-Arab Free Trade Area (PAFTA), Southern African Customs Union (SACU), South Asian Free Trade Agreement (SAFTA) e West African Economic and Monetary Union (WAEMU).

[7] Furthermore, Glick and Rose (2001) suggested the constraint that the country-pair fixed effects to be symmetric, that is, $\alpha_{ij} = \alpha_{ji}$ in order to reduce the number of estimated parameters.

[8] Although the dependent variable is specified in level, the coefficients of any independent variables, inserted in logarithm, can still be interpreted as semi-elasticities.

Specifically, the HMR estimator will only be valid if all the random components of the model are homoskedastic. However, Santos Silva and Tenreyro (2015) did statistical tests using the sample of Helpman et al (2008) and clearly rejected such assumptions and, furthermore, the authors performed numerical experiments which indicated that the HMR estimator is very sensitive to deviations from the homoscedasticity assumption. Thus, Santos Silva and Tenreyro (2015) posed doubts about any inference made, based on the empirical implementation of the HMR model.

An additional advantage of the PPML estimator is that it does not suffer from the incidental parameters problem (see Fernández-Val and Weidner, 2016), which is an important concern whenever fixed effects are used. In other words, the PPML allows for "differencing out" of the fixed effects, and this improves the computational speed and accuracy. A shortcoming of the PPML estimator is that its numerical implementation does not converge sometimes. This problem also affects several non-linear estimators and can be attenuated by re-scaling and centering variables. Since it is not clear whether the assumption about the conditional variance actually hold, to account fully heteroskedasticity it is recommended to make inferences based on the Eicker-White robust covariance matrix estimator. Because of all these arguments, we chose the PPML estimator.

4. Data and Empirical Methods

Our sample covers 133 countries for a period of 20 years from 1995 to 2014.[9] These nations represented, in terms of global trade, approximately 99% of total world imports for the period under review. Thus, this study contains 17,556 annual observations (133 importing countries × 132 bilateral import flows) and 351,120 observations for the whole period (17,556 pairs × 20 years). Dependent variables[10], imports of primary products, textiles, industrialized and total import, in millions of current US dollars, were obtained from UNCTADstat. The distance in kilometers was obtained from the CEPII[11], as well as the dummies of frontier, language and colonial relations. The dummies for the RTAs and the WTO were built by the authors themselves, based on the WTO official data (WTO, 2019).

In this paper, the gravitational model was specificity in four different ways. The first specification labeled PPML-Pair incorporates the fixed effects for each pair of countries. This model can be represented as follows:

$$m_{ijt} = \exp[\alpha_{ij} + \boldsymbol{x}_{ijt}\boldsymbol{\beta}] \times \varepsilon_{ijt}$$

where:

m_{ijt} is the scalar of imports from country *i* from exporter *j* at time *t*;
$\boldsymbol{x}_{ijt}$ is a vector line 1×K of the k variables explanatory of the model;
$\boldsymbol{\beta}$ is a vector K×1 of the parameters to be estimated;
ε_{ijt} is the scalar of idiosyncratic error.

The second specification controls the multilateral resistance by including fixed effects for importers and exporters. This model labeled PPML-MLR can be represented as follows:

[9] The sample includes the following countries: Algeria, Angola, Argentina, Australia, Austria, Azerbaijan, Bahrain, Bangladesh, Belarus, Belgium, Benin, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cape Verde, Canada, Chile, China, Colombia, Comoros, Congo, Costa Rica, Côte d'Ivoire, Croatia, Cuba, Czech Republic, Denmark, Djibouti, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Finland, France, Gambia, Germany, Ghana, Greece, Guatemala, Guinea, Guinea-Bissau, Honduras, Hong Kong, Hungary, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Latvia, Lebanon, Lesotho, Liberia, Libya, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Mali, Mauritius, Mexico, Morocco, Mozambique, Namibia, Netherlands, New Zealand, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Republic of Korea, Romania, Russian, Rwanda, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, Syrian Arab Republic, Taiwan, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Venezuela, Viet Nam, Yemen, Zaire, Zambia and Zimbabwe.

[10] For primary products, SITC classification was considered as 0 + 1 + 2 + 3 + 4 + 68 and, for the textile sector, textile, yarn, fabric and clothing fibers classified as SITC 26 + 65 + 84.

[11] Available at http://www.cepii.fr.

$$m_{ijt} = \exp[\alpha_0 + \alpha_{it} + \alpha_{jt} + \boldsymbol{x}_{ijt}\boldsymbol{\beta}] \times \varepsilon_{ijt}$$

where:

m_{ijt} is the scalar of imports from country *i* from exporter *j* at time *t*;
α_0 is the scalar of the constant;
α_{it} is the scalar of the fixed effect of importer *i* at time *t*;
α_{jt} is the scalar of the fixed effect of the exporter *j* at time *t*;
$\boldsymbol{x}_{ijt}$ is a vector line 1×K of the k variables explanatory of the model;
$\boldsymbol{\beta}$ is a vector K×1 of the parameters to be estimated;
ε_{ijt} is the scalar of idiosyncratic error.

The third specification address multilateral resistance terms and the fixed effect for each pair of countries. This specification labeled PPML-MLR-Pair has theoretical support, as demonstrated by Anderson and van Wincoop (2003) and Baldwin and Taglioni (2006). Formally, this equation, that represent the structural gravity model, can be represented as follows:

$$m_{ijt} = \exp[\alpha_{ij} + \alpha_{it} + \alpha_{jt} + \boldsymbol{x}_{ijt}\boldsymbol{\beta}] \times \varepsilon_{ijt}$$

where:

m_{ijt} is the scalar of imports from country *i* from exporter *j* at time *t*;
α_{ij} is the scalar of the fixed effect in time for each pair of countries *ij*;
α_{it} is the scalar of the fixed effect of importer *i* at time *t*;
α_{jt} is the scalar of the fixed effect of the exporter *j* at time *t*;
$\boldsymbol{x}_{ijt}$ is a vector line 1×K of the k variables explanatory of the model;
$\boldsymbol{\beta}$ is a vector K×1 of the parameters to be estimated;
ε_{ijt} is the scalar of idiosyncratic error.

