DEEP INTEGRATION: FREE TRADE AGREEMENTS HETEROGENEITY AND ITS IMPACT ON BILATERAL TRADE

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Abstract

Regional trade agreements (RTAs) have surged in a context of stalled multilateral trade negotiations. Their impact on trade have been well documented while scant attention have been paid to empirical studies exploring their heterogeneity in the scope of deep integration. We intend in this paper to determine if deeper RTAs promote trade more effectively than less ambitious agreements. We proceed to generate credible indicators of deep integration exploiting two recently available data sets from WTO and WTI-DESTA, and then we test their significance in a gravity model for International Trade. We find that deeper agreements with provisions inside or outside WTO's domains increase trade more than shallow ones. Treating additive indicators as factor variables, as well as our innovative use of Multiple Correspondence Analysis MCA to get distilled indicators of deep integration allow us to give a new insight on this phenomenon and to confirm recent findings on the field of deep integration.

Key words: Deep integration, gravity model, regional trade agreements, trade liberalization, international trade.

Résumé

Les accords commerciaux régionaux (ACR) ont proliféré alors même que les négociations multilatérales ne parvenaient pas à progresser. Leur impact sur le commerce a été bien documenté mais peu d'attention a été portée aux études empiriques qui exploraient l'hétérogénéité d'accords plus ou moins "profonds". Le but de cet article est de déterminer si des ACR plus profonds promeuvent le commerce plus efficacement que les accords moins ambitieux. Nous commençons par créer des indicateurs pertinents d'intégration profonde à partir de deux bases de données récentes construites par l'OMC et par WTI-DESTA. Puis nous testons leur signification dans un modèle de gravité. Nous trouvons ainsi que les accords plus profonds incluant des dispositions se situant dans ou hors les compétences de l'OMC, accroissent davantage le commerce que les accords superficiels. Nous utilisons des indicateurs additifs ainsi que des indicateurs construits à partir de l'analyse des correspondances multiples (ACM), afin d'obtenir des indicateurs synthétiques et confirmer les résultats obtenus récemment sur les effets de l'intégration profonde sur le commerce.

Mots Clés : Intégration profonde, modèle de gravité, accords commerciaux régionaux, libéralisation du commerce

JEL Code : F14, F15, F 53, F55

1. Introduction

Substantial progress has been made to respond to the following question: do regional trade agreements (RTA) increase trade flows (see Rose (2004), Baier & Bergstrand (2007), Martínez et al. (2009))? Nevertheless, it has been done neglecting thorny issues like free trade agreements heterogeneity and the concept of deep integration.

One question pose renewed interest: are all free trade agreements comparable? This paper seeks to gain an insight into the nature of free trade agreements, their design and contents, to shed light into the implications of deep integration on bilateral trade flows.

Although all free trade agreements share an inherent intention to liberalize and regulate international trade, they also present outstanding differences: They vary on the number of signatories, their economic size and the distance between them, as well as in the level of development among partners and their implementation periods. No less important, they also vary on their depth, i.e. the number and the nature of provisions included in the agreement. Beyond the traditional provisions on customs duties and rules of origin, the agreements often deepen issues that subject to agreements administered by the WTO (e.g. intellectual property rights or sanitary and phytosanitary rules) or outside the WTO's field as competition or labour standards.

Introducing the effect of a RTA in the gravity model by the means of a dummy variable as it is commonly done, is equivalent to assume that we give the same treatment dose to any pair of countries, whatever the scope of the trade agreement.

The subject of Regional Trade Agreements RTAs heterogeneity has been little explored, so it is convenient to try to dig deeper in this topic, recognize its importance and evaluate its implications, particularly for the interpretation of RTA coefficients and for our understanding of the limits of trade liberalization.

Finding a way to measure this heterogeneity, and being able to associate it to a scale of the depth for the agreements themselves, allow us to set up some indicators that would clarify the impact of this heterogeneity on bilateral trade flows.

Our research finds that a 10% increase on a measure of the depth of the integration increases bilateral international trade flows by around a 4.0%.

