THE GRADUATE INSTITUTE | GENEVA
CENTRE FOR TRADE
AND ECONOMIC INTEGRATION

CTEI PAPERS

CTEI-2011-11

CTEI Working Paper

Does the Nature of Regional Trade Agreements Matter in Promoting Trade?

Sohaib Shahid

Graduate Institute of International and Development Studies

Abstract

Globalization's 'second unbundling' has drastically altered the nature of international trade giving rise to what might be referred to as the trade-investment-service nexus. Today's RTAs are qualitatively different than those signed two decades ago, since they cover disciplines that go beyond preferential market access. This paper investigates whether the nature of RTAs matters when it comes to promoting trade. Controlling for the 'gravitational un-constant' terms, I use an augmented specification of the gravity model with a balanced panel over the 1994-2010 period. Employing four different econometric techniques taking care of zero trade flows, I check for robustness across all four procedures. Controlling for heterogeneity and self-selection of RTAs my results show that the nature of an RTA matters in trade promotion but the magnitude and direction of that relationship is unclear.

http://graduateinstitute.ch/ctei/working_papers.html

CTEI PAPERS

CTEI-2011-11

Centre for Trade and Economic Integration (CTEI)

The Centre for Trade and Economic Integration fosters world-class multidisciplinary scholarship aimed at developing solutions to problems facing the international trade system and economic integration more generally. It works in association with public sector and private sector actors, giving special prominence to Geneva-based International Organisations such as the WTO and UNCTAD. The Centre also bridges gaps between the scholarly and policymaking communities through outreach and training activities in Geneva.

www.graduateinstitute.ch/ctei

http://graduateinstitute.ch/ctei/working_papers.html

INSTITUT DE HAUTES ÉTUDES INTERNATIONALES ET DU DÉVELOPPEMENT

GRADUATE INSTITUTE OF INTERNATIONAL AND DEVELOPMENT STUDIES

CP 136 – CH-1211 GENÈVE 21
TÉL +41 22 908 57 00
http://graduateinstitute.ch

Does the nature of Regional Trade Agreements (RTAs) Matter in Promoting Trade?[1]

October 2011

Abstract

Globalization's 'second unbundling' has drastically altered the nature of international trade giving rise to what might be referred to as the trade-investment-service nexus. Today's RTAs are qualitatively different than those signed two decades ago, since they cover disciplines that go beyond preferential market access. This paper investigates whether the nature of RTAs matters when it comes to promoting trade. Controlling for the 'gravitational un-constant' terms, I use an augmented specification of the gravity model with a balanced panel over the 1994-2010 period. Employing four different econometric techniques taking care of zero trade flows, I check for robustness across all four procedures. Controlling for heterogeneity and self-selection of RTAs my results show that the nature of an RTA matters in trade promotion but the magnitude and direction of that relationship is unclear.

JEL classification: F10, F13, F15
Keywords: Trade, Regionalism, Gravity, RTAs, Depth

Sohaib Shahid
Centre for Trade and Economic Integration (CTEI)
Graduate Institute of International and Development Studies
Richard Wagner 1, 5th Floor
Geneva 1202, Switzerland
sohaib.shahid@graduateinstitute.ch

[1] I thank Richard Baldwin and Nicolas Berman for very useful comments and discussions. I also thank Jean-Louis Arcand, Theresa Carpenter, Nadia Rocha, Martina Bozzola, Pavel Chakraborty, Yose Damuri, Andreas Lendle, as well as participants at the 11th ETSG conference for their insightful suggestions. I gratefully acknowledge support from the CEPR project 'Politics, Economics and Global Governance: The European Dimensions' (PEGGED) funded by the Theme Socio-economic sciences and humanities of the European Commission's 7th Framework Programme for Research. Grant Agreement No. 217559.

1 Introduction

Regional Trade Agreements (RTAs) are fast becoming an important cornerstone of the world trading system. As of November 2010, 195 RTAs had been notified to the WTO under the Enabling Clause and GATT Art. XXIV. The Information Communication Technologies (ICT) revolution of the mid 1980s gave birth to the internationalization of supply chains, leading to complex rules and regulations. Globalization's 'second unbundling' has radically altered the nature of international trade giving rise to what might be referred to as the trade-investment-service nexus (Baldwin, 2011). More of this nexus has led to the birth of RTAs of a different nature (those with deeper disciplines i.e., covering different areas such as competition policy). The issue of whether a stronger nexus leads to more trade is unclear. Therefore, the objective of this paper is to attempt to answer the question of whether the nature of RTAs matters in promoting trade. I look into the various provisions that are found in RTA texts, and try to determine the magnitude and direction of the relationship between these provisions and trade flows.

The rationale for exploring the relationship between RTA provisions and bilateral trade flows is that 21st century regionalism is not about preferential market access as was the case for 20th century regionalism; it is about deeper disciplines (Baldwin 2011; WTO World Trade Report 2011). Nowadays, regional integration is more than just trade in goods and tariff liberalization, but encompasses other issues such as intellectual property rights (IPRs), competition policy, investment protection, labor standards, and environment protection. This new 'breed' of RTAs has a far reaching effect on a country's domestic policy and is important to explore, as they are fast becoming a topic of contention regarding the sovereignty of small countries vis-à-vis large countries. It also helps to understand the economic power asymmetries existing in today's world which might be exacerbated by deep RTAs signed by the US, EU and Japan with small sized developing or Least Developed Countries (LDCs), as shown in figure A.1 of the appendix.

According to Baldwin (2011) at a time when the WTO was otherwise occupied, the governance gap was filled by uncoordinated developments elsewhere (mostly in deep regional trade agreements and other complex arrangements such as bilateral investment treaties). As a result demand for disciplines grew and deeper RTAs were being signed. The US-Mexico component of NAFTA and Europe's Euro-Med Association Agreements led the way in deepening trade ties. Recently Japan has also been involved in signing deeper

Economic Partnership Agreements (EPAs) with the large ASEAN nations as shown in figure A.1. It is worth noting that during the past decade, South-South agreements have also deepened as shown in figure A.2 of the appendix. These newer (more complex) disciplines witnessed a surge after the Doha Development Agenda (DDA) negotiations went underway, as shown in Table 1. Since 21st century regionalism has different consequences for the world trading system than the kind of regionalism seen in the previous century, this topic requires renewed thinking.

Table 1: WTO+ and WTO-X provisions in RTA

	Pre-WTO	1995-2000	DDA era, post 2001
WTO+ Issues			
Customs	13	11	56
AD	12	8	53
CVM	4	5	52
Export Taxes	8	8	41
State Aid	10	9	34
TRIPs	6	4	41
GATS	7	2	39
STE	5	3	35
TBT	2	2	36
SPS	2	1	35
Public Procurement	5	0	32
TRIMs	6	2	31
WTO-X Issues			
Competition Policy	11	9	39
Movement of Capital	6	5	38
IPR	5	2	39
Investment	4	1	35

Source: World Trade Report, WTO (2011). The WTO+ and WTO-X classification is from Horn et al. (2010).
Note: WTO+ provisions are those that come under the WTO mandate, whereas WTO-X provisions are those that go beyond the WTO agenda. See section 3.2 for a detailed description of WTO+ and WTO-X.

Using a dataset constructed by the WTO for the World Trade Report (2011), the paper segments the provisions into two classifications i.e., 'WTO-plus' (WTO+) and 'WTO-extra' (WTO-X), following the definition of Horn et al. (2010), and uses four different techniques to test for the sensitivity of the results while taking into account zeros in the trade matrix. Results indicate that though the nature of an RTA matters in trade-promotion, the direction and magnitude of this relationship is unclear. This is because there are factors other than trade (e.g., investment, services, and foreign affiliate sales) that might prompt countries to sign this new 'breed' of RTAs.

1.1 Literature

Though there is substantial literature on the effect of RTAs on trade, few authors have studied the impact of RTAs of different nature on trade volume.[2] Ghosh and Yamarik (2004) and Kandogan (2008) distinguish between the different categories of RTAs and find a negative impact of Customs Union (CU) and Common Market (CM) membership on trade flows. However, they do not control for the 'gravitational un-constant' (i.e., what Anderson and van Wincoop (2003) refer to as the 'multilateral resistance', or what Frankel and Wei (2008) call 'remote-ness') and for self-selection into RTAs.

There is no consensus on the definition of 'depth' of an agreement. Some authors define it with reference to how 'offensive' some rules and regulations contained in RTA texts can be to the sovereignty of a country. Indeed, concluding an RTA would mean integrating national laws with those of other countries, thereby leading to a loss of sovereignty for the respective country. The more 'offensive' or the more far-reaching the regulations contained in an RTA text the deeper it is considered. Lawrence (1996) explained the distinction between deep and shallow RTAs. He linked deep RTAs with complex trade and highlighted that both first came about among developed nations. From the mid-1990s, deep RTAs saw a sudden increase thereby covering North-South trade as well, which is illustrated in Figure 1 in section 3.1 and figure A.2 of the appendix.

Recent research in regionalism quantifies the depth of RTAs based on the methodology put forward by Horn et al. (2010) who analyzed all the US and EU agreements and noted whether an agreement contained WTO+ and WTO-X provisions, and if they were legally enforceable. WTO+ provisions are those that already exist in WTO agreements but are an 'addition' to the WTO disciplines. WTO-X provisions concern commitments that are outside the scope of the WTO agenda. WTO-X provisions have become an important component of present day RTAs, and have grown substantially in the past decade as shown in figure A.3 and A.4. Yap et al. (2007) and Balboa (2008) have done similar work on Japanese EPAs. Vicard (2009) differentiates RTA depth based on a canonical taxonomy (Preferential Arrangements, Free Trade Agreements, Currency Unions and Common

[2] Carrère (2006) finds that the RTAs in her sample lead to a significant increase in trade among members, at the expense of non-members. The trade creation/diversion effect however varies from one RTA to the other. The underlying message of literature in this area is that countries self-select themselves into RTAs and that different RTAs have different effects. Baier and Bergstrand (2007) observe an average treatment effect of RTAs on bilateral trade close to 50%, which goes on up to 100% after 10 years. They also show that due to endogeneity the coefficient on RTA is biased downwards, which means that countries choose 'well' their RTA partners. Vicard (2011) shows that the effectiveness of an RTA in increasing trade between two countries, depends not only on the country pair in question, but all other members of that RTA.

Market) and finds that once self-selection is controlled for, the trade creation effect of RTAs does not statistically differ according to the depth of the RTAs. Orefice and Rocha (2011) were the first to look at the impact of deep integration on production networks.

The WTO World Trade Report (2011) concludes that RTAs have recently been getting increasingly deep. The report points out that "The pattern observed suggests that deepening commitments in these areas, i.e., going beyond commitments in the WTO, continue to be a major driving force for recent RTAs." The report also notes that RTAs that have come into force recently contain more WTO-X provisions than earlier RTAs. Since WTO-X provisions are largely regulatory in nature, it is "testimony to the growing importance of behind-the-border measures in RTAs." Baldwin (2011) suggests that deep RTAs can also be defined by what they are not. For example, tariff preferences are no longer an important component at the global level. Carpenter and Lendle (2010) provide further evidence by showing that though bilateral trade flows under RTAs account for about half of world imports, only 16.7% of total world trade is eligible for preferences. They also note that less than 2% of world imports enjoy preferences over ten percentage points.

The paper makes a comparison of the empirical results obtained through different econometric approaches and tests for the robustness of the various econometric methods used to correct for zero trade flows. This allows me to compare my results with Baldwin (1994) and Frankel (1997) who show that zero trade flows do not have much impact on empirical results. A number of papers have dealt with the question of 'zeros' in the trade matrix, for example, Helpman, Melitz and Rubenstein (2008) solve for the zero trade flow problem by using a sophisticated two-step procedure. Westerlund and Wilhelmsson (2009) use a Poisson fixed effects estimator, and Silva and Tenreyro (2006) advocate the usage of the Pseudo-Poisson Maximum Likelihood (PPML) estimate.

The paper takes a step towards filling the gap in previous literature at various levels. First, by improving the understanding of the relationship between RTAs of varying nature and trade. Second, by providing evidence that the new 'breed' of RTAs is important in today's world trading system. Third, my results open topics for further discussion about the changing roles of the WTO as a regulatory organization. Finally, my study shows that countries are signing more and more RTAs of regulatory nature because they have other goals to achieve rather than just trade promotion.

The next section provides a brief theoretical framework that shapes this paper. The database used in this study and the variables of interest are discussed in section 3. Section 4 explains the empirics involved in the paper by looking at a detailed overview of the question the paper attempts to answer. The results from the econometric estimation within the established theoretical framework are shared in section 5. Section 6 presents the concluding remarks.