The third specification were used in the fourth model specification. In this model (PPML-MLR-Pair-Mcluster), we used the multi-way clustering variance/covariance matrix, which considers all possible panel dimensions (importers, exporters and time) to make more robust inferences of the estimated parameters. Finally, each of these specifications will have four regression models (total, primary, textiles and manufactured imports).

5. Results

The results of the four different specifications of the gravitational model were presented in Table 2. Nevertheless, it is useful to note that the PPML-Pair specification employs only country-pair fixed effects, and thus ignores the terms of multilateral resistance. In addition, as Baldwin and Taglioni (2006) emphasize if the model does not control the multilateral resistance, then the estimates would become biased, a situation that the authors called Gold Medal mistake. On the other hand, the PPML-MLR specification employs only exporter-year and importer-year fixed effects, and it is not able to control the endogeneity of trade policy variables, as Baier and Bergstrand (2007) point out. In addition, this fixed effect provides more robust estimates for transport costs than the distance between countries and the other variables traditionally used in the gravitational model [see Baier and Bergstrand (2007); Egger and Nigai (2015)].

The PPML-MLR-Pair and PPML-MLR-Pair-Mcluster specifications include country-pair, importer-year and exporter-year fixed effects. Hence, they can be considered more robust than the others. The standard errors of the PPML-MLR-Pair-Mcluster specification are clustered on all possible dimensions of the panel (importer, exporter and time). According to Larch et al (2017), this multi-way clustering generally leads to more conservative inferences of the estimated parameters. Indeed, the results of this fourth model (PPML-MLR-Pair-Mcluster) seem to be more realistic, especially when compared to the two initial specifications (PPML-Pair and PPML-MLR). It is possible to note a significant decrease in the magnitude of the coefficients related to both the WTO and RTAs effects. In some cases, even the sign of the coefficient has changed. Thus, the analysis of the results focuses on the fourth model.

Table 2: Regression Results

Variables	PPML-Pair				PPML-MLR				PPML-MLR-Pair				PPML-MLR-Pair-Mcluster			
	Total	Primary	Textiles	Manufacturing	Total	Primary	Textiles	Manufacturing	Total	Primary	Textiles	Manufacturing	Total	Primary	Textiles	Manufacturing
comesa	0.080	0.396	-0.522*	-0.091	0.329	0.534**	0.509*	0.042	0.228	0.554**	-1.016***	0.196	0.229	0.558**	-1.018**	0.196
ecowas	-	-	-	-	0.280	0.862**	1.991***	-0.893	-0.345	-0.174	-	-	-0.345	-0.177	-	-
sadc	1.771***	2.000***	1.069**	1.817***	1.934***	1.174***	1.916***	2.420***	0.493*	0.343	0.275	0.230	0.494	0.355	0.271	0.232
eu	1.690***	1.977***	0.879***	1.614***	2.707***	2.933***	2.360***	2.362***	0.586***	0.840***	0.369	0.442**	0.600**	0.951***	0.288	0.463
nafta	-	-	-	-	1.262***	2.409***	2.645***	0.966***	-	-	-	-0.106	-	-	-	-0.107
mercosur	1.476***	1.680***	0.503***	1.461***	0.844***	0.342	1.718***	1.333***	0.208	-0.192	0.047	0.493***	0.209	-0.186	0.045	0.494
afta	-	-	-	-	0.590**	0.008	0.318	0.861***	0.000	-	-	-0.000	0.000	-	-	0.000
agadir	1.385***	1.415***	1.360***	1.355***	-0.269	1.622***	-1.031***	-0.692	0.409**	0.153	0.540**	0.417	0.410*	0.157	0.539***	0.417
anzcerta	-	-	-	-	2.811***	2.696***	3.248***	2.667***	-	-	-	-	-	-	-	-
aRTA	2.362***	2.165***	0.853**	2.553***	-0.073	-0.252	0.193	0.428	0.271	-0.349	-0.611***	0.454**	0.273	-0.332	-0.623***	0.456**
cacm	-	-	-	-	2.586***	1.503***	-0.112	3.143***	-	-	-	-	-	-	-	-
can	-0.272	0.140	-1.263***	-0.304	0.979***	0.348	1.451***	1.596***	0.717*	0.973**	-0.486**	0.261	0.717	0.979	-0.487**	0.262
cefta	0.293***	0.686***	0.154	0.132	2.522***	3.733***	1.606***	1.899***	0.094	0.014	0.576*	0.039	0.108	0.113	0.499	0.059
cez	1.133***	1.212***	0.702***	1.082***	-0.122	-0.143	0.740	-0.218	-0.911***	-0.939***	0.463**	-0.748***	-0.911***	-0.935***	0.460	-0.747***
cis	-	-	-	-	2.260***	1.566***	1.103**	3.012***	0.690	-	-0.068	-	0.691	-	-0.065	-
eac	1.267***	1.107***	0.456*	1.455***	1.721**	2.214***	2.574***	1.560**	0.027	0.266	-0.865**	-0.159	0.027	0.267	-0.865	-0.159
eco	-	-	-	-	0.791***	0.461	0.618*	1.493***	-0.095	-	-	-	-0.095	-	-	-
efta	-	-	-	-	0.892	1.101*	1.609***	0.575	-	-	-	-	-	-	-	-
gcc	-	-	-	-	-0.351	-0.773**	0.352	0.517	-0.205	-	-0.429	-	-0.206	-	-0.425	-
laia	2.060***	2.440***	0.156	1.986***	0.968***	0.107	1.406***	1.770***	0.589**	0.448	-0.443	0.539*	0.591***	0.464	-0.455**	0.541**
pafta	1.150***	1.244***	0.803***	1.142***	-0.392	-0.889***	0.392	-0.349	0.212	0.250*	0.473**	0.361**	0.213	0.259	0.468	0.362
sacu	-	-	-	-	1.495***	1.423***	1.648**	1.365**	-0.520	-0.297	-	-	-0.521	-0.310***	-	-
safta	1.585***	1.699***	1.704***	1.343***	0.356	0.014	0.134	0.714	-0.125	-0.368	-0.073	-0.342**	-0.125	-0.364***	-0.077	-0.341***
waemu	1.473***	1.454***	1.638***	1.699***	1.493*	1.896***	-0.086	2.285***	1.056***	1.106**	3.743***	1.446***	1.055***	1.106***	3.511***	1.448***
distance	-	-	-	-	-0.703***	-0.929***	-0.815***	-0.698***	-	-	-	-	-	-	-	-
contiguity	-	-	-	-	0.321***	0.393***	0.319***	0.210*	-	-	-	-	-	-	-	-
common lang.	-	-	-	-	0.162*	0.214**	0.327***	0.195*	-	-	-	-	-	-	-	-
colonial rel.	-	-	-	-	0.040	0.312***	0.262*	0.015	-	-	-	-	-	-	-	-
constant	-	-	-	-	15.640***	15.061***	15.928***	15.353***	-	-	-	-	-	-	-	-
rta_wto	0.711***	0.975***	0.185*	0.641***	0.072	0.040	0.346***	0.180	0.137	-0.209***	-0.177**	0.299*	0.137	-0.202**	-0.180	0.300
rta_nwto	0.560***	0.877***	-0.664***	0.472*	0.097	0.388**	-0.192	0.256	-0.085	-0.135	-0.547***	0.012	-0.085	-0.128	-0.550***	0.012
wtod_wtod	0.013	-0.035	0.469***	-0.064	1.883***	2.470***	1.516***	1.273***	0.166	0.447**	0.847***	-0.107	0.180	0.553***	0.770*	-0.087
wtod_wtos	0.381*	0.693***	1.299***	0.051	2.227***	2.360***	2.404***	1.846***	-0.091	0.430*	0.665**	-0.397**	-0.073	0.580**	0.562	-0.372
wtod_nwto	-0.295	-0.185	0.844***	-0.534*	2.082***	2.237***	1.321**	1.459***	-0.094	0.393	0.958***	-0.268	-0.075	0.545*	0.854	-0.243
wtos_wto	0.926***	1.109***	0.497***	0.894***	0.442***	0.486**	0.421*	0.461***	0.159**	0.303***	-0.171	-0.035	0.160	0.313**	-0.180	-0.034
wtos_nwto	-0.165	0.007	0.294*	-0.310	-0.133	-0.215	-0.455	-0.571	0.198	0.282	0.277	0.011	0.199	0.296	0.265	0.013
nwto_nwto	-1.129***	-1.123***	-0.435	-1.067***	-0.861***	-1.181***	-0.956**	-1.002***	-0.158	-0.157	0.221	-0.083	-0.157	-0.151	0.217	-0.082
Observations	339,740	326,360	308,960	337,160	351,120	351,120	351,120	351,120	339,740	326,360	308,960	337,160	339,740	326,360	308,960	337,160
R-squared	-	-	-	-	0.721	0.788	0.912	0.733	0.970	0.983	0.990	0.974	0.970	0.983	0.990	0.974
Number of par	16,987	16,318	15,448	16,858	17,556	17,556	17,556	17,556	-	-	-	-	-	-	-	-
Country-year effects	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pair effects	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: *** p<0.01, ** p<0.05 and * p<0.1