After this introduction, section 2 provides a review of the most important contributions of the literature on the subject of deep integration, section 3 presents our data set resources and methodological approach. Section 4 introduces our econometric model and the four main specifications we employ to estimate the impact of the depth of the agreements on bilateral trade flows. Section 5 displays results, and finally, section 6 exposes our conclusions.

2. Literature review

RTAs are international agreements that seek to liberalize trade. Actually, they not only pursuit market access, but also seek a broader international trade regulation that not automatically means creating more trade.

For example, the RTA between the European Union (EU), Colombia and Peru (OJEU 354, 2012) states a commitment to protect intellectual property rights (IPR). It also includes a provision to engage in disarmament and non-proliferation of weapons of mass destruction. In both cases, the main objective of these provisions is first to encourage innovation and second to maintain peace, not directly trade creation.

In the IPR case, a nation that subscribes this commitment might present a reduction in its non-patented trade, not necessarily offset by a rise in trade of patented goods if these are essential, non-substitutable goods that present low price elasticities.

In the second case, a country that commits to non-proliferation of weapons of mass destruction would abstain itself to export or import minerals like uranium or plutonium or industrial goods like nuclear reactors.

Because they are largely shared by academics and international trade researchers, we follow the definitions suggested by the WTO. On the first hand WTO (2014) defines that Regional Trade Agreements RTAs are “reciprocal trade agreements between two or more partners”. They contain free trade agreements and customs unions and also more advanced schemes like the EU single marked. On the second hand, “Preferential trade arrangements (PTAs) are unilateral trade preferences. They include Generalized System of Preferences GSP schemes (under which developed countries grant preferential tariffs to imports from developing countries), as well as other non-reciprocal preferential schemes granted a waiver by the General Council”. RTAs and PTAs can be held across contiguous and non-contiguous countries. Along this paper we would work basically with RTAs and when we refer to free trade agreements FTAs we would be talking mainly about RTAs.

RTAs agreements typically may include the following provisions: market access in goods (including tariffs and non-tariff barriers), services, intellectual property rights, “Singapore issues” (investment, government procurement, trade facilitation and competition), labour standards, environment and food standards issues. (Khor, 2008)

Bourgeois, Dawar & Evnenett (2007) made a qualitative legal analysis of the contents of 27 RTAs. They compare and describe the discrepancies between these accords by analysing five provisions (labour market, competition policy, government procurement, environmental laws and non-tariff barriers).Another qualitative work, this time analysing ASEAN’s external PTAs is provided by Kleimann, D. (2014). It concludes that bilateral PTAs between ASEAN members and the same external partners result in deeper commitments.

In order to estimate the impact of the depth of the agreements, Magee (2008) presented a classification including preferential agreement (PAs), free trade agreements (FTAs), custom

unions (CUs) and common markets (CMs), which is also the standard classification suggested by the WTO database on trade and is also closely related with the most commonly accepted successive stages approach of economic integration first depicted by Balassa (1961).

Following a similar classification, Vicard (2009) found that "once self-selection into agreement is controlled for, their trade creation effect does not statistically differ according to the depth of the RTA, so creating a FTA, a CU or a CM had a comparable impact on trade among members.

However, by introducing interactions terms among RTA and some country features Magee (2008), and Vicard (2011), find that some trade agreements are more effective than others. In fact, those signed by large, similar and close countries tend to perform better in term of trade creation than smaller, more distant and dissimilar ones. They estimate different RTAs effects for CUs, FTA, and PAs in what could be seen as a measure of their depth.

Introducing a minor variation to trade integration categories Baier, Bergstrand and Feng, (2014) provided evidence of the differential partial effect of various levels of Economic Integration Agreements EIAs on the intensive and extensive margin of trade.

These approaches are not completely focused on the dose, design or content of the agreements, but on the intrinsic and observable characteristics of the countries. At the same time, they rely on a Balassa (1961) like representation of economic integration levels that is no longer suitable with the degree of complexity introduced by recent generations of RTAs.

Much of current evolution on the subject of deep integration owes to Horn, Mavroidis & Sapir (2010) who codified provisions for 100 free trade agreements and introduced non-traditional WTO provisions in the analysis. They also explored legal enforcement effects by identifying the nuances of language in RTAs texts. In the paper we adopt the position to avoid this kind of subjective judgments even at the cost of assuming that all RTAs' provisions are equally enforceable, which is of course also controversial.