2 Theoretical Framework

2.1 The Traditional Gravity Equation

The traditional gravity equation initiated by Tinbergen (1962) relates bilateral trade flows to the GDP level of a country pair and the geographic distance between them. The GDP levels reflect the market size in the two countries and are a measure of 'economic mass'. The GDP of the exporting country reflects the potential supply of bilateral exports from that country, whereas the GDP of the importing country shows the potential for the demand of bilateral imports. The geographical distance is a measure of 'resistance'. The functional form of Newton's 'Law of Universal Gravitation' is then used to establish a relationship between bilateral trade and the variables of the GDP of the country pair and the distance between them:

$$T_{ij} = \alpha_o Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} \quad (1)$$

where:

i = exporting country

j= importing country

'ij' is each country pair

$\alpha_o, \alpha_1, \alpha_2$and α_3 are unknown parameters.

T_{ij} = quantity of bilateral imports of a single variety from country *i* to country *j*.

Y_i = Country *i*'s output measured in terms of the numeraire.

Y_j = Country *j*'s output measured in terms of the numeraire.

D_{ij} = distance between country *i* and country *j*.

The stochastic form of the gravity equation has the form:

$$T_{ij} = \alpha_o Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} \eta_{ij} \quad (2)$$

where η_{ij} is the disturbance term which shows the random deviations from the underlying relationship. The disturbance term with $E\left(\eta_{ij}\middle|Y_i, Y_j, D_{ij}\right) = 1$ is assumed to be statistically independent of the regressors, which gives:

$$E\left(\mathrm{T}_{ij}\middle|Y_i, Y_j, D_{ij}\right) = T_{ij} = \alpha_o Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} \qquad (3)$$

The gravity equation is usually expressed in logarithmic form. Therefore, I log-linearize equation (1) and estimate the parameters of interest by least squares using the following equation:

$$\ln\left(T_{ij}\right) = \ln\left(\alpha_o\right) + \alpha_1 \ln\left(Y_i\right) + \alpha_2 \ln\left(Y_j\right) + \alpha_3 \ln\left(D_{ij}\right) + \ \eta_{ij} \qquad (4)$$

The above procedure is only valid if η_{ij} and therefore $\ln\left(n_{ij}\right)$ are statistically independent of the regressors. The expected value of the logarithm of a random variable depends both on its means and the higher-order moments of the distribution e.g., if the error term η_{ij} in (4) depends on the regressors, the expected value of $\ln\left(n_{ij}\right)$ will depend on Y_i, Y_j or D_{ij} as well. This violates the condition for OLS being consistent and efficient. Silva and Tenreyro (2006) establish that the error terms in the usual log-linear specification of the gravity equation are heteroskedastic. In this case, the assumption that $\ln\left(n_{ij}\right)$ is statistically independent of the regressors is violated. This violation would therefore give inconsistent estimates. I use the PPML method in section 4.1 to solve for this problem.

2.2 The Anderson-van Wincoop Gravity Equation

According to Anderson and van Wincoop (2003), the traditional gravity equation (Tinbergen, 1962) does not take into account 'gravitational un-constant' terms, and is therefore incorrectly specified. They derive importer and exporter's gravitational 'un-constant' terms from a full expenditure system on a cross-section of data, and show that including country-specific fixed effects give identical results. To solve for this misspecification the authors propose to augment the traditional gravity equation with exporter and importer fixed effects, giving:

$$T_{ij} = \alpha_o Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} e^{\theta_i d_i + \theta_j d_j} \qquad (5)$$

where:

$\alpha_o, \alpha_1, \alpha_2, \alpha_3, \theta_i$and $\theta_j$are the unknown parameters

d_i= dummy for country *i*

d_j= dummy for country *j*

The model put forward also predicts that $\alpha_1 = \alpha_2 = 1$, which then gives the unit-income elasticity model:

$$T_{ij} = \alpha_o Y_i Y_j D_{ij}^{\alpha_3} e^{\theta_i d_i + \theta_j d_j} \quad (6)$$

which can also be written as:

$$E(T_{ij}|Y_i, Y_j, D_{ij}, d_i, d_j) = \alpha_o Y_i Y_j D_{ij}^{\alpha_3} e^{\theta_i d_i + \theta_j d_j} \quad (7)$$

As in the traditional gravity equation, log-linearizing equation (7) once again leads us to the problem of treating zero trade flows. Since equation (7) is also a multiplicative model, log-linearizing it would bias the results in the presence of heteroskedasticity (Silva and Tenreyro, 2006).

I follow previous literature in extending the Anderson van Wincoop (2003) gravity equation with several variables that are used as a proxy for different measures of economic and geographical distance. These include control dummies for common (official) language, common border and a common colonizer.

2.3 RTAs and the Gravity Equation

In trade theory the impact of RTAs is mostly analyzed ex-post using a gravity equation (Frankel 1997; Carrère 2006). Baier and Bergstrand (2007) suggest using two types of econometric specifications of the gravity model to correctly estimate the average treatment effect of RTAs: (i) panel data with bilateral and country-and-time fixed effects or (ii) differenced panel data with country-and-time effects. The former is one of the techniques is used in this paper. Including bilateral fixed effects helps purge the biasness arising from the omission of unobserved variables affecting both bilateral trade and RTA provisions (WTO+ and WTO-X), and also allows to account for endogeneity arising from self-selection. The issue of self-selection is mainly cross-sectional in nature, because it is related to the actual level of trade instead of its potential level (Vicard, 2009).

RTAs of varying nature are related differently to the unobservables which impede or facilitate trade. Anderson and van Wincoop (2004), point out that in the contemporary politically fragmented world, international transaction costs depend more on domestic policies (e.g., regulation, property rights, norms) than on conventional tariff barriers. Anderson and Marcouiller (2002) and Bloomberg et al. (2006) show that insecurity and violence have a negative impact on trade. Vicard (2011) shows that the determinants of RTAs depend on the depth of the RTA. He also underlines that in a system where there is no supranational authority to enforce property rights at the international level, a dyad facing interstate conflicts needs a mechanism that secures the continuity of trade flows in the future. He also states that countries experiencing a lot of interstate conflicts in the past are more likely to sign deeper RTAs leading to strong regional institutional frameworks, whereas international insecurity deters the formation of shallow agreements. Therefore, omitting security variables would bias the coefficients on the RTA depth variables. This entails that the omitted variable bias would differ between categories of RTAs.

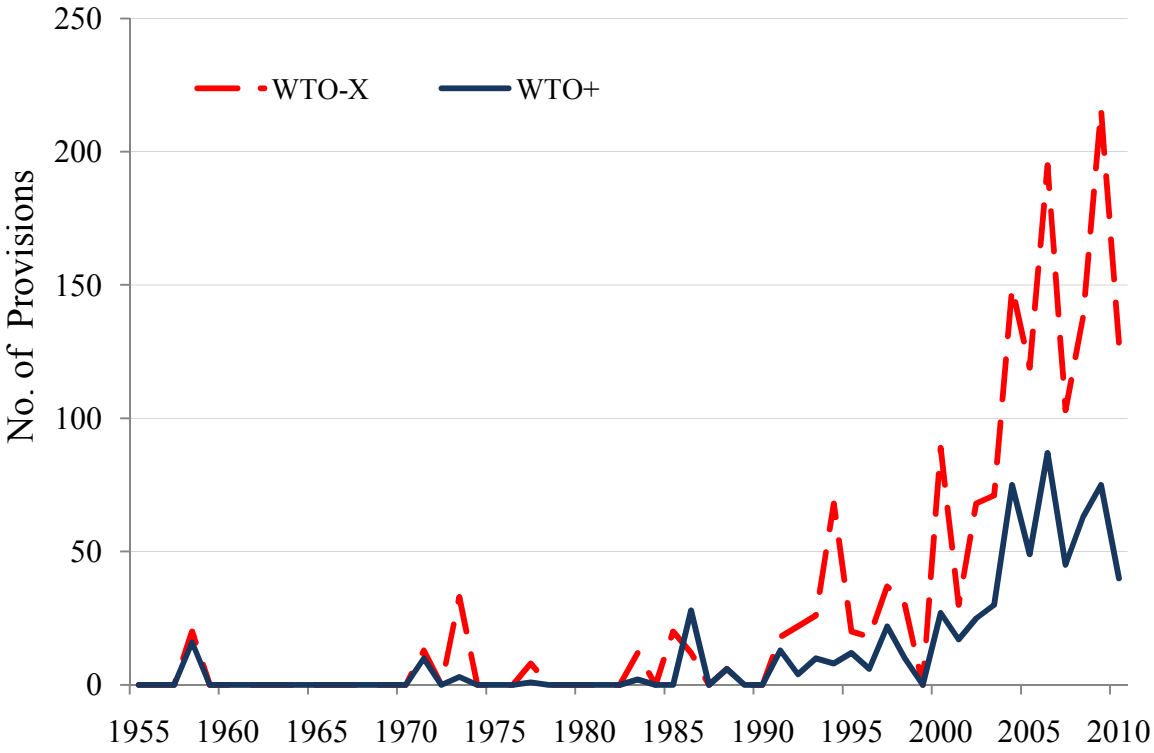
3 Data

3.1 Database

The data on the nature/depth of RTAs used in this paper comes from the World Trade Report (2011) prepared by the WTO secretariat which uses the Horn-Mavroidis-Sapir method to build a dataset containing 97 RTAs. 44 of these RTAs either involved the EU or the US, whereas the other 43 RTAs were signed by regional trading blocs such as ASEAN and MERCOSUR. The sample of RTAs was chosen based primarily on the volume of intra-RTA trade and covers agreements that were concluded during the 1958 to 2010 period.

The balanced panel data used in this paper contains 132 countries and 97 RTAs signed from 1994 to 2010. The rationale for excluding data prior to 1994 is that provisions included in RTA texts have only become an important component of regionalism since 1994, as shown in Figure 1. The descriptive statistics can be found in Table A.1 of the appendix, whereas data description and sources can be seen in Table A.2 of the appendix.

Figure 1: Evolution of provisions in RTAs



The agreements covered in the dataset are divided into 52 policy areas falling into two categories, namely WTO+ and WTO-X. WTO+ contains 14 provisions, whereas WTO-X contains 38 provisions. Figures A.5 and A.6 in the appendix list all the provisions and the frequency of their occurrence in RTA texts, without differentiating between those provisions that are legally enforceable and those that are not.[3] Tables A.3 and A.4 of the appendix list the 52 provisions, segment them according to the WTO+ and WTO-X classification, and also provide a brief description of each provision. Nominal bilateral flows are from UN Comtrade (zero trade flows are included) with a procedure to extract mirror flow declarations. The gravity controls include real GDP for each country pair (adjusted for local price differences) from the Penn World Table figures, adjacency, common (official) language, and common colonizer dummy, which come from the CEPII distance database.[4]

3.2 Variables of Interest

The 52 provisions are classified into two broad groups: WTO+ and WTO-X as in Horn et al. (2010). A WTO+ designation includes those obligations in policy areas that have

[3] Section 3.2 provides a detailed description on legally enforceable provisions.
[4] http://www.cepii.fr/anglaisgraph/bdd/distances.htm

already been committed to by the WTO member states. For example, the formation of an RTA is a typical obligation since that means a reduction in tariffs which go beyond what is already committed to under the WTO. Some examples of WTO+ provisions include obligations on SPS (Sanitary and Phytosanitary measures), TBT (Technical Barriers to Trade) and CVM (Countervailing Measures).

A WTO-X provision captures an obligation in an area that is 'qualitatively new', i.e., it covers an area that has not been previously regulated by the WTO or does not come under the WTO mandate. For example, there are no undertakings concerning labor laws in the WTO. Therefore, labor laws are classified as WTO-X. Competition policy, environmental laws and illegal immigration are some other examples of areas covered by WTO-X provisions.

For each agreement, both WTO+ and WTO-X provisions are divided into 'Areas Covered' (AC) and 'Legally Enforceable' (LE) categories, i.e., whether the provisions are non-enforceable or enforceable respectively. The classification of whether a provision comes under AC or LE depends upon the language used in the text of the RTAs. The dataset gives a value of 0 in case a certain provision does not exist in an RTA, AC has been coded as 1, and LE is coded as 2.[5] Differentiating between the impact of AC and LE provisions on trade is beyond the scope of this paper.