The joint analysis of the coefficients of the RTAs with the dummies *rta_wto* and *rta_nwto* can indicate whether the regional openness was conditioned on multilateral liberalization. It is noteworthy that regionalism seems to have not affected the RTAs imports from non-members of the same RTA which is also a member of the WTO. Only in the primary sector, the RTAs were able to decrease extra-bloc imports, originating from members of the WTO, since *rta_wto* was negative and significant at 95%.[12] Given the vast discussion in the literature addressing whether regionalism constitute a threat to multilateralism, this result signals something very important, that, with the exception of the primary sector, the RTAs examined may not be considered stumbling blocks.[13]

Most of the RTA dummies exhibited no statistically significant coefficients. These estimates indicate that the RTAs did not promote intrabloc trade. One important exception is the EU, where the bloc had a positive effect on total trade among its members. Nonetheless, it is confined to the primary sector, as the coefficients related to textile and manufacturing sectors were not statistically significant. This may result from the protectionist measures adopted by the EU against imports from the primary sector from non-member countries. Yet, there are three agreements (*Cez*, *Sacu*, and *Safta*) that exhibited a negative impact on trade in primary goods.

Considering total imports, our estimates indicate that the WTO had no impact on total trade in the period 1995-2014, for both developed and developing countries. Although our database covers a more recent period, this result confirming the estimates by Rose (2004) and Roy (2011). At first sight this result surprises, but considering the difference between the periodicity of the data used in the papers it makes sense mainly for two reasons. First, manufactured goods have the largest share in world trade[14]. Second, import tariffs on manufactured goods were already low after the Uruguay Round. Our results using total trade data reflect the fact that import tariffs for manufactured products are already very low and that most of the international trade is of manufactured goods, so it is not possible to observe trade growth that can be attributed to the WTO. Moreover, this does not mean that this institution has never increased total trade, but rather that most of the WTO effects on manufactured goods are likely to have taken place before the Uruguay Round, i.e. during the GATT era.

However, analyzing sectoral trade flows, the impacts of the WTO on trade is asymmetric between the developed and developing countries, members and non-members. We find that the WTO effects on trade in primary and textiles products were positive and significant, strongly differing from the estimates of Subramanian and Wei (2007). Thus, these estimates reinforce the importance of using disaggregated trade data to make inferences about the impact of Regional and Multilateral liberalization on trade.

Table 3 presents a summary of the estimated results to show that developed countries engaged in a non-discriminatory trade openness benefited most from the WTO liberalization in the period examined. It is possible to note that the magnitude of this positive effect on primary goods was very similar for developed countries, with their imports growing above 70 percent, regardless of its origin (both developed or developing country or even from a non-member of WTO). It appears that non-members do seem to benefit equally from the liberalization by developed countries under the WTO. Therefore, there is evidence that the Lerner symmetry hold in the de multilateral system considering developed countries.[15]

The imports of primary products in developing countries members of the WTO from the other members grew by 36.8 percent in the period ($[(e^{0.313} - 1) \times 100] = 36.8$), while non-members of the institution did not benefit from the WTO (*wtos_nwto*). This important role in the opening up of the primary sector contrasts with those of the RTAs, which contributed to reduce trade in the sector in the period under review. In addition, WTO also increased by 116 percent trade among its developed members on textile products. On the other hand, the

[12] The variable *rta_nwto* was also not significant for total trade and seems to have affected negatively only imports from the textile sector.