Based on data from the Research division of the WTO for the World Trade Report (2011), Shahid (2011) and Orefice & Rocha (2013) go forward on taking up the content of the agreements and applying empirical analysis. Shahid (2011) concludes that the nature of RTAs matters while the magnitude and the direction of the relationship remain unclear as deeper agreements can be exposed to diminishing returns.

Results from Orefice & Rocha (2013) using Principal Component Analysis PCA and additive indicators find that on average, signing deep agreements increases trade in production networks between member countries by almost 12 percentage points.

Finally, Dür, Baccini & Elsig (2013) build up their own enlarged database for 733 FTAs of which 356 are listed by the WTO. The authors also introduced latent trade analysis to compute a distilled indicator for the depth of the agreements. Their results also show a significant and positive relationship between deeper agreements and bilateral trade flows.

3. Database and Methodology

One of the main hurdles deep integration literature has faced is related to the lack of publicly available data sets documenting the contents of a reasonable big sample of RTAs. This problem has recently been attenuated with the appearance of two independently projects that codify RTAs by the different provisions they contain. These data sets are: first, WTO (2011) Research division for the World Trade Report, and second, Design of Trade Agreements DESTA-WTI (2014). We resort to these two data sets to account for the presence of a provision in an RTA, an invaluable input needed to produce credible deep integration indices.

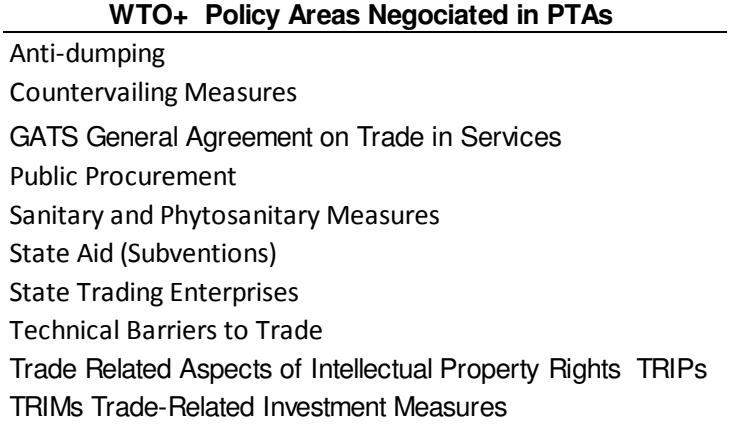
Following the approach of Horn ***et al***. (2010), the first data set creates two main categories: WTO+ and WTO-X. The first one register provisions which are topics under the competence of the WTO agreements (Figure 1), and the second (Figure 2), codify provisions for issues outside the current competences of the WTO but somehow negotiated in RTAs worldwide as they are related to trade.

Figure 1

WTO-X Provisions Negociated in PTAs	
Agriculture	Innovation policies
Anti-corruption	Investment measures
Approximation of Legislation	IPR
Audiovisual	Labour market regulation
Competition policy	Mining
Consumer protection	Money laundering
Cultural cooperation	Movement of capital
Data protection	Nuclear safety
Economic policy dialogue	Political dialogue
Education and training	Public administration
Energy	Regional cooperation
Environmental laws	Research and technology
Financial assistance	SMEs
Health	Social matters
Human rights	Statistics
Illegal immigration	Taxation
Illicit drugs	Terrorism
Industrial cooperation	Visa and asylum
Information society	

Source: Orefice & Rocha (2013), Horn ***et al.*** (2010). WTO **(**2011) Research division for the World Trade Report

Figure 2



Source: Orefice & Rocha (2013), Horn ***et al.*** (2010). WTO **(**2011) Research division for the World Trade Report.