The 14 WTO+ provisions and the 38 WTO-X provisions are strongly correlated with each other and can result in imprecise estimates of the underlying gravity model. This is because multiple provisions enter an RTA at the same time, leading to a high correlation between them, which can potentially affect the accuracy and reliability of the model. These variables however are relevant to the question this paper is trying to answer. Therefore, excluding them from the model can lead to a potential bias. I use a Principal Component Analysis (PCA) summarizing correlated indicators into two Principal Components, namely WTO+ and WTO-X, which are uncorrelated with each other. PCA uses an orthogonal transformation to summarize data with many correlated variables into smaller set of derived components (variables) with zero covariance between them. One component (WTO+) was formed from the 14 WTO+ provisions, whereas another component (WTO-X) was formed using the other 38 WTO-X provisions, which has allowed to capture as

[5] See Horn et al. (2010) for further information on the differentiation between WTO+ and WTO-X provisions and also between provisions that are 'Legally Enforceable' and those that come under the category of 'Area Covered'.

much variability in the data as possible. This measure leads to a loss of variation in the data and some information, but it also allows for more precise estimates of the effect of the two different types of provisions, WTO+ and WTO-X. The newly formed WTO+ and WTO-X principal components are the weighted average of the underlying indicators (provisions).[6]

The coefficients on the WTO+ and WTO-X variables cannot be interpreted in terms of elasticities. The reasons for this are twofold; firstly, the WTO+ and WTO-X are principal variables formed by using the principal component analysis. Secondly, it would not make sense to interpret the WTO+ and WTO-X variables as an increase of one provision leading to an increase in trade flows by a certain amount, and vice versa. This is because we do not know which provision has increased once we do the principal component analysis. We can only compare the size and sign of the coefficients on WTO+ and WTO-X. Since the principal variable WTO+ was formed by using 14 provisions and WTO-X was formed using 38 provisions the two cannot be directly compared due to varying standard deviations. Therefore, I standardize WTO+ and WTO-X for comparison purposes. Standardizing the two variables equalizes the standard deviations of the two variables (to 1), which allows comparison between the two. I now turn to the empirical analysis of the relationship between the nature of RTAs and trade flows.

4 Empirics

4.1 Empirical Methodology

The gravity model in its logarithmic specification does not explain the occurrence of zero-flow observations due to the logarithm of zero being undefined. A linear-in-logs specification converts the zeros to missing values and these observations drop out of the sample, resulting in a selection bias. At the aggregate level, zero flows are usually occurring for trade between small or distant countries that are expected to have a small volume of trade (Frankel, 1997). In most cases, no trade between small and remote (distant) countries might also be due to other factors, such as high fixed costs (e.g., acquiring a license in foreign markets) or large variable costs (e.g., steel is too costly to transport). Thus, omitting zero trade flows can bias results, and can also lead to a loss of

[6] The underlying indicators are the 14 provisions which formed the WTO+ principal component, and 38 provisions which formed the WTO-X principal component. See tables A.3 and A.4 of the appendix for further description of the 52 provisions.

information on the causes of (very) low trade. For example, it is highly probable that Pakistan and Honduras did not trade in a given year at all.

Since the paper takes into account the zero trade flows, it uses three other methods apart from an OLS with zero trade flows. These other methods are, firstly, adding a constant to the trade flows and running an OLS ($T_{ij} + 1$). Secondly, I use a Tobit estimate, and lastly, a Poisson Pseudo Maximum Likelihood (PPML) Estimate as in Silva and Tenreyro (2006). Table 2 provides a summary of the methods I use in this paper.[7]

Table 2: Summary of Estimation Methods

Estimation Method	Advantages	Disadvantages	References
OLS (T_{ij})	-Simple	- Loss of efficiency due to the elimination of zero trade flows - Inconsistent coefficients	Linders and de Groot (2006); Westerlund and Wilhelmsson (2009); Martin and Pham (2008)
OLS ($1 + T_{ij}$)	-Simple -Deals with the zero trade flow problem	- Lack of theoretical foundation - Inconsistent coefficients	Linneman (1966); Van Bergeijk and Oldersma (1990); Wang and Winters (1991); Raballand (2003); Baldwin and Di Nino (2006)
Tobit (censored regression)	-Simple -Can be used to study zero trade flows	- Incorporates zeros and makes strong assumptions on the error term, log normality and homoskedasticity. - No consensus on what should be used as the left censor value	Soloaga and Winters (2001); Anderson and Marcouiller (2002); Rose (2004); Baldwin and Di Nino (2006); Linders (2006); Schiavo (2007); Martin and Pham (2008)
PPML (Poisson Pseudo Maximum Likelihood)	-It can be applied to study zero flows and hetereogeneity. - All observations are weighted equally. - The mean is always positive.	- It may present limited dependent variable bias when a significant part of the observations are censored. - Monte Carlo results of Poisson yield biased estimates when large number of zeros are generated by a limited dependent variable process	Silva and Tenreyro (2006); Westerlund and Wilhelmsson (2009); Silverstovs and Schumacher (2009); Liu (2009); Hebble, Sheperd and Wilson (2007); Martinez-Zarzaso et al. (2008); An and Puttitanum (2009)

Having seen the main characteristics of the four estimation techniques used in this paper, I now briefly discuss these four methods. Instead of ignoring the observations with $T_{ij} = 0$,

[7]The Table is based on Table 1 of Herrera (2010).

some authors do their estimations using $1 + T_{ij}$ as the regressand. Adding a small constant (1 in this paper) to the zero trade flows can take care of this problem because the double-log model can be estimated without throwing these country pairs out of the sample. For example, log (0) is undefined, but log (0+1) is not. Adding a small positive number to all trade flows is a good place to start to see if including or excluding zeros appears to make much of a difference empirically. This methodology is used in policy literature, but has no theoretical basis, and is only an approximation. The value that is inserted is arbitrary and does not reflect the underlying expected value, therefore, inserting arbitrary values close to zero does not provide any formal guarantee that the resulting estimates of the gravity equation are consistent (Linders, 2006).

Since the natural method to handle data generated by a limited dependent variable process is a Tobit, I also employ the censored regression model (Tobit) because a large fraction of the observations cluster at the (zero) limit. The Tobit model describes a situation in which some of the observations of the dependent variable are censored (unobservable) and represented instead by mapping them to a specific value, generally zero. I use this model because in this particular situation I cannot determine the outcome over some range, either because actual outcomes cannot reflect desired outcomes (e.g., trade cannot be negative), or because of measurement inaccuracy (e.g., rounding). For this paper, the trade flow data being used is import flows from country *i* to country *j,* and the concern I have here is that the rounding of trade flows is an important issue. I have substituted 1 (=$1000) for the zeros, and put the censoring limit to ln(1)=0, censoring all flows below $1000 including the zero observations. This method of imposing a censoring limit is arbitrary, due to the absence of actual rounding of trade flows. Therefore, though I treat the zeros as if they were censored, there is no direct causal relationship between the zero flows and the imposed censoring limit. Cameron and Trivedi (2009, p. 531) suggest the usage of the observed minimum value of logged exports as the left-censor value.

The estimates using OLS with T_{ij}, $1 + T_{ij}$, or Tobit can generally lead to inconsistent estimates of the β (Silva and Tenreyro, 2006), which is why I also employ the PPML estimation technique. The PPML model which is commonly used for count data can also be applied to non-integer variables, and is equivalent to (weighted) non-linear least

squares.[8] The estimator is consistent under weak assumptions, and the data need not be distributed as Poisson. The reason PPML is useful is because the econometric estimates of log-linearized models can be misleading due heteroskedasticity, whereas the PPML takes this into account. It is important to mention here that when using use PPML the dependent variable is trade, not the natural log of trade. However, the gravity variables still enter in logs and the coefficients can still be interpreted as elasticities.

Using the four different econometric methods, I estimate a theoretically motivated gravity equation which is augmented by adding the provision (WTO+ and WTO-X) variables. Most recent gravity model estimates use panel data rather than cross section data. Some examples include Egger 2000; Rose and van Wincoop 2001; Glick and Rose 2002; Brun et al. 2005. In contrast to a cross-sectional dataset, a panel framework allows to recognize how the relevant variables evolve through time and to identify the specific time or country effects (economic, institutional, cultural, time invariant or country invariant factors). Therefore, I add the relevant controls and variables of interest. In a panel context, equation (4) can be written as follows:[9]

$$lnT_{ijt} = \beta_0 + \beta_1 ln\mathrm{GDP}_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnDIST_{ij} + \beta_4 Control_{ij} + \beta_5 WTO(+)_{ij}.RTA_{ij} + \beta_6 WTO(x)_{ij}.RTA_{ij} + \beta_7 RTA_{ij} + \eta_{ij} \quad (8)$$

Controls added are common to the gravity literature, i.e., bilateral distance and dummies for common border, official language and common colonizer.

4.2 Endogeneity Issues

The estimates of the main coefficients of interest, β_5 and $\beta_6$in equation (8) are contaminated by several sources of endogeneity, discussed below.

4.2.1 Self Selection

Literature on the determinants of RTAs suggests a "market for regionalism" view of regional trade integration, where countries choose their trading partners (Baier and Bergstrand, 2007) and the form of the RTA (Vicard, 2009) according to economic and

[8] See Cameron and Trivedi (2009) and Winkelmann (2003) for more details on the Poisson regression and on more general models for count data.
[9] The logarithms of the dependent variable (bilateral trade flows) would be dropped prior to using the Poisson method to estimate equation (8).

political determinants. Therefore, ex post estimation of the effect of RTAs and their content (WTO+ and WTO-X in this case) are likely to suffer from a selection bias, because a country pair that has more to gain from regional integration is more likely to create an RTA and to choose the appropriate nature of regional integration. I account for self-selection by using a panel data with time and bilateral fixed effects. Time-invariant bilateral determinants of trade are dropped when bilateral fixed effects are introduced.

4.2.2 Measurement Errors

Zeros in a trade matrix may be a result of rounding the trade flows. For example, if trade is measured in thousands of dollars, it is likely that for a country pair for while bilateral trade did not reach a minimum value, say $250, the value of trade is registered as 0. If these rounded down observations were compensated by rounded-up ones, the overall effect of these errors would be negligible. The rounding down is more likely to occur for countries that are small in size and are remotely located, which entails that the probability of rounding down will depend on the values of the covariates, leading to inconsistency of the estimators. It can also be the case that zeros can be missing observations that are wrongly recorded as 0. The problem is more likely to occur when small countries are considered, and in this case as well the measurement error will depend on the covariates, leading to inconsistency (Silva and Tenreyro, 2006).

Techniques that incorporate zeros may also generate biased results if some trade flows are incorrectly specified as zeros.[10] In the UN Comtrade dataset, there are examples of reported zeros in colony-metropole trade before and after independence that should be coded as missing, but are reported as zeros. For example, British exports to Singapore are spuriously recorded as zero before 1963 (1964 is the year of independence), whereas there is a sudden jump in trade for post-independence Singapore and the United Kingdom. Such incorrect zero-trade observations can result in biased estimates.

4.2.3 Two Types of Zeros

When the trade matrix was balanced, the missing values in the trade flows variables and among the provisions were replaced by zeros. The zeros in question in this sub-section are those present in the provisions. Some of those zeros occur when a certain provision is not

[10] Trade data can suffer from many other forms of errors, as described in Feenstra et al. (1997).

included in an RTA, whereas others are those zeros that naturally do not occur when an RTA is not signed. For example, if a certain country pair (Canada-Mexico) has signed an RTA but their agreement does not contain the provision on TBT, then it would be recorded as zero in the database. If another dyad (Peru-Bhutan) does not have an RTA between them, then naturally the database for the pair would include zeros for all provisions including TBT. The zero of TBT, for Canada-Mexico is different than the zero of TBT for Peru. Not differentiating between the two zeros would bias the results. Table 3 provides an illustration of this problem:

Table 3: Differentiating between the two types of zeros present in the provisions

Country i	Country j	Provision 1	Provision 2	Provision 3	RTA
CAN	MEX	1	0	2	1
JAP	SIN	2	1	1	1
PER	BHU	0	0	0	0

In order to solve for this problem, I form a new variable by interacting RTA_{ij} with $WTO(+)$ and $WTO(x)$. The two new variables formed are $WTO+_{ij}.RTA_{ij}$and $WTOx_{ij}.RTA_{ij}$. By constructing the two new variables I am able to econometrically distinguish between the two different zeros.