[13] Bhagwati (1991) brought this discussion to light, in questioning whether regionalism converges to multilateralism. Some economists, such as Summers (1991) and Bergsten (1991), argue that the RTAs contribute to multilateral liberalization both by the progressive inclusion of new members and by the acceleration of multilateral trade negotiations. Thus, the formation of the block would move towards multilateralism, characterizing itself as building block. On the other hand, Bhagwati (1991) and Krugman (1991) identify RTAs as an obstacle to multilateral liberalization, especially for their potential to divert trade, because openness is discriminatory. Such blocks are known as stumbling blocks.

[14] According to WTO (2019), over 70 per cent of merchandise exports was manufactured goods in 2017.

[15] As Subramanian and Wei (2007) explains, the Lerner Symmetry suggest that, on average, WTO members tend to liberalize more than non-members. Therefore, the Lerner Symmetry implies that liberalization from member countries will generate more imports from WTO members (on average, liberalizers) than from non-members (non-liberalizers).

WTO failed to increase textile imports in developing countries. As expected, when importers and exporters were not part of the WTO (*nwto_nwto*), the trade was not affected by the multilateral agreement in the period.

Table 3: Summary of the asymmetric WTO effects on international trade flows

Type of trade flow	Total	Primary	Textiles	Manufacturing
wtod_wtod	0	73.8%	116%	0
wtod_wtos	0	78.6%	0	0
wtod_nwto	0	72.5%	0	0
wtos_wto	0	36.8%	0	0
wtos_nwto	0	0	0	0
nwto_nwto	0	0	0	0

Thus, the results obtained from the primary sector show that the asymmetry proposed by Subramanian and Wei (2007) has reversed, reflecting efforts made during the Uruguay Round to bring agriculture under the GATT/WTO discipline, which were fundamental to further liberalization sector, leveraging world trade.[16] The estimates found in this paper for the textile sector also contradict the results estimated by Subramanian and Wei (2007), who suggested that the WTO did not promote trade in these products, regardless of whether the countries were developed or developing.

The increase in trade in textiles provided by the WTO can be justified by the advances made in the Uruguay Round for this sector. The textile sector has a history of being highly protected, with import quotas dominating the textile trade since the early 1960s. From 1974 until the end of the Uruguay Round (1994), the Multifibre Arrangement (MFA) governed textile trade. However, in the Uruguay Round it was established that the system should be eliminated within ten years through the Agreement on Textiles and Clothing (ATC)[17] that succeeded the MFA. As of January 1, 2005, the sector was fully integrated with the general rules of the WTO.

5.1 *WTO trade effects over time*

As Eicher and Henn (2011) have pointed out, the effects of the WTO on trade can vary considerably over time. Considering a large sample covering several years it is possible the effects of the WTO oscillates, causing a regression to exhibit a statistically insignificant coefficient, although the WTO effect could have been positive in some sub period. Trefler (2004) and Olivero and Yotov (2012) argue that the gravitational model in panel data should be estimated considering small time intervals rather than using a sample covering several decades. Estimations using smaller samples allows bilateral trade flows to adjust in response to changes in trade policy or trade costs. As the sample used in this paper cover a period of two decades, it is important to identify whether the WTO effects on trade vary over time.

Table 4 presents the WTO effects on trade for every five years. Considering total trade, the coefficient of the dummy relating to developing country imports from WTO members indicate that there was no discrimination between members and non-members in the period 2005 to 2009, since both dummies (*wtos_wto* and *wtos_nwto)* are positive and significant. However, the magnitudes of these coefficients suggest that developing country imports from non-members is greater than that relating to imports from WTO members. In other words, this means that developing countries did trade more with non-members than with WTO members in the period 2005 to 2009, which is somewhat surprising. Between 2010 and 2014, WTO non-members traded less amongst themselves than the average set of countries on manufacturing products. This is also observed for the total imports in the period 1995 to 1999.

The results for trade between developed WTO members show positive effects on imports of primary products between 1995-1999 and 2000-2004. This same positive WTO effects on primary products has been observed on developing country imports from WTO members, but this occurs in a later period (2010-2014). In order to understand why WTO effects on primary products have impacted developed countries differently than

[16] According to World Bank (2019), the average import tariff for primary products fell from 13.8% to 2.5% in developed countries and from 18.7% to 9% in developing countries between 1995 and 2014.

[17] The Agreement on Textiles and Clothing no longer exists: it's the only WTO agreement that had self-destruction built in.

developing countries across the period examined, it is necessary to examine the basis of the Agriculture Agreement.

Table 4: WTO effects on trade for each five years

Variables		Total	Primary	Textiles	Manufacturing
rta_wto	1995s	0.347	-0.149	0.026	0.543***
	2000s	0.111	-0.244***	-0.082	0.261**
	2005s	0.081	-0.183**	-0.268**	0.206
	2010s	0.144	-0.111	-0.299**	0.277*
rta_nwto	1995s	0.043	-0.126	-0.424**	0.207
	2000s	0.073	-0.090	-0.101	0.162
	2005s	-0.047	-0.061	-0.231	0.113
	2010s	0.035	-0.172	-0.201	0.248
wtod_wtod	1995s	0.013	0.456*	0.682	-0.274
	2000s	0.262	0.464*	0.754	0.025
	2005s	0.284	0.380	1.030	0.088
	2010s	0.115	0.287	1.012	-0.062
wtod_wtos	1995s	-0.041	0.552*	0.415	-0.325
	2000s	0.055	0.411	0.514	-0.179
	2005s	0.000	0.318	0.884	-0.194
	2010s	-0.243	0.298	0.824	-0.467
wtod_nwto	1995s	-0.356	0.371	0.996	-0.462
	2000s	-0.127	0.391	0.822	-0.178
	2005s	0.054	0.424	0.701	-0.129
	2010s	-0.251	0.406	0.091	-0.879*
wtos_wto	1995s	-0.130	0.235	-0.452	-0.320***
	2000s	0.039	0.167	-0.234	-0.052
	2005s	0.158*	0.178	-0.048	0.066
	2010s	0.272	0.330*	0.124	0.129
wtos_nwto	1995s	-0.217	0.189	0.287	-0.335
	2000s	0.026	0.165	-0.066	0.057
	2005s	0.305*	0.222	0.239	0.123
	2010s	0.291	0.558	0.204	-0.202
nwto_nwto	1995s	-0.359*	-0.222	0.389	-0.201
	2000s	0.112	-0.059	0.302	0.251
	2005s	-0.035	-0.197	0.207	-0.014
	2010s	-0.245	-0.029	-0.025	-0.690**