It is noteworthy to point out that TRIPs and IPR are closely related, as well as TRIMs and investment measures, being at the same time negotiated under and outside the scope of WTO. When we find these provisions present in RTAs, codified under the category WTO-X, we must assume that these agreements have gone further, than what WTO commonly comprehend. Another difficult case arises with the agriculture provision in WTO-X, because much of Figure 1 provisions are applied to agricultural issues too. To deal with these cases we compute indicators with and without these provisions. When a restrained dimension that excludes agriculture, IPR and investment appears in the analysis, we would mark that variables with an ***r*** at the end their name.

The WTO (2011) Research division for the World Trade Report data set is exploited by Orefice & Rocha (2013). Their regressions account for 66 RTA and 200 countries from 1980–2007. It is also explored by Shahid (2011) for the 1994-2010 stretch who works with 97 RTAs and 132 countries.

We include in our calculations 103 RTAs including agreements for Peru & Colombia from 1980-2012, and our gravity model includes 153 countries. That way we expand the number of agreements and the period considered in previous articles.

We sustain that free trade agreements are heterogeneous and they vary on the number and the combination of provisions they include. This variability can be understood as a proxy of the depth of the integration.

We introduce our depth indicator, into our gravity model data set for 153 countries adding up to 613.030 bilateral trade flows from 1980 to 2012. We use an unbalanced panel data set, due mainly to the disappearance and appearance of countries during the period. More details about this data base are available on the appendix.

In order to measure the impact of deep integration on trade we would capture the most of the variability of the provisions in just one indicator.

The main approach that we follow is given by Shahid (2011), Orifice & Rocha (2013) and Dür, Baccini & Elsig (2013). We also contribute to a better visualisation of the implication of these indices by presenting the additive indices as factor variables. These papers put forward two different kinds of indicators to try to capture deep integration from a set of dummy variables related, with the appearance of certain provisions that characterize RTAs texts. These indicators are first, additive indicators and second, distilled indicators extracted from PCA related methodologies.

- Additive indicators

When we analyse a RTA, the construction of an index that considers the appearance or not of certain chapters or provisions would tell us more about the depth of the agreement than just the extend of tariff reduction. The first step to build up additive indicators is to stablish a set of provisions prone to appear in a RTA, the second step consists of counting up how many of these provisions are present in a particular agreement. The RTAs with the most provisions will be considered as the deepest. The advantage of this approach is that it is easy to compute, the weakness is that it assigns an equal weight to all the provisions embodied in an agreement, which may not be the best assumption to do if we reckons that some issues could be more important for trade than others. To solve this, additive indicators can also be obtained by assigning different weights. In the absence of good reasons to assume that some provisions are more important than others, resorting to weighted indicators would be arbitrary, and might lead us up to researcher's opinion bias.

Additive indicators tested in our gravity model takes on 0 if there is no agreement between both countries. Because Dür ***et al.*** (2014) in DESTA data set assigned their shallowest agreements with 0, and our count of WTO+ and WTO-X provisions is also 0 for the shallowest agreements, we recode these agreements with a 1 and raise the additive index measure of every RTA by one unit too. This can be thought as a common denominator clause for all agreements, namely, tariff reduction. We do this to avoid confounding the shallowest agreements with not having a free trade agreement at all. By this way, we will compare countries having a RTA with all the countries without.

Figure 3 presents information for WTO+, WTO-X and DESTA data sets, on the number of RTAs by the number of provision and regrouped number of provisions they contain, as well as for the number of bilateral trade flows affected by these RTAs. As it can be seen, DESTA data set comprises the largest number of RTAs, 269 against 103 for WTO and WTO-X.

Figure 3

WTO+, WTO-X and DESTA: Number of RTAs and Number of associated bilateral trade flows by number of provision and regrouped number of provisions

WTO+

Number of provisions	# RTAs	# Flows	Regrouped range of provisions	# RTAs	# Flows
1	5	1,036	1--3	14	6,804
2	3	1,588	4--6	22	11,272
3	6	4,180	7--9	37	13,396
4	7	6,244	10--11	30	4,362
5	7	902			
6	8	4,126			
7	9	8,672			
8	17	4,030			
9	11	694			
10	14	4,104			
11	16	258			
	Total 103	Total 35,834		Total 103	Total 35,834