4.2.4 Reverse Causality

An increase in trade flows might lead to an increase in the number of provisions included in a given RTA, or a high number of provisions in a certain RTA might result in an increase in trading volume, thereby leading to a reverse causality issue. This can lead to overestimating the coefficients β_5 and β_6 because an increase in provisions would lead to a higher probability of an increase in trade flows. Therefore, there is a potential endogeneity problem which can be dealt in two ways: using country-pair fixed effects or by differencing the data. Taking fixed effects also solves the problem partially, but does not take into account everything, as detailed in section 3.7.

4.2.5 Omitted Variables

In equation (8), the coefficients of WTO+ and WTO-X and their interaction with the RTA dummy, β_5 and β_6 could be contaminated by omitted co-determinants of including a provision (+ or X) and GDP of the two countries. Indeed, there are many economic,

political and social variables that determine the inclusion of a certain provision in an RTA. Trade flows are affected by many other variables other than GDP, distance, common language, common colonizer, common border and the provisions present in an RTA text. Including controls and fixed effects partially solves for this problem.

4.3 Fixed versus Random Effects

To estimate my panel data I used fixed effects rather than random effects, for two reasons; First, one of the sources of endogeneity bias in the gravity equation is unobserved heterogeneity. There are unobserved time-invariant bilateral random variables (v_{ij}) which are included in the error term(η_{ij}), which simultaneously influences the presence of a provision (with WTO+ or WTO-X) and the volume of trade. Though these variables are random, they are best taken into account by using bilateral fixed effects, since it allows for arbitrary correlations of v_{ij} with T_{ij}. If I had used random effects, I would have to assume zero correlation between unobservables v_{ij} with T_{ij}, which is not plausible. Secondly, recent literature also prefers the usage of fixed effects rather than random effects. For example, Egger (2000) rejects the random effect gravity model compared to the fixed effect gravity model, using either bilateral-pair or country-specific fixed effects. The next section discusses the different effects used when measuring the gravity equation and taking into account the 'gravitational un-constant' terms.

4.4 Accounting for 'Gravitational Un-Constant' Terms

Recent research provides formal economic foundations for the atheoretical gravity while taking into account price levels to avoid any estimation bias due to the omission of 'gravitational un-constant' terms (Anderson and van Wincoop 2003, 2004; Feenstra 2004). Baldwin and Taglioni (2006) show that since 'gravitational un-constant' terms are usually time varying, the methodology put forward by Anderson and can Wincoop (2003) does not work in a panel setting. Therefore, country-and-time fixed effects should be included to specify the gravity equation properly with panel data, as doing this will take into account the 'gravitational un-constant' terms that vary over time.

Accounting for 'gravitational un-constant' terms, the proper way to express (8) is:

$$lnT_{ijt} = \beta_0 + \beta_1 ln\mathrm{GDP}_{\mathrm{it}} + \beta_2 lnGDP_{jt} + \beta_3 lnDIST_{ij} + \beta_4 Control_{ij} + \beta_5 WTO(+)_{ij}.RTA_{ij} + \beta_6 WTO(x)_{ij}.RTA_{ij} + \beta_7 RTA_{ij} - lnP_{it}^{1-\sigma} - lnP_{jt}^{1-\sigma} + \eta_{ij} \quad (9)$$

Note that the difference between equation (8) and (9) is the inclusion of terms $lnP_{it}^{1-\sigma}$ and $lnP_{jt}^{1-\sigma}$ in (9). In a panel context, the price variables are time varying, and therefore econometric estimates using equation (8) would suffer from an omitted variable bias due to the exclusion of time-varying variables. When estimated on panel data, there are two potential sources of bias; firstly, the usage of constant price trade data, which Baldwin and Taglioni (2006) refer to as the 'bronze medal mistake'. I measure trade flows in constant US dollars, but any significant trend in US inflation will generate an omitted variable bias in the parameter estimates. Since all trade data are deflated in the same manner, I use time dummies to reduce the severity of the 'bronze medal mistake'. Also, since the time period consists of only sixteen years, this is less of a problem. Secondly, some elements of the 'gravitational un-constant' change over time, and not taking them into account leads to an omitted variable bias, referred to as the 'gold medal error' by Baldwin and Taglioni (2006).

Though many elements in equation (9), common border, common language and common colonizer are intrinsically time invariant, others, $WTO(+)_{ij}.RTA_{ij}$ and $WTO(x)_{ij}.RTA_{ij}$ are not. This is a dilemma that cannot be solved by proxying for the 'gravitational un-constant' using only country-specific dummies since that would only control for the *average over time* of 'gravitational un-constant' and not the time-varying component. The time varying component enters the error term and results in a potential source of bias if correlated with the variables of interest. Therefore, it is necessary to allow for time variation in the 'gravitational un-constant' terms. Fixed effects using the panel data in its current form (levels) is not an optimal solution either since it only partially eliminates the gold medal bias.

I do my estimations using country-and-time (it, jt) effects, imposing the restriction of unitary income elasticity from equation (6). Country fixed effects could have been interacted with time to control for the time-varying aspect of 'gravitational un-constant', but adding fixed effects to time-and-country effects is unnecessary since the variables distance, adjacency and to some extent common language, control for the idiosyncratic bilateral trade factors. Another reason why it is unnecessary is that doing so would entail

adding additional NT regressors (over 2,000 in this case), which due to the large dataset was not possible to compute. Also, the time varying component of the 'gravitational un-constant' should not cause too many problems in this model because there is little variation in $WTO+_{ij}.RTA_{ij}$ and $WTOx_{ij}.RTA_{ij}$.[11] Results presented in the next section also suggest that using country-and-time bilateral fixed effects would not change the qualitative results, since the signs on the coefficients in columns (1) and (2) remain consistent across different econometric methods.

5 Results

This section summarizes the results of estimating the gravity equation over the period 1994-2010 using OLS with zero trade flows. The results in this section use a panel of trade flows (T_{ijt}) and real GDPs (GDP_{it}, GDP_{jt}) performing alternative specifications with and without fixed effects, time effects and country effects. Coefficients on the control variables are found significant and all have the expected sign; geographical distance impedes bilateral trade, whereas sharing a common border, language and colonial history increases trade.[12] In all tables presenting the regression results in section 4, column (1) estimates equation (9), whereas columns (2) to (6) use equation (8). The proper way to interpret the coefficients on $WTOplus$ and $WTOx$ would be to keep the RTA coefficient in perspective, and adding it to the coefficients on $WTO+.RTA_{ij}$and $WTOx.RTA_{ij}$. To see the individual impact of RTA on trade volume, see Table A.7 of the appendix. The standard errors provided in the regression results are clustered at the country-pair level since I work in direction-specific trade flows rather than the more traditional average of bilateral flows.

5.1 Benchmark Estimation

Table 4 uses the OLS with zero trade flows to estimate the gravity equation where column (1) is the benchmark specification. In a panel setting the multilateral prices variables would be time varying, therefore I estimate equation (9) using country-and-time effects and present the results in column (1). According to the theory that motivates equation (9), this

[11] There is only a onetime change in the provisions data. When a country pair signs an RTA, the provisions included are either classified as Areas Covered (1) or Legally Enforceable (2) and from then on do not change with time. A switch from 0 to1 or 0 to 2 is seen, and once the switch takes place, it stays constant.

[12] Results remain qualitatively similar when the coefficient on GDPs is constrained to 1, i.e. when the dependent variable is replaced by $T_{ijt} = (ln\frac{imp_{ijt}}{GDP_{it}GDP_{jt}} + ln\frac{imp_{jit}}{GDP_{it}GDP_{jt}})/2$

should generate unbiased estimates for the variables of interest, and substantially reduce the magnitude of the gold medal error (not taking into account the 'gravitational un-constant').[13] In certain RTAs, WTO+ or WTO-X provisions might have a tendency to occur more than the average level of WTO+ or WTO-X provisions among all RTAs in the sample. Results indicate that above average WTO+ provisions (in a given RTA) are harmful for trade, whereas, the above average inclusion of WTO-X provisions is trade-promoting, as shown by the coefficients of $WTO+.RTA_{ij}$and $WTOx.RTA_{ij}$ which are negative and positive respectively, and are both highly significant. WTO+ provisions are harming trade on the margin, but we also see that the aggregate result of signing an RTA by including both WTO+ and WTO-X provisions is positive.[14] The results also show that the presence of WTO+ in an RTA text is in itself not harmful since we have to interpret its coefficient by adding it to that of the RTA. The negative sign on $WTO+.RTA_{ij}$ also shows us that when RTAs are biased towards WTO+ provisions compared to WTO-X provisions, we have a selection bias, which biases β_5 downwards.

Column (2) provides results using both time and bilateral fixed effects. The time dummies correct for the bronze medal mistake (incorrect deflation of bilateral trade), and the bilateral fixed effects reduce the severity of the gold medal mistake by eliminating cross-section correlation between the omitted 'gravitational un-constant' terms and included variables.[15] The cross-section correlation is expected to be positive so including time effects reduces the estimated impact of WTO+, WTO-X and RTA dummy. Comparing columns (1) and (2), we see that the coefficients on the variables of interest fall substantially. The point estimates on the economic mass variables ($lnRGDP_i$and $lnRGDP_j$) also appear in line with theory. Underestimation of the coefficients in this specification should be expected since deflating the GDP by the GDP price deflator is a measurement error (or a noisy version) of the correct estimator, i.e., nominal GDP deflated by the gravitational un-constant term. However, the variables of interest are all insignificant at conventional significance levels. The reason is that the data on the provisions, which helped make the principal components WTO+ and WTO-X only witness a onetime change (when the RTA is signed), and then stay constant. Since there is only a onetime switch the

[13] See section 3.7 for a detailed explanation on country-and-time effects and the gold medal error.
[14] $\beta_5 + \beta_6 + \beta_7 = (0.280 + 0.121 + (-0.149) = 0.252)$
[15] See section 3.7 for a detailed explanation on the 'gravitational un-constant' and the bronze medal error.

pair dummy wipes out all the cross-section correlation between the WTO+, WTO-X and RTA coefficient and bilateral trade. This is one of the drawbacks of using bilateral fixed effects, when working with data with little variation.

Column (3) of Table 4 uses bilateral fixed effects to adjust for unobserved heterogeneity. It displays the results with bilateral fixed effects when the incorrect deflation of trade is not offset with time effects. After having analyzed column (2), a cursory look at column (3) illustrates the importance of the bronze medal mistake. The results do not make much sense, since the point estimates on the economic mass coefficients and RTA dummy are too low. Recently, many authors working with gravity equations have ceased to report such results in panel estimation, and almost always include time effects despite the lack of clear theoretical motivation.

Column (4) of Table 4 includes country fixed effects and we see that the variables of interest have results qualitatively similar to column (1), though the economic mass coefficients are too low to establish its credibility. This further reinforces the point of the bronze medal error.

Column (5) of Table 4 provides empirical results using a time dummy, where (for brevity) I omit reporting the coefficient estimates for these dummy variables. This specification corrects the bronze medal mistake. This correction implies little changes in the size of the variables of interest, but the coefficient on WTO+ at the margin does not have a negative impact on trade as opposed to column (1) and (4). In other words, the bronze mistake in isolation would reverse the policy conclusion from the gravity equation regression. The aggregate impact of both WTO+ and WTO-X is again positive, which shows us that the inclusion of these provisions in an RTA text is trade-promoting. Time effects however, do not adjust for the endogeneity of WTO+ and WTO-X provisions.

Column (6) of Table 4 provides the baseline gravity equation (naive regression) without any fixed effects or time dummies for all 16 years. This is only included for comparison purposes, since nothing has been controlled for in this estimation.