Notes: *** p<0.01, ** p<0.05 and * p<0.1. PPML-MLR-Pair-Mcluster specification. Intercepts and coefficients for standard covariates not reported for ease of presentation.

The reform achieved in the Uruguay Round brought all the agricultural products listed in the Agriculture Agreement under the WTO discipline. In this agreement, member countries made commitments to reduce protectionism in the agricultural sector on three main fronts: reduction of export subsidies, domestic support and import tariffs. However, the time and the magnitude of the reduction of protectionism that were provided for in the Agriculture Agreement were different between developed and developing countries. Countries' reductions in agricultural subsidies and protection agreed in the Uruguay Round are reported in Table 5.

Developing countries had 10 years to comply with the agreement (1995-2004), while developed countries had to meet their obligations within 6 years (1995-2000). In addition, trade liberalization in the agricultural sector was more intense for developed countries in terms of tariff reduction, domestic support cuts and export subsidies. As a result, it was expected the WTO effect on developing countries would occur later than on developed members, reflecting the longer period of transition and softer liberalization commitments. Our results are consistent with this difference in treatment foresee in the Agriculture Agreement, since that the WTO impacts on

developed countries were observed in the periods 1995-1999 and 2000-2004, while in developing countries it occurred only during the period 2010-2014. Furthermore, the magnitude of these effects on developed countries imports in the primary sector are bigger than those estimated in developing countries.

Table 5: Numerical targets for cutting subsidies and protection

Targets		**Developed**	**Developing**
Tariffs	Ave. Cut, All Ag. Goods	–36%	–24%
	Min. Cut Per Product	–15%	-10%
Domestic Support	Cuts For Sector (‘AMS’)	–20%	–13%
Exports	Value Of Subsidies (Outlays)	–36%	–24%
	Subsidized Quantities	–21%	–14%

Source: WTO website.

Note: Least-developed countries do not have to make commitments to reduce tariffs or subsidies. The base level for tariff cuts was the bound rate before 1 Jan 95; or, for unbound tariffs, the actual rate charged in Sept 86, when the Uruguay Round began. Only the figures for cutting export subsidies appear in the agreement. The other figures were targets used to calculate countries’ legally binding “schedules” of commitments.

Figures 1, 2, and 3 present the evolution of the annual WTO effects. The highlighted points represent the significant coefficients at a level of at least 90 percent confidence and the dashed upper and lower lines represent the 95 percent confidence interval of the coefficients.