WTO-X

Number of provisions	# RTAs	# Flows	Regrouped range of provisions	# RTAs	# Flows	Regrouped range of provisions	# RTAs	# Flows
1	11	5,598	1--5	38	13,458	1--10	77	16,811
2	8	4,246	6--10	39	3,353	11--20	15	16,817
3	4	232	11--15	11	10,339	21--37	11	5,162
4	7	1,198	16--20	4	6,478			
5	8	2,184	21--26	5	2,268			
6	5	242	27--37	6	2,894			
7	8	2,133						
8	8	80						
9	14	864						
10	4	34						
11	2	58						
12	4	4,718						
13	2	282						
14	2	3,615						
15	1	1,666						
16	1	810						
17	1	1,800						
18	0	-						
19	0	-						
20	2	3,868						
21	3	1,200						
22	1	594						
23	0	-						
24	0	-						
25	0	-						
26	1	474						
27	1	594						
28	3	1,442						
29	0	-						
30	1	534						
31	0	-						
32	1	324						
33	0	-						
34	0	-						
35	0	-						
36	0	-						
37	0	.						
	Total 103	Total 38,790		Total 103	Total		Total 103	Total 38,790

DESTA

Number of provisions	# RTAs	# Flows	Regrouped range of provisions	# RTAs	# Flows
1	25	4,504	1--3	136	21,095
2	43	6,317	4--6	93	26,601
3	68	10,274	7--8	40	3,186
4	34	8,461			
5	33	4,962			
6	26	13,178			
7	26	1,233			
8	14	1,953			
	Total 269	Total 50882		Total 269	Total 50,882

Source: Own computations on data from WTO 2011 and WTI-DESTA 2014.

The first column for each data set shows the distribution of RTAs by the number of provisions they incorporated in their entry into force date. We considered RTAs for the period 1980-2012. For example; we find that WTO, WTO-X and DESTA have 5, 11 and 25 RTAs in the shallowest range (1 provision). Also important to remark is the fact that the number of RTAs is low for certain ranges, mainly in the WTO-X database. The a few numbers of individuals might be a trouble for econometric estimations. That's the reason why we decide to regroup agreements. It allows us to reduce the number of ranges which automatically increase the number of observations in each new regrouped range. For example, in the WTO+ case, the deepest range of provisions includes 30 RTAs in the regrouped array against 16 in the original. This procedure allows us to better capture the effect of deep integration by the means of the estimation of the depth on a factor variables specification.

Considering this, in the results section, we pass from 12 ranges to 5 grouped ranges for WTO+ framework provisions (Figure 5). In the case of WTO-X provisions, we do not present the results for the original 37 ranges; being too large to be informative, we prefer to show results for 7 regrouped ranges on the left and for 4 regrouped ranges on the right side (Figure 6). DESTA provisions are computed for 9 ranges on the left and for 4 regrouped ranges on the right side (Figure 7). Our results are sensitive to this regrouping procedure, but their analysis turns out to be clearer on the regrouped specification.

Some extra caveats may be presented; first, the number of provisions an agreement incorporate doesn't assure by itself the enforceability of the agreement. We do not consider legal enforceability due to the subjectivity of its codification process. Second, an additive indicator doesn't promise neither that what we consider to be a very deep agreement, due to its institutional maturity or hype, would appear as so in the data. For instance, Claar and Nölke (2010) consider that "Europe's single market is probably the best example globally of successful deep integration. EU members have not only eliminated all tariff barriers, they have also harmonised product and service standards in past decades". Nevertheless, Dur ***et al.*** (2014) additive indicator gives UE 1992 single market agreement a 5 while Colombia-USA is assigned with a 7. In parallel, Orefice and Rocha (2014) give 6 in WTO+ and 11 in WTO-X to EU_27 but 9 in WTO+ and 27 in WTO-X to EU-Chile. This situation arises due to methodology consistency requirements that are needed to avoid a researcher vision bias.

- Distilled Indicators

To deal with the evoked problem of additive indicators, consisting of treating all characteristics as equals or being accused of arbitrariness, some statistical methods have been developed to produce indicators that distil or capture the inertia of a set of variables (characteristics) in a single dimension, a new variable that catalyses it all into one indicator. In our case, into what we claim is an indicator of the depth of RTAs.