Table 4: OLS [dependent variable is $\ln(T_{ij})$]

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	With Country-and-Time Effects	With Time and Bilateral Fixed Effects	With Bilateral Fixed Effects	Country Fixed Effects	With Time Effects	No Fixed or Time Effects
$lnRGDP_i$		1.083***	0.913***	0.860***	1.104***	1.087***
		(0.051)	(0.039)	(0.042)	(0.009)	(0.009)
$lnRGDP_j$		0.812***	0.643***	0.459***	1.317***	1.298***
		(0.057)	(0.042)	(0.045)	(0.008)	(0.008)
$lnDIST_{ij}$	-1.417***			-1.407***	-1.219***	-1.210***
	(0.024)			(0.024)	(0.023)	(0.023)
ADJ_{ij}	0.807***			0.941***	0.691***	0.726***
	(0.102)			(0.103)	(0.102)	(0.102)
$LANG_{ij}$	0.741***			0.733***	0.796***	0.788***
	(0.047)			(0.048)	(0.053)	(0.053)
COL_{ij}	0.997***			0.987***	0.653***	0.612***
	(0.063)			(0.065)	(0.071)	(0.071)
$WTO +* RTA_{ij}$	-0.149***	0.008	0.007	-0.144***	0.078***	0.084***
	(0.015)	(0.012)	(0.012)	(0.015)	(0.015)	(0.014)
$WTOx * RTA_{ij}$	0.121***	-0.03	-0.031	0.114***	0.110***	0.096***
	(0.029)	(0.034)	(0.034)	(0.030)	(0.034)	(0.034)
RTA_{ij}	0.280***	0.073	0.069	0.300***	0.14	0.192*
	(0.097)	(0.010)	(0.010)	(0.010)	(0.113)	(0.113)
RMSE	1.990			1.97	2.388	2.413
Overall R^2	0.756	0.486	0.472	0.747	0.629	0.621
Between R^2		0.55	0.536			
Within R^2		0.486	0.088			
No. Observ.	205680	164201	164201	164201	164201	164201

Robust standard errors (clustered by country-pairs) recorded in parenthesis. Intercepts not reported.
Significance levels: ***1%, **5%, *10%

5.2 Robustness analysis

In this section, I test for the sensitivity (robustness) to zeros present in the trade matrix as this is a potentially major source of bias. I use OLS with $(1 + T_{ij})$, Tobit and the Poisson Maximum Likelihood technique to assess the sensitivity of my results for using different methods of correcting for zero trade flows.[16] The findings on the gravity variables and controls of the sensitivity analysis reported in Tables 5, 6 and 7 are in line with the existing literature. Throughout the robustness analysis, column (1) with country-and-time effects would be the focus of discussion.[17]

[16] Refer to section 3.3 for the motivation of using these methods.
[17] Though emphasis would be on column (1), the results in column (2) are also important for comparison purposes because both columns are controlling for different things. Columns (3) to (6) are useful for comparison purposes.

For the results in Table 5, a small constant (one) was added to the trade flow variable. This allows to take into account the zeros present in the trade flow matrix. Once the constant is added and logs taken, the observations do not drop off as opposed to the method used in Table 4 (OLS with T_{ij} as the dependent variable), which is why the estimation in Table 5 has more observations than Table 4. Further analysis shows us that both $WTO+.RTA_{ij}$ and $WTOx.RTA_{ij}$ have negative signs (though the former is insignificant). This indicates that above average presence of these provisions in a given RTA would lead to a negative impact on bilateral trade flows. Though in aggregate terms, the effect of signing an RTA in the presence of WTO+ and WTO-X would lead to a positive outcome for trade. Column (2) gives significant results for both $WTO+.RTA_{ij}$ and $WTOx.RTA_{ij}$, and shows that on the margin, WTO+ is beneficial for trade.

Table 5: OLS [dependent variable is $\ln(1 + T_{ij})$]

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	With Country-and-Time Effects	With Time and Bilateral Fixed Effects	With Bilateral Fixed Effects	Country Fixed Effects	With Time Effects	No Fixed or Time Effects
$lnRGDP_i$		0.688***	1.394***	1.424***	1.254***	1.258***
		(0.051)	(0.041)	(0.042)	(0.01)	(0.01)
$lnRGDP_j$		0.297***	1.054***	1.079***	1.168***	1.172***
		(0.057)	(0.042)	(0.042)	(0.01)	(0.01)
$lnDIST_{ij}$	-0.551***			-0.614***	-0.594***	-0.592***
	(0.05)			(0.054)	(0.039)	(0.039)
ADJ_{ij}	1.491***			1.700***	1.122***	1.114***
	(0.146)			(0.149)	(0.175)	(0.175)
$LANG_{ij}$	0.908***			0.976***	0.939***	0.940***
	(0.056)			(0.058)	(0.061)	(0.061)
COL_{ij}	0.924***			0.918***	0.669***	0.676***
	(0.060)			(0.064)	(0.070)	(0.07)
$WTO + * RTA_{ij}$	-0.017	0.163**	0.169**	-0.046**	0.193***	0.192***
	(0.020)	(0.069)	(0.07)	(0.021)	(0.016)	(0.016)
$WTOx * RTA_{ij}$	-0.288***	-0.687***	-0.680***	-0.210***	-0.131***	-0.129***
	(0.036)	(0.091)	(0.091)	(0.037)	(0.037)	(0.037)
RTA_{ij}	3.003***	5.977***	6.086***	2.648***	2.690***	2.708***
	(0.119)	(0.263)	(0.265)	(0.125)	(0.132)	(0.132)
RMSE	2.861			2.741	3.246	3.255
Overall R^2	0.674	0.427	0.532	0.688	0.562	0.56
Between R^2		0.499	0.621			
Within R^2		0.165	0.15			
No. Observ.	335039	260829	260829	260829	260829	260829

Robust standard errors (clustered by country-pairs) recorded in parenthesis. Intercepts not reported.
Significance levels: ***1%, **5%, *10%

Table 6 estimates equation (8) by using the Tobit estimation technique.[18] Interpreting estimated coefficients from the Tobit model is more complex than interpreting estimated coefficients from the ordinary least squares model. Therefore, the coefficients I report in Table 4 are marginal effects in terms of the latent variable. The marginal effects have been scaled down by a fixed proportion (related to the share of zeros). The results using this methodology are similar to results in Table 1. The highly significant coefficients on $WTO+.RTA_{ij}$ and $WTOx.RTA_{ij}$ indicate that a country-pair would greatly benefit from signing an RTA including both types of provisions, but an above-average presence of WTO+ in that RTA would be harmful for trade. If we look at the impact of WTO+ and WTO-X individually, we see that both types of provisions are trade-promoting. As in the previous two tables, the aggregate impact of including the two provisions in a given RTA is positive. One of the main takeaways from Table 6 is that small changes in the specification of implementing Tobit yield drastic changes in the results.[19]

[18] Table 6 does not present specifications involving bilateral fixed effects since bilateral fixed effects are not possible in Tobit as there does not exist a sufficient statistic allowing the fixed effects to be conditioned out of the likelihood.

[19] I provide pseudo R^2 values instead of overall R^2 because Tobit is a Maximum Likelihood Estimate (MLE).

Table 6: Tobit [dependent variable is $\ln(a + T_{ij})$]

Variable	(1) With Country-and-Time Effects	(2) Country Fixed Effects	(3) With Time Effects	(4) No Fixed or Time Effects
$lnRGDP_i$		1.423***	1.038***	1.041***
		(0.014)	(0.009)	(0.009)
$lnRGDP_j$		0.712***	0.933***	0.937***
		(0.007)	(0.010)	(0.009)
$lnDIST_{ij}$	-0.345***	-0.392***	-0.488***	-0.486***
	(0.001)	(0.003)	(0.032)	(0.032)
ADJ_{ij}	0.898***	1.133***	0.476***	0.463***
	(0.011)	(0.017)	(0.139)	(0.139)
$LANG_{ij}$	0.830***	0.927***	0.774***	0.775***
	(0.011)	(0.016)	(0.054)	(0.054)
COL_{ij}	0.761***	0.823***	0.651***	0.663***
	(0.012)	(0.015)	(0.069)	(0.069)
$WTO + * RTA_{ij}$	-0.124***	-0.129**	0.048**	0.047***
	(0.002)	(0.002)	(0.013)	(0.013)
$WTOx * RTA_{ij}$	0.032***	0.082***	-0.057***	0.060***
	(0.003)	(0.004)	(0.027)	(0.027)
RTA_{ij}	1.715***	1.449***	1.942***	1.958*
	(0.020)	(0.02)	(0.124)	(0.125)
Pseudo R^2	0.228	0.191	0.153	0.151
No. Observ.	335039	260829	260829	260829

Tobit coefficients are marginal effects computed at means for the observed dependent variable.
Robust standard errors (clustered by country-pairs) recorded in parenthesis. Intercepts not reported.
Significance levels: ***1%, **5%, *10%

Table 7 reports the results of the Poisson Pseudo Maximum Likelihood (PPML) estimate. Since the PPML takes care of heteroskedasticity and is the most efficient method in taking into account zeros in the trade matrix, it is my preferred estimation. Analyzing the coefficients on WTO+ and WTO-X at the margin, we see that they have opposite signs compared to column (1) of Table 2 and 4, and that WTO-X becomes insignificant. Though, if we aggregate them, the interpretation of the results using the Poisson technique does not change, compared to the estimation techniques used before. If we consider PPML as the best method of estimation we see (looking at columns 1 and 2) that on the margin WTO+ has a higher impact on trade, whereas WTO-X has a negative impact if there is an above average presence of it. This makes sense because WTO-X provisions are more regulatory in nature compared to WTO+ provisions. These regulations often result in impeding trade, but at the same time might promote investment or achieve other goals, which is why countries continue to sign them.

Table 7: Poisson [dependent variable is(T_{ij})]

Variable	(1) With Country-and-Time Effects	(2) With Time and Bilateral Fixed Effects	(3) With Bilateral Fixed Effects	(4) Country Fixed Effects	(5) With Time Effects	(6) No Fixed or Time Effects
$lnRGDP_i$		1.201***	0.729***	0.683***	0.887***	0.885***
		(0.107)	(0.091)	(0.105)	(0.046)	(0.044)
$lnRGDP_j$		1.301***	0.975***	0.997***	0.803***	0.800***
		(0.083)	(0.074)	(0.087)	(0.038)	(0.036)
$lnDIST_{ij}$	-0.294***			-0.257***	-0.488***	-0.487***
	(0.077)			(0.084)	(0.08)	(0.080)
ADJ_{ij}	1.097***			1.332***	0.900***	0.902***
	(0.137)			(0.152)	(0.216)	(0.216)
$LANG_{ij}$	0.361***			0.340***	0.648***	0.647***
	(0.101)			(0.109)	(0.141)	(0.141)
COL_{ij}	0.681			0.578***	-0.191	-0.198
	(0.155)			(0.169)	(0.352)	(0.350)
$WTO +* RTA_{ij}$	0.028***	0.146***	0.136***	0.061**	0.119***	0.119***
	(0.027)	(0.051)	(0.048)	(0.026)	(0.029)	(0.029)
$WTOx * RTA_{ij}$	-0.014	-0.209**	-0.227**	-0.032	0.099	0.101
	(0.061)	(0.093)	(0.093)	(0.06)	(0.066)	(0.065)
RTA_{ij}	0.598***	0.777***	0.825***	0.566***	-0.27	-0.277
	(0.211)	(0.231)	(0.226)	(0.216)	(0.300)	(0.310)
No. Observ.	335039	260829	260829	260829	260829	260829

Robust standard errors (clustered by country-pairs) recorded in parenthesis. Intercepts not reported.
Significance levels: ***1%, **5%, *10%

Comparing all of the above results we see that my estimation is highly sensitive to the four different econometric techniques. This suggests that the nature of an RTA matters in promoting trade, but the direction and magnitude of different RTAs is unclear. There is not enough nuance in the regressions to extract more information. Some further nuance and interaction term might be able to give some more information. We also see that the aggregate impact of RTAs (including WTO+ and WTO-X provisions) is always positive, and therefore robust for various econometric techniques that attempt to solve for the zero trade flow problem. However, the individual impact of WTO+ and WTO-X provisions is not always consistent, and varies depending on the econometric procedure and specification used. Therefore, I cannot make a concrete inference on the individual impact of WTO+ and WTO-X provisions on trade, partially due to the sensitivity of various procedures used.

Results also indicate that above average occurrence of either WTO+ or WTO-X provisions can be detrimental to trade. This is because many of these provisions are regulatory in nature and therefore more complicated to implement, which impedes trade flows.

6 Concluding Remarks

The purpose of this paper was to analyze whether the nature of RTAs matters in promoting trade. A motivation for this paper came from the fact that today's RTAs are much different than those signed two decades ago, since nowadays RTAs encompass issues that are more complex than tariff cuts, e.g., regulatory mechanisms on illegal immigration, civil protection and competition policy among others. In this paper I provide a thorough empirical analysis of the impact of WTO+ and WTO-X provisions on trade volume, in the light of prevailing knowledge on the theoretical foundations of the gravity equation using modern econometric techniques. Using a large panel database I used four different econometric methods on a dataset used in the WTO's World Trade Report (2011), and tested for their sensitivity by using different methods to control for zeros in the trade matrix.