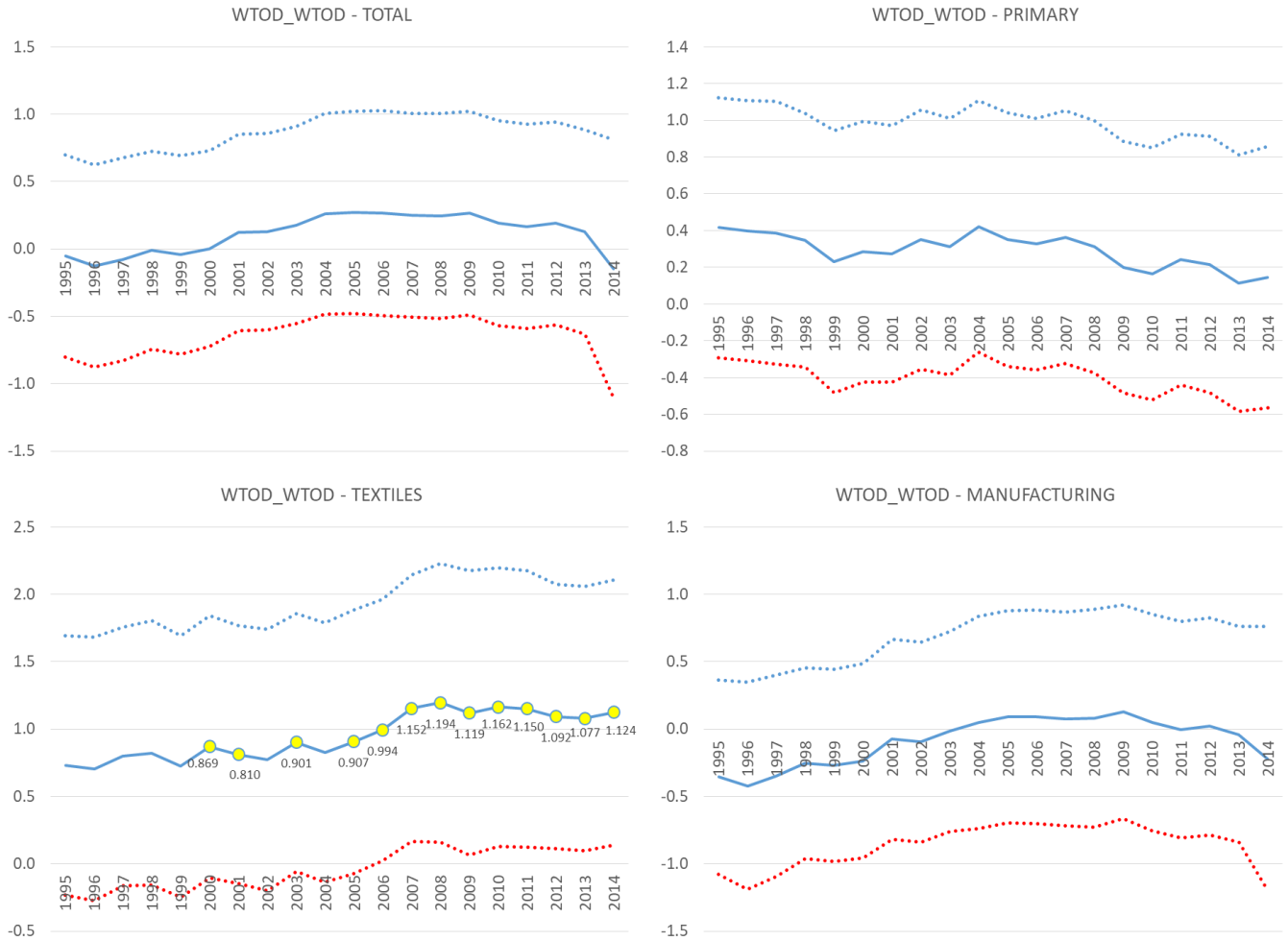

Figure 1: Developed country imports from other developed country WTO members

In general, it is clear that the coefficients of developed countries import from other developed members are more stable compared to the imports from developing countries. With the exception of primary products, the

other coefficients of the imports from developing countries showed an upward trend, becoming significant for total trade from 2009. For three of the four aggregations - total, primary and manufacturing - the coefficients of developed country imports from other developed countries are not significantly in any year of the sample. The only exception are textiles, with the coefficient becoming significant and positive from 2000 onwards. Developed country imports from developing countries showed a similar behavior. The main difference is that the impact of the WTO on textile imports was observed later, from 2007, i.e. 7 years after this effect was observed in trade between developed countries and lasted less, only five years.

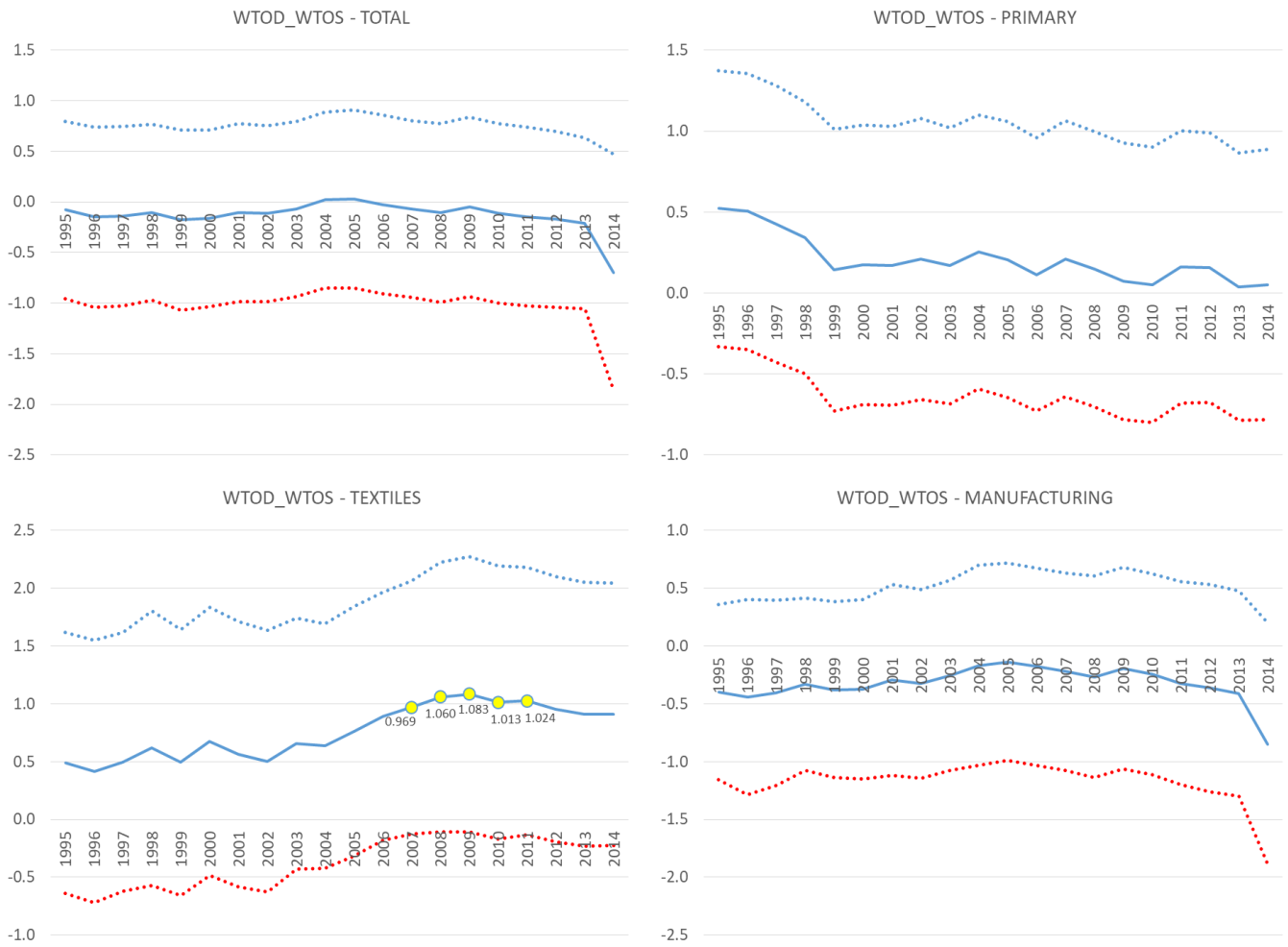

Figure 2: Developed country imports from developing country WTO members

The annual dummies of the WTO effects on trade in its developing members showed an upward trend in all aggregations, starting with significant and negative coefficients for textiles and manufacturing in the first years of the sample. Afterwards, the WTO ceased to adversely affect trade in those sectors, even affecting positively total imports and primary products in the last years of the sample, with the effects on total imports lasting longer when compared to imports of primary products. These results could be explained by the China's accession to the WTO in 2001 or by the more rigorous treatment associated with post-Uruguay Round accessions.