Controlling for the 'gravitational un-constant' terms my empirical results show the nature of an RTA matters in trade but the magnitude and direction of the relationship is unclear. This seems surprising in light of the contagious proliferation of the new 'breed' of RTAs and widespread expectations that such agreements should increase trade. My preferred method of estimation was the PPML, which showed that an above average presence of WTO+ provisions in a given RTA is beneficial for trade, whereas the above average presence of WTO-X provisions hinders trade. The question which might arise is that why countries are keen on signing more and more RTAs with provisions that are regulatory in nature. One of the answers to this question is that countries today have multiple motives to sign RTAs. Areas like investment and services are important to countries (especially in the north-south case), and might sign an RTA primarily for the promotion of these areas rather than trade.

Contributing to the little research done on the relationship between the nature of RTAs and trade, my results indicate that some WTO+ provisions foster trade while others hinder trade. Similarly, some WTO-X provisions are detrimental to trade, while others act as an obstacle. I also show that the presence of both WTO+ and WTO-X provisions in a given

RTA is always beneficial for trade, but if one of the provisions exists more than the average existence, it can have a negative impact on trade.

It is highly likely that some provisions instead of promoting trade, foster investment and services. Further work is nevertheless necessary to understand what drives gains from regionalism, and to further explore the impact of certain provisions on trade. Future avenues of research can be to look at the different factors that have led to some RTAs being different than others and also to explore how the domino theory (of regionalism) has worked for a particular provision. It would also be interesting to see how some provisions are pro-trade for the north-north case, but hinder trade for the north-south case.

References

Anderson, J. & Marcouiller, D. (2002) "Insecurity And The Pattern Of Trade: An Empirical Investigation," *The Review of Economics and Statistics*, MIT Press, vol. 84(2), pages 342-352, May.

Anderson, J.E. & van Wincoop, E. (2003) "Gravity with Gravitas: A Solution to the Border Puzzle," *American Economic Review*, American Economic Association, vol. 93(1), pages 170-192, March.

Anderson, J.E., & van Wincoop, E. (2004) "Trade Costs," NBER Working Papers 10480, National Bureau of Economic Research, Inc.

Baier,S.L. & Bergstrand, J.H., (2007) "Do free trade agreements actually increase members' international trade?," *Journal of International Economics*, Elsevier, vol. 71(1), pages 72-95, March.

Balboa, J. (2008) "Negotiated Trade Liberalization in East Asia: Examining Japan's Economic Partnership Agreement (EPA): Focusing on the Japan Philippines Economic Partnership Agreement (JPEPA)," Philippine APEC Study Center Network, Philippines Institute for Development Studies working paper.

Baldwin, R. (1994) "Towards an Integrated Europe," London: Centre for Economic Policy Research (CEPR).

Baldwin, R. & Taglioni, D. (2006) "Gravity for dummies and dummies for gravity equations," NBER Working Paper 12516, Cambridge, MA.

Baldwin, R. (2011) "21st Century Regionalism: Filling the gap between 21st century trade and 20th century trade rules," CEPR Policy Insight No. 56. May 2011.

Blomberg, S.B., DeLeire, T. and Hess, G.D. (2006) "The (After) Life-Cycle Theory of Religious Contributions," CESifo Working Paper Series 1854, CESifo Group Munich.

Brun, J., Carrère, C., Guillaumont, P., and Melo, J.D., (2005) "Has Distance Died? Evidence from a Panel Gravity Model," *World Bank Economic Review*, Oxford University Press, vol. 19(1), pages 99-120.

Cameron, A.C. & Trivedi, P.K. (2009) "Microeconometrics," Cambridge Books, Cambridge University Press, number 9780521848053

Carpenter, T. & Lendle, A. (2010) "How Preferential is World trade?," IHEID Working Paper 2010-32

Carrère, C. (2006) "Revisiting the Effects of Regional Trading Agreements on trade flows with proper Specification of the Gravity Model," *European Economic Review*, February 2006, Volume 50, Issue 2, pp. 223-247

Egger, P. (2000) "A Note on the Proper Econometric Specification of the Gravity Equation," *Economic Letters* 66: 25-31

Feenstra, R. C. (2004) “Advanced international trade: Theory and evidence,” Princeton: Princeton University Press.

Feenstra, R.C., Lipsey, R.E. and Bowen, H.P. (1997) "World Trade Flows, 1970-1992, with Production and Tariff Data," NBER Working Papers 5910, National Bureau of Economic Research, Inc.

Frankel, J. (1997) “Regional Trading Blocs,” Washington, DC: Institute for International Economics.

Frankel, J. & Wei, S. (2008) "Estimation of De Facto Exchange Rate Regimes: Synthesis of the Techniques for Inferring Flexibility and Basket Weights," IMF Staff Papers, Palgrave Macmillan Journals, vol. 55(3), pages 384-416, July.

Ghosh, S. & Yamarik, S. (2004) “Does trade creation measure up? A re-examination of the effects of regional trading arrangements,” *Economics Letters*, 82(2), 213–219

Glick, R. & Rose, A.K. (2002) "Does a currency union affect trade? The time-series evidence," *European Economic Review*, Elsevier, vol. 46(6), pages 1125-1151, June.

Helpman, E., Melitz, M. and Rubinstein, Y. (2008) "Estimating Trade Flows: Trading Partners and Trading Volumes," *The Quarterly Journal of Economics*, MIT Press, vol. 123(2), pages 441-487, 05

Herrera, E.H. (2010) “Are estimation techniques neutral to estimate gravity equations?” No 10/05, ThE Papers, Department of Economic Theory and Economic History of the University of Granada..

Horn, H., Mavroidis, P.C. and Sapir, A. (2010) “Beyond the WTO? An Anatomy of EU and US Preferential Trade Agreements,” *Bruegel Blueprint Series,* Volume VII, 87, 30–46

Kandogan, Y. (2008) “Consistent estimates of regional blocs trade effects,” *Review of International Economics*, 16(2), 301–314

Lawrence, R. (1996) “Regionalism, Multilateralism, and Deeper Integration,” Brookings Institution, Washington DC.

Linders, G.M. & de Groot, H.L.F., (2006) "Estimation of the Gravity Equation in the Presence of Zero Flows," Tinbergen Institute Discussion Papers 06-072/3, Tinbergen Institute.

Orefice, G. & Rocha, N. (2011) “Deep Integration and Production Networks: an empirical analysis,” WTO Working Paper 2011

Rose, A.K. & van Wincoop, E. (2001) "National Money as a Barrier to International Trade: The Real Case for Currency Union," *American Economic Review*, American Economic Association, vol. 91(2), pages 386-390, May.

Silva, J.M.C.S & Tenreyro, S. (2006) “The Log of Gravity,” *The Review of Economics and Statistics*, 88(4), pp. 641-658

Summers, L. & Mavroidis, P.C. (1991) "Regionalism and the world trading system," in L. Summers (ed.) Policy implications of trade and currency zones, Federal Reserve Bank of Kansas City.

Tinbergen, J. (1962) "Shaping the World Economy: Suggestions for an International Economic Policy," New York: The Twentieth Century Fund.

Vicard, V. (2009) "On trade creation and regional trade agreements: does depth matter?," *Review of World Economics*, Springer vol. 145 (2), pages 167-187, July.

Vicard, V. (2011) "Trade, conflicts and political integration: the regional interplays," R&R European Economics Review.

Westerlund, J. & Wilhelmsson, F., (2009) "Estimating the gravity model without gravity using panel data," forthcoming in *Applied Economics*.

Winkelmann, R., 2003. "Econometric Analysis of Count Data," 4th ed. Springer Verlag, Heidelberg.

World Trade Organization (2011) World Trade Report 2011: From Co-existence to Coherence (Geneva: WTO)

Yap, J.T., Medalla, E.M., and Aldaba, R.M., (2007) "The JPEPA: why ratify?," Philippine Institute for Development Studies (PIDS) Policy Notes ISSN 1656-5266, No. 2007-02

7 Appendix

Figure A.1: Evolution of provisions for EU, US and Japanese RTAs

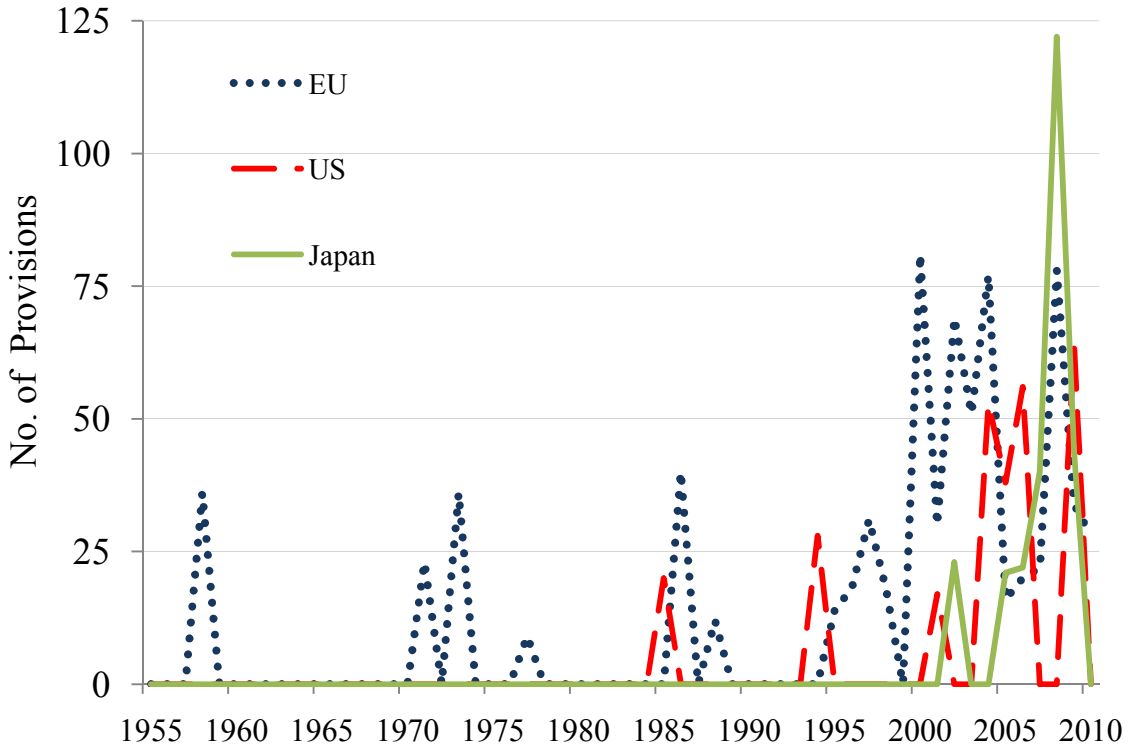


Figure A.2: Evolution of North-North, North-South and South-South RTAs

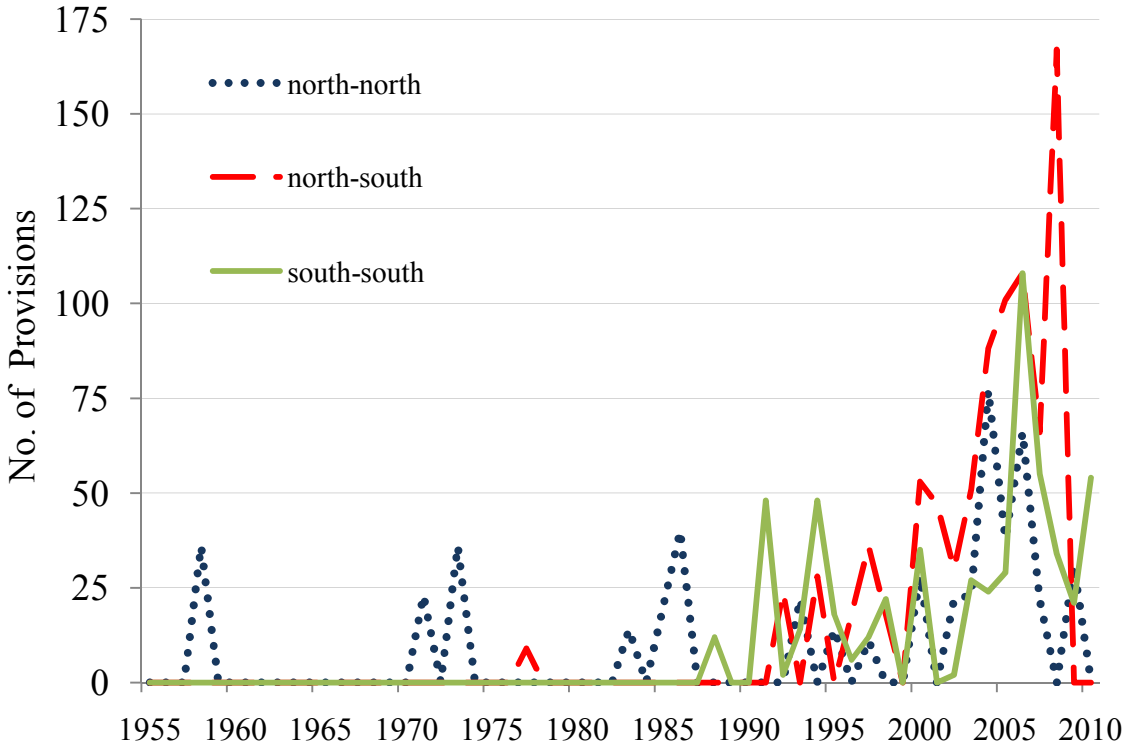


Figure A.3: Occurrence of four core provisions in all RTAs in the sample[20]

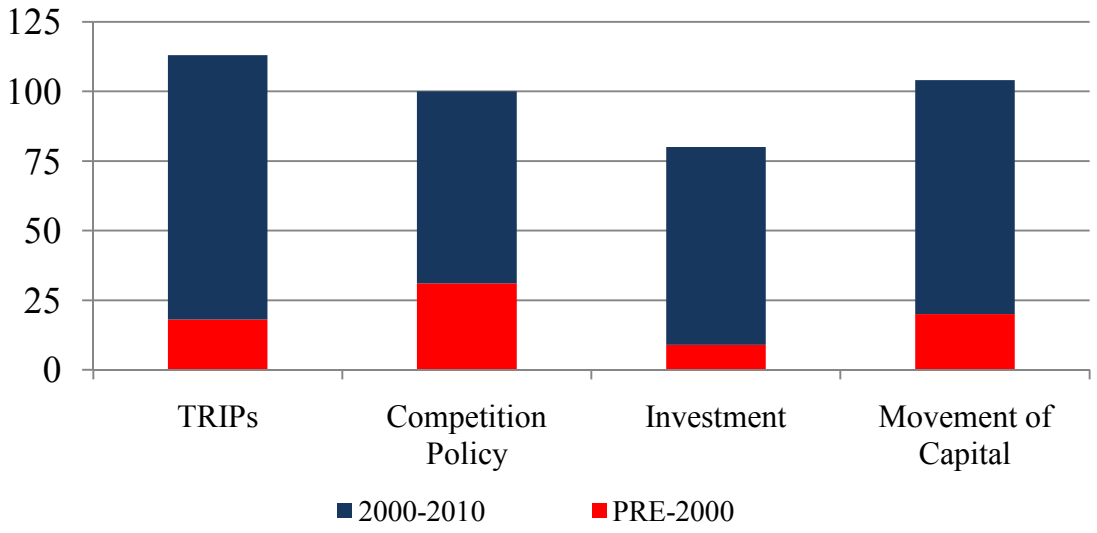
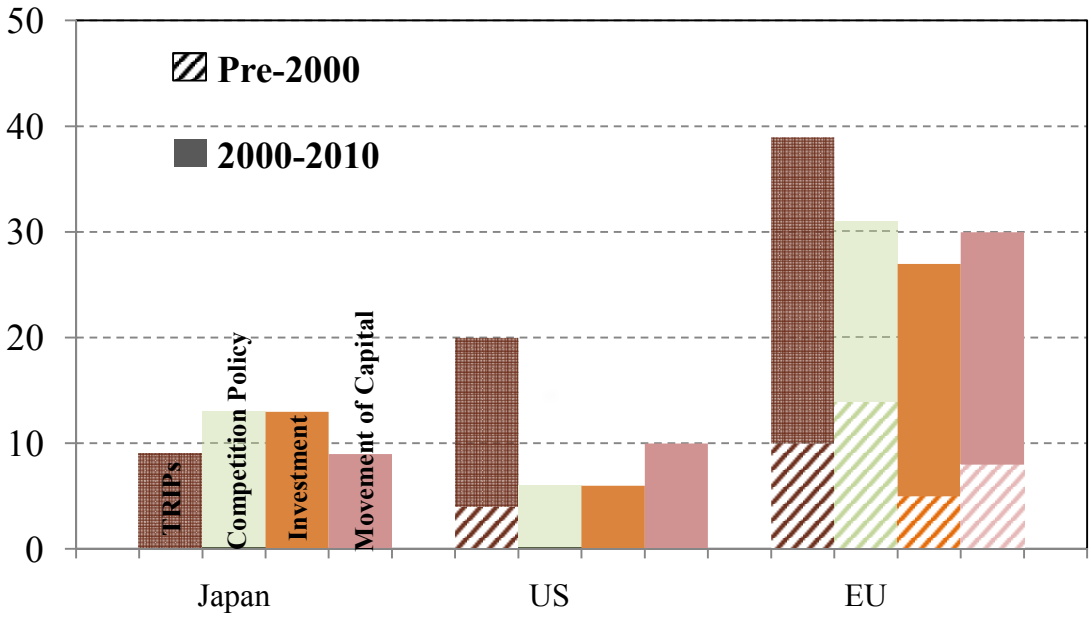


Figure A.4: Occurrence of four core provisions in US, EU and Japanese RTAs



[20] Competition policy, movement of capital and investment come under WTO-X, whereas TRIPs belongs to the WTO+ category.

Figure A.5: Volume WTO+ provisions

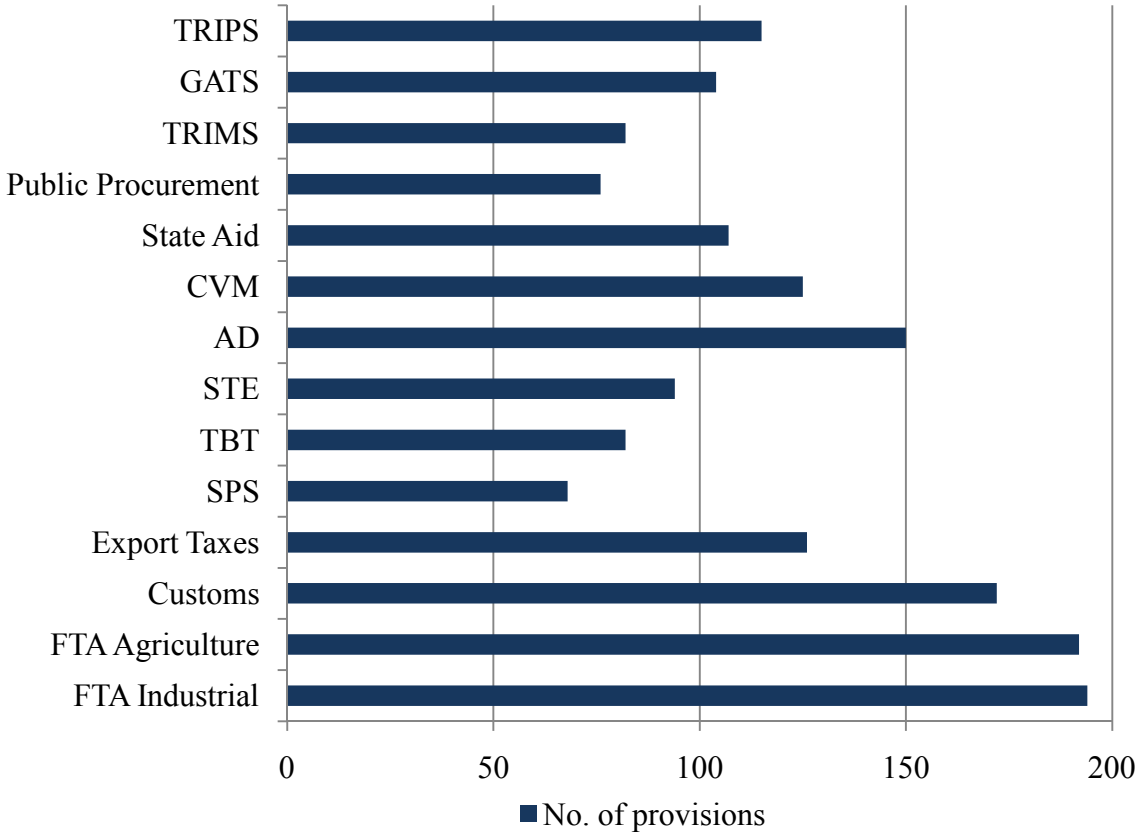


Figure A.6: Volume of WTO-X provisions

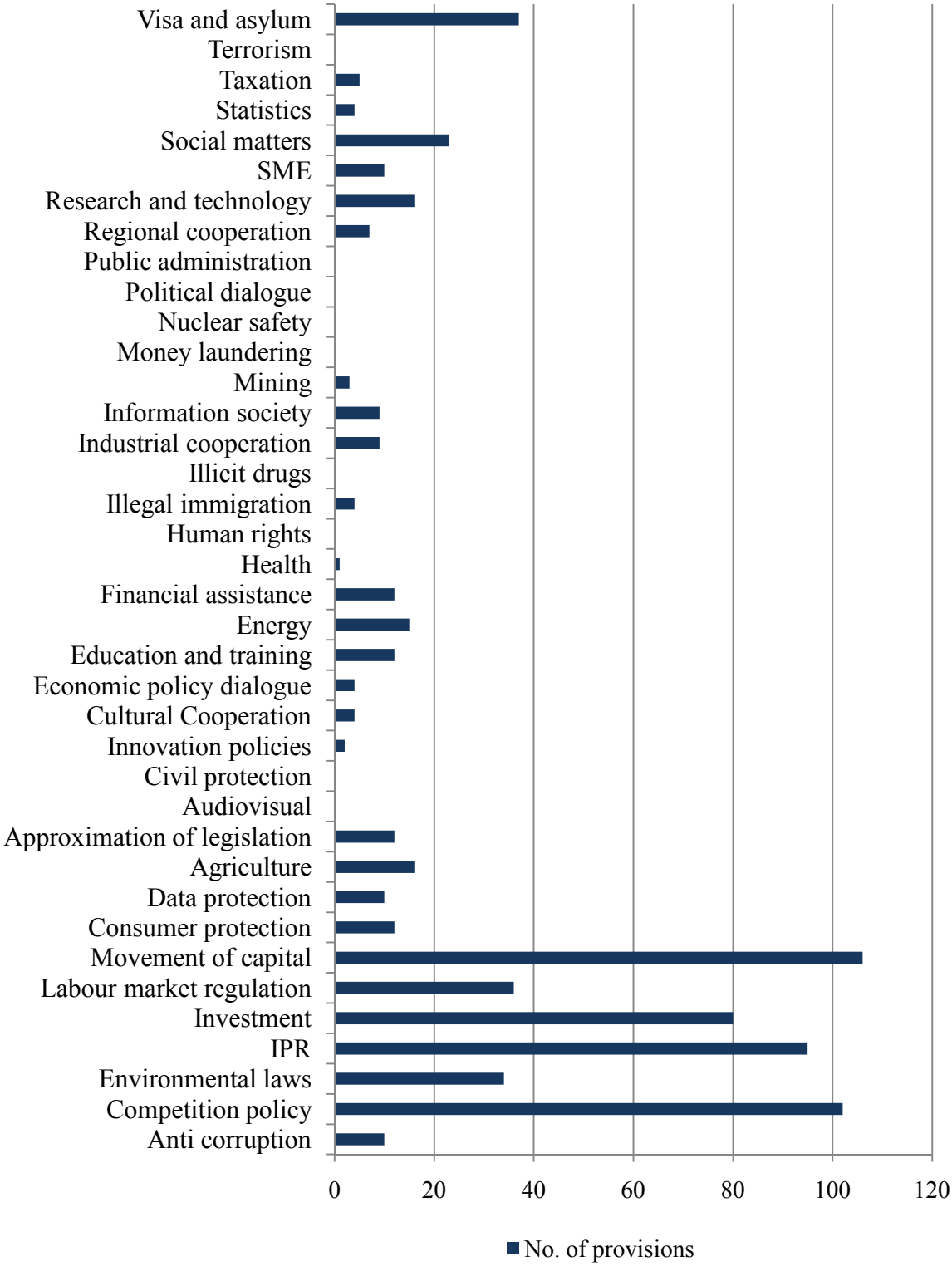


Table A.1: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
T_{ij}	337283	348396.4	3919271	0	3.83e+08
$RGDP_i$	273430	3.41e+08	1.13e+09	234471.8	1.37e+10
$RGDP_j$	264995	3.04e+08	1.07e+09	234471.8	1.37e+10
$DIST_{ij}$	335039	7150.453	4164.75	8.449664	19650.13
ADJ_{ij}	335039	0.020323	0.1411029	0	1
$LANG_{ij}$	335039	.1205113	0.325559	0	1
COL_{ij}	335039	.087742	0.2829198	0	1
$WTO+$	337283	-8.39e-09	1	-.2140125	6.784698
$WTOx$	337283	-9.55e-09	1	-.2693059	5.64565
RTA_{ij}	337283	.0792332	.2701027	0	1