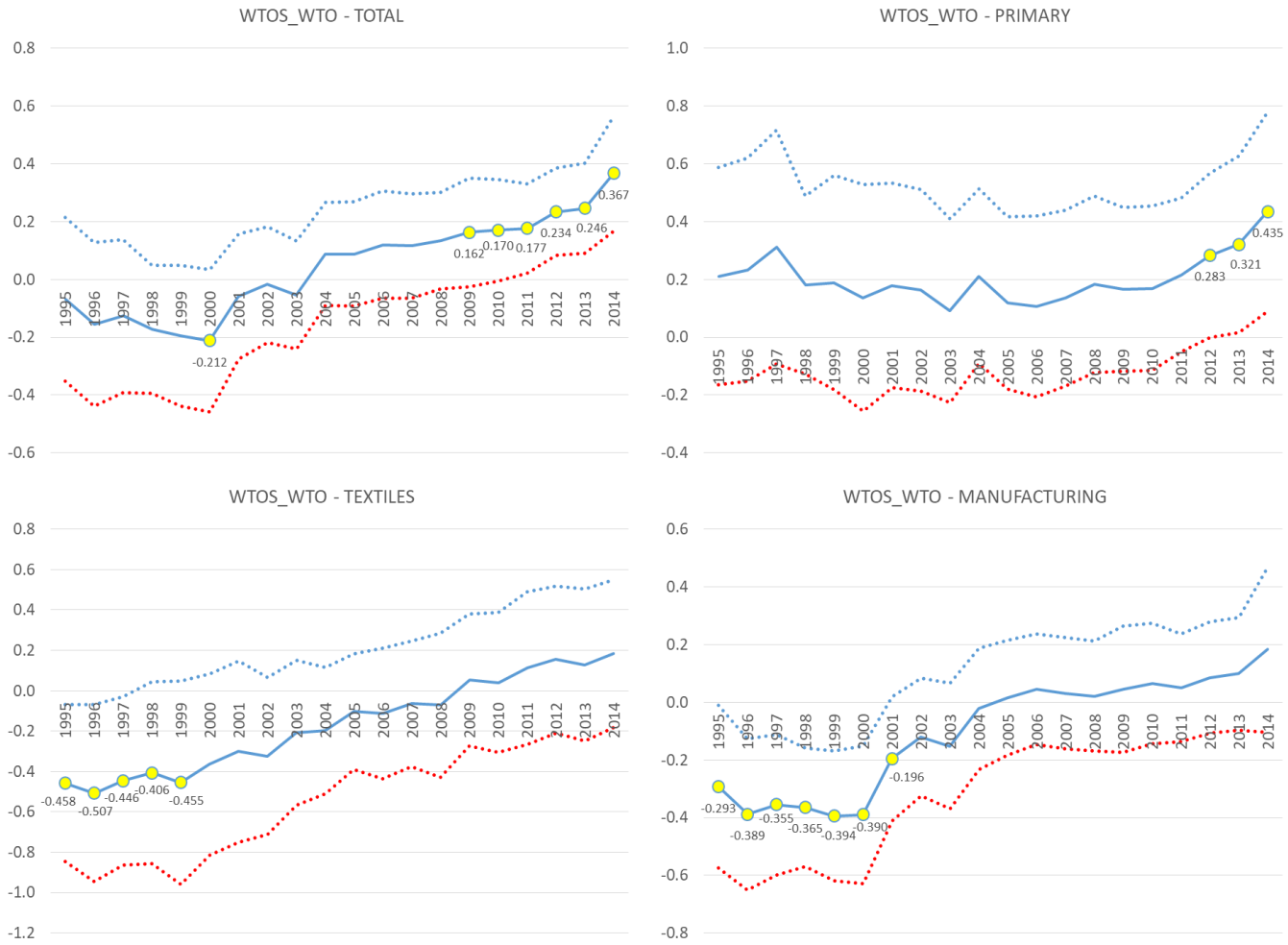

Figure 3: Developing country imports from WTO members

Finally, our results demonstrate that the dynamics of imports between developed and developing countries members differed not only in terms of volume, duration, and sector, but also in the speed at which the trade flows responded to the conclusion of the Uruguay Round.

5.2 *New versus former Developing Country Members in the WTO*

Developing countries that joined the multilateral system in the GATT era had liberalization commitments that were softer than those imposed on new entrants after 1995. Indeed, many developing countries maintained sustained tariffs even after they became members of GATT.[18] However, Tang and Wei (2009) show that the Uruguay Round caused a drastic change in this treatment, since developing countries were subject to stricter requirements to join the WTO.

This difference in treatment is tested in this subsection and refers to the fourth WTO asymmetry that was suggested by Subramanian and Wei (2007). Table 5 clarifies this question. For this, developing country members were divided between those who were members before the Uruguay Round of those who joined the institution after it (these coefficients were identified as new). Next, the gravitational model was again estimated, with the specification PPML-MLR-Pair-Mcluster, to test the hypothesis of the existence of this fourth asymmetry in the multilateral system.

[18] Under the old GATT rules, a member could invoke non-application only on the condition that it has never entered into bilateral negotiations with the acceding country. However, after the Uruguay Round, a member could choose not to extend its WTO-related benefits to a new member, even if they already have a history of bilateral negotiations (Tang and Wei, 2009).

Table 5: New and former developing country members in the WTO

VARIABLES	Total	Primary	Textiles	Manufacturing
apc_wto	0.129	-0.221***	-0.187	0.294
apc_nwto	-0.092	-0.141	-0.553	0.010
wtod_wtod	0.131	0.466**	0.763	-0.123
wtod_wtos	-0.042	0.855***	0.990	-0.168
wtod_newwtos	-0.108	-0.439	-0.506	-0.261
wtod_nwto	-0.153	0.387	0.779	-0.302
wtos_wto	-0.047	-0.162	-0.233	-0.207*
newwtos_wto	0.215	0.503***	0.067	0.178
wtos_nwto	-0.008	-0.189	0.233	-0.155
newwtos_nwto	0.240	0.561***	-0.029	0.171
nwto_nwto	-0.152	-0.139	0.215	-0.080

Notes: *** p<0.01, ** p<0.05 and * p<0.1. PPML-MLR-Pair-Mcluster specification.
Intercepts and coefficients for standard covariates not reported for ease of presentation.