Table A.2: Data Description and Sources

Variable Abbreviation	Variable Full Name	Description	Source
T_{ij}	Bilateral Trade	Value of imports by Country *i* from Country *j*, current USD.	UN Comtrade
$RGDP$	Real Gross Domestic Product	Gross Domestic Product, billion USD, current prices.	Penn World Table
$DIST_{ij}$	Distance	The great circle distance (in kilometres) between most populous cities.	CEPII
ADJ_{ij}	Adjacency	A dummy variable with value 1 if the two countries have a common border.	CEPII
$LANG_{ij}$	Common (official) language	A dummy with value 1 if the two countries have a common official language.	CEPII
COL_{ij}	Common Colonizer	A dummy with value 1 if *i* and *j* were ever colonies after 1945 with same colonizer and 0 otherwise.	CEPII
$WTO+$	WTO+ provision	Principal variable constructed from 14 WTO+ provisions using principal component analysis.	World Trade Report (2011), WTO
$WTOx$	WTO-X provision	Principal variable constructed from 38 WTO-X provisions using principal component analysis.	World Trade Report (2011), WTO
RTA_{ij}	Regional Trade Agreement	A dummy with value 1 if *i* and *j* have signed a Regional Trade Agreement and 0 otherwise.	World Trade Report (2011), WTO

Table A.3: Brief description of WTO (+) provisions

Area Covered	Content
FTA industrial goods (FTA ind.)	Tariff liberalization; elimination of non-tariff measures.
FTA agricultural goods (FTA agr.)	Tariff liberalization; elimination of non-tariff measures.
Customs administration	Provision of information; publication on the Internet of new laws and regulations; training.
Export taxes	Elimination of export taxes.
Sanitary and Phytosanitary (SPS) measures	Affirmation of rights and obligations under the WTO Agreement on SPS; harmonization of regulations; mutual recognition of agreements.
Technical barriers to trade (TBT)	Affirmation of rights and obligations under WTO Agreement on TBT; provision of information; harmonization of regulations; mutual recognition agreements.
State trading enterprises (STE)	Establishment or maintenance of an independent competition authority; non-discrimination regarding production and marketing conditions; provisions of information; affirmation of Art XVII GATT provisions.
Antidumping (AD)	Retention of AD rights and obligations under eth WTO Agreement (Art. VI GATT).
Countervailing measures (CVM)	Retention of CVM rights and obligations under the WTO Agreement (Art VI GATT)
State aid	Assessment of anticompetitive behavior; annual reporting on the value and distribution of state aid given; provision of information.
Public procurement	Progressive liberalization; national treatment and/or non-discrimination principle; publication of laws and regulations on the internet; specification of public procurement regime.
Trade-related investment measures (TRIMs)	Provisions concerning requirements for local content and export performance on foreign direct investment.
Trade in services agreement (GATS)	Liberalization of trade in services.
Trade-related intellectual property rights (TRIPs)	Harmonization of standards; enforcement: national treatment, most-favored nation treatment.

Source: Horn et al. (2010)

Table A.4: Brief description of WTO (x) provisions

Area Covered	Content
Anti-corruption	Regulations concerning criminal offence measures in matters affecting international trade and investment.
Competition policy	Maintenance of measures to prescribe anticompetitive business conduct; harmonization of competition laws; Establishment or maintenance of an independent competition authority.
Consumer protection	Harmonization of consumer protection of laws; exchange of information and experts; training.
Data protection	Exchange of information and experts; joint projects.
Environmental laws	Development of environmental standards; enforcement of national environmental laws; establishment of sanctions for violation of environmental laws; publication of laws and regulations.
Investment	Information exchange; Development of legal frameworks; Harmonization and simplification of procedures; National Treatment; Establishment of mechanisms for the settlement of disputes.
Movement of capital	Liberalization of capital movement; prohibition of new restrictions.
Labor market regulations	Regulation of the national labor market; affirmation of International Labor Organization (ILO) commitments; enforcement.
Intellectual Property Rights (IPR)	Accession to international treaties not referenced in the TRIPs Agreement.
Agriculture	Technical assistance to conduct modernization projects; exchange of information.
Approximation of legislation	Application of EC legislation in national legislation.
Audio visual	Promotion of the industry; encouragement of co-production.
Civil protection	Implementation of harmonized rules.
Innovation policies	Participation in framework programs; promotion of technology transfers.
Cultural cooperation	Promotion of joint initiatives and local culture.
Economic policy dialogue	Enhance of ideas and opinions; joint studies.
Education and training	Measures to improve the general level of education.
Energy	Exchange of information; technology transfer; joint studies.
Financial assistance	Set of rules guiding the granting and administration of financial assistance.
Health	Monitoring of diseases; development of health information systems; exchange of information.
Human rights	Respect for human rights.
Illegal immigration	Conclusion of re-admission agreements; prevention and control of illegal immigration.
Illicit drugs	Treatment and rehabilitation of drug addicts; joint projects on prevention of consumption; reduction of

	drug supply; information exchange.
Industrial cooperation	Assistance in conducting modernization projects; facilitation and access to credit to finance.
Information society	Exchange of information; dissemination of new technologies; training.
Mining	Exchange of information and experience; development of joint initiatives.
Money laundering	Harmonization of standards; technical and administrative assistance.
Nuclear safety	Development of laws and regulations; supervision of the transportation of radioactive materials.
Political dialogue	Convergence of the parties' positions on international issues.
Public administration	Technical assistance; exchange of information; joint projects; Training.
Regional cooperation	Promotion of regional cooperation; technical assistance programs.
Research and technology	Joint research projects; exchange of researchers; development of public-private partnership.
Small and medium enterprise	Technical assistance; facilitation of the access to finance.
Social matters	Coordination of social security systems; non-discrimination regarding working conditions.
Statistics	Harmonization and/or development of statistical methods; training.
Taxation	Assistance in conducting fiscal system reforms.
Terrorism	Exchange of information and experience; joint research and studies.
Visa and asylum	Exchange of information; drafting legislation; training.

Source: Horn et al. (2010)

Table A.5: List of countries in the sample

Albania	Georgia	Netherlands
Angola	Germany	Nicaragua
Argentina	Ghana	Nigeria
Armenia	Greece	Norway
Australia	Guatemala	Oman
Austria	Guinea-Bissau	Pakistan
Azerbaijan	Honduras	Paraguay
Bahrain	Hungary	Philippines
Bangladesh	Iceland	Poland
Belarus	India	Portugal
Belgium	Indonesia	Qatar
Benin	Iraq	Romania
Bhutan	Ireland	Russian Federation
Bolivia	Italy	Rwanda
Bosnia and Herz.	Japan	Saudi Arabia
Botswana	Jordan	Senegal
Brazil	Kazakhstan	Serbia
Brunei Darussalam	Kenya	Seychelles
Bulgaria	Rep. of Korea	Sierra Leone
Burkina Faso	Kuwait	Singapore
Burundi	Kyrgyzstan	Slovakia
Cambodia	Laos	Slovenia
Canada	Latvia	South Africa
Cape Verde	Lebanon	Spain
Chile	Lesotho	Sudan
China	Liberia	Swaziland
Colombia	Libya	Sweden
Comoros	Liechtenstein	Switzerland
Costa Rica	Lithuania	Syria
Côte d'Ivoire	Luxembourg	Tajikistan
Croatia	Macedonia	Tanzania
Cyprus	Madagascar	Thailand
Czech Republic	Malawi	Tunisia
DR Congo	Malaysia	Turkey
Denmark	Maldives	Turkmenistan
Djibouti	Mali	Uganda
Dominican Republic	Malta	Ukraine
Ecuador	Mauritius	UAE
Egypt	Mexico	United Kingdom
El Salvador	Moldova	Uruguay
Eritrea	Montenegro	United States
Estonia	Morocco	Uzbekistan
Ethiopia	Mozambique	Vietnam
Finland	Myanmar	Zambia
France	Namibia	Zimbabwe
Gambia	Nepal	

Table A.6: List of Agreements in the sample

ASEAN-India	EC-Algeria	Korea, Rep. of Singapore
APTA	EC-Bosnia Herzeg.	MERCOSUR
ASEAN free trade area	EC-Cameroon	MERCOSUR-Bolivia
ASEAN-Australia-New Zealand	EC-CARIFORUM	MERCOSUR-Chile
ASEAN-Korea, Rep. of	EC-Chile	MERCOSUR-India
Australia-New Zealand	EC-Côte d'Ivoire	NAFTA
Australia-Singapore	EC-Croatia	PAFTA
Australia-Thailand	EC-Egypt	Pakistan-China
CAFTA-DR	EC-FYR Macedonia	Pakistan-Malaysia
CAN	EC-Iceland	Pakistan-Sri Lanka
Canada-EFTA	EC-Israel	Russia-Ukraine
Canada-Peru	EC-Jordan	SACU
CEFTA	EC-Lebanon	SAFTA
CEZ	EC-Mexico	SADC
Chile-Australia	EC-Montenegro	Turkey-Albania
Chile-Canada	EC-Morocco	Turkey-Bosnia Herzegovina
Chile-Central America	EC-Norway	Turkey-Croatia
Chile-China	ECOWAS	Turkey-EC
Chile-Colombia	EC-South Africa	Turkey-EFTA
Chile-EC	EC-Switzerland-Liechtenstein	Turkey-FYR Macedonia
Chile-EFTA	EC-Syria	Turkey-Georgia
Chile-India	EC-Tunisia	Turkey-Israel
Chile-Japan	EC-Turkey	Turkey-Montenegro
Chile-Korea	EFTA-Israel	Turkey-Morocco
Chile-MERCOSUR	EFTA-Korea, Rep. of	Turkey-Serbia
Chile-Mexico	EU-Serbia	Turkey-Syria
Chile-Panama	GCC	Turkey-Tunisia
Chile-US	India-Singapore	Ukraine-Belarus
China-ASEAN	Japan-ASEAN	Ukraine-Kazakhstan
China-Chile	Japan-Brunei Darussalam	Ukraine-Turkmenistan
China-Hong Kong	Japan-Chile	US-Australia
China-New Zealand	Japan-Indonesia	US-Bahrain
China-Pakistan	Japan-Malaysia	US-Chile
China-Peru	Japan-Mexico	US-Israel
China-Singapore	Japan-Philippines	US-Jordan
CIS	Japan-Singapore	US-Morocco
COMESA	Japan-Switzerland	US-Oman
Dominican Republic- Central America - US	Japan-Thailand	US-Peru
EC (27)	Japan-Vietnam	US-Singapore
EC-Albania	Korea, Rep. of-India	

Table A.7: OLS [dependent variable is ln (T_{ij})]

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	With Country-and-Time Effects	With Time and Bilateral Fixed Effects	With Bilateral Fixed Effects	Country Fixed Effects	With Time Effects	No Fixed or Time Effects
$lnRGDP_i$		1.083***	0.913***	0.858***	1.104***	1.088***
		(0.051)	(0.039)	(0.042)	(0.009)	(0.009)
$lnRGDP_j$		0.812***	0.643***	0.459***	1.315***	1.297***
		(0.057)	(0.042)	(0.045)	(0.008)	(0.008)
$lnDIST_{ij}$	-1.399***			-1.389***	-1.220***	-1.212***
	(0.023)			(0.024)	(0.022)	(0.022)
ADJ_{ij}	0.834***			0.973***	0.643***	0.678***
	(0.104)			(0.105)	(0.103)	(0.102)
$LANG_{ij}$	0.750***			0.741***	0.755***	0.748***
	(0.047)			(0.048)	(0.052)	(0.053)
COL_{ij}	1.014***			1.002***	0.637***	0.596***
	(0.063)			(0.065)	(0.071)	(0.071)
RTA_{ij}	0.312***	-0.004	-0.013	0.324***	0.681***	0.700***
	(0.044)	(0.041)	(0.041)	(0.046)	(0.049)	(0.049)
RMSE	1.992			1.973	2.390	2.415
Overall R^2	0.756	0.485	0.471	0.747	0.628	0.620
Between R^2		0.549	0.535			
Within R^2		0.094	0.088			
No. Observ.	205680	164201	164201	164201	164201	164201

Robust standard errors (clustered by country-pairs) recorded in parenthesis. Intercepts not reported.
Significance levels: ***1%, **5%, *10%