First, most of the coefficients for new members changed signal, which confirms a modification of treatment associated with post-Uruguay Round accessions. For trade in primary products, the new developing country members imported 65 percent more from other WTO members than the former developing countries. On average, these new members imported 75 percent more from non-WTO members than the former members, also considering primary products. This suggests that only the new developing members have extended the tariff reduction to all countries. Another point is that developing countries that have joined in the GATT era have only experienced a significant increase in their exports of primary products to developed countries. Considering trade between WTO members, the former developing countries export an average of 135 percent more for developed countries than new entrants developing members.

These results corroborate those found by Subramanian and Wei (2007), confirming the existence of this fourth asymmetry in the WTO. Developing countries that joined the system before the Uruguay Round had a longer period to begin the process of multilateral liberalization and the magnitude of trade liberalization was lower than for new members. According to Subramanian and Wei (2007), China is an example of this change of treatment. China's accession to the WTO in 2001 came at the end of a 13-year process where the list of liberalization obligations imposed on China has grown steadily. At the end of the transition period, China's trade regime was more open than most current WTO members. Figure 4 evaluates the simple mean tariff rate in select developing country members for every 5 years beginning in 1995 and ending in 2014.

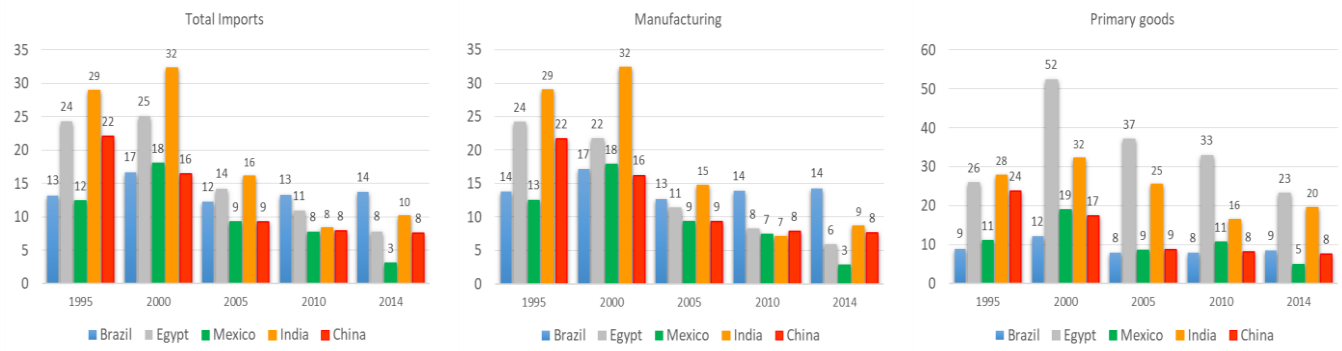

Figure 4: Evolution of the simple mean tariff rate in select developing country members (%)

The Chinese tariff cut was higher than that observed in Brazil and India, both for all products and at the sectorial level (primary and manufactures). Although Mexico (former member) was more open than China in 2014, the Chinese tariff reduction was more intense after the Uruguay Round, which also reflects the difference in treatment between old and new members. However, there is another aspect to be observed. Given the

heterogeneity of the tariff cut among developed countries, it was to be expected that the WTO effects on developing countries imports would be lower than on developed countries imports, and our results have confirmed this.

6. Concluding remarks

The results suggest that the WTO has positive impact on trade international trade flows, which differs from the results of Rose (2004), Eicher and Henn (2011) and Roy (2011), but this growth occurred asymmetrically between the between developed and developing countries and between members and non-members. Although Subramanian and Wei (2007) also found positive effects on trade, considering these four asymmetries of the WTO, we show that some of these did not hold up over time. The results suggest that the first asymmetry remained, since developed countries was the most benefited from the Multilateral Agreement. The second asymmetry, which refers to discrimination between members and non-members of the WTO, was also partially found in this paper. These results was expected, since the most favored nation clause and the principle of reciprocity which guide the WTO-coordinated trading system, are only required to be extended to the WTO members, so non-members should not benefit from the multilateral trade liberalization.

The third asymmetry proposed by Subramanian and Wei (2007) states that trade liberalization should be greater in the industrial sector, which implies that the agricultural and textile sectors did not benefit from the WTO. However, our estimates suggest that this asymmetry has been reversed, since the largest impacts of the WTO on trade were observed in the primary and textile sectors in the period post-Uruguay Round. One possible explanation for this result is that the other papers used different data and econometric specifications. In this article, the data cover a more recent period, from 1995 to 2014, in which import tariffs for industrialized products were already at very low levels. In addition, the advances made in the Uruguay Round, especially the entry of agricultural and textile sectors under WTO discipline meant that the reduction in import tariffs for these products, which were much higher than those for industrialized products, promoted a growth in trade among members of the institution. And, in fact, the greatest trade liberalization, in terms of reducing import tariffs, occurred in the agricultural sector. The reduction in primary goods import tariffs from 1995 to 2014 was higher in developed countries than in developing nations, from an average of 13.78% to 2.50% and from 18.68% to 9.01%, respectively, which could potentially explain these new results.

In the period 1995-2014, developed countries were the most benefited from the increase in world trade promoted by the WTO and its multilateral trade liberalization was not discriminatory, extend the benefits of their tariff cuts to non-members. In contrast, trade liberalization in developing countries was discriminatory and trade growth was seen only in primary and industrial products, but to a lesser extent than developed nations. Eicher and Henn (2011) have already suggested this, showing that the countries that made the largest tariff reductions during the WTO accession negotiations were those that had positive and significant WTO effects on trade.

Finally, with the exception of the textile sector, the RTAs examined could be considered stumbling blocks, since our estimates confirm to a certain extent that they are obstacles to the multilateral openness, which confirms the hypothesis advocated by Bhagwati (1991) and Krugman (1991).

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