The relative position of an RTA on the indicator, which is a continuous variable, is going to be given by the interactions of the correlations between all characteristics, namely, provisions in our analysis.

To obtain this kind of indicators, Orefice and Rocha (2013) develop a Principal Component Analysis (PCA) indicator. But this methodology is primarily conceived to deal with continuous variables (see Cahuzac, E. & Bontemps, C.; 2008)[1].

[1] "Principal component analysis is a statistical technique that linearly transforms an original set of variables into a substantially smaller set of uncorrelated variables that represents most of the information in the original set of variables. Its goal is to reduce the dimensionality of the original data set because a small set of uncorrelated variables is easier to use in further analysis than a larger set of correlated variables." Dunteman (1989, 7) "If the variables are highly correlated, then we can linearly transform the p correlated variables into a smaller set of k uncorrelated variables, such that the k

(Dür ***et al.,*** 2014) compute a Rasch indicator, which has the advantage of previously assuming that only one dimension is defined by the observations of the dataset. It presents some setbacks too. Special software must be used to obtain a Rash indicator.

Given our purpose of finding an indicator of deep integration that stems from the first dimension of a component determination technique, we prefer an indicator obtained from a Multiple Correspondence Analysis (MCA) procedure. This procedure is equivalent to a principal component analysis PCA, but is more suitable for categorical variables, as PCA is best prescribed for continuous variables (Cahuzac & Bontemps, 2008). MCA is set out to be used with categorical variables. Binomial variables, as the kind we face in our analysis, are a particular kind of categorical variables. MCA is used to detect and represent underlying structures in a data set and arranges data as points in a set of dimensions. (Le Roux, B. and H. Rouanet, 2010).

The MCA we perform on the traditional provisions under the competence of the WTO (WTO+) shows that a great deal, equivalent to more than 85% of the inertia is explained by the first dimension. We relate this dimension to a measure of deep integration. As a MCA procedure does not predefine the sense of the relationship, we review its sign to be able to correctly introduce the data in the gravity model so that the shallowest agreements in the MCA indicator take on lowest valuations. Hence, an increase in the index means move on a higher depth of integration.

Likewise, to explore the impact of deeper agreements on the case of WTO non-traditional provisions we run a MCA for WTO-X and also for our restricted WTO-Xr provisions, namely, excluding agriculture, IPR and Investment. This time about 89% of the inertia is explained for the first dimension. 4. Econometric Specifications

The international trade gravity theory (Tinbergen, 1962) claims that bilateral international trade flows from country i to country j, for a given year t, X_{ijt}, depend positively on the size of both economies y_{it} and y_{jt} respectively, and negatively on a set of trade cost variables t_{ijt}.

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derived variables, if considered as independent variables, will maximize the prediction of the original p variables. The k derived variables which maximize the variance accounted for the original variables are called principal components". Dunteman (1989, 5).

Anderson and Van Wincoop (2003) provide us with a micro funded mathematical approach to better estimate the gravity equation. We keep here their main set of equations as the starting point to present the econometric model specification. More details about the Anderson and Van Wincoop structural gravity model are presented in the appendix.

$$(1)\quad x_{ij} = \frac{y_i\, y_j}{y^w}\left(\frac{t_{ijt}}{P_i \Pi_j}\right)^{1-\sigma}$$

Where

$$(2)\quad \Pi_i = \left(\sum\nolimits_j \left({t_{ij}}/{\mathrm{P}_j}\right)^{1-\sigma}\ \theta_j\right)^{1/(1-\sigma)}$$

and

$$(3)\quad P_j = \left(\sum\nolimits_i \left({t_{ij}}/{\Pi_i}\right)^{1-\sigma}\ \theta_i\right)^{1/(1-\sigma)}$$

Here, multilateral resistance for countries i and j (P_i and Π_j) are non-observable variables.

As we don't have data for P_i and Π_j, the so-called multilateral resistance terms from equation (1), it is usual to introduce fixed effects from importer and exporter to first avoid endogeneity due to unobservable heterogeneity and then to partially control for omitted variable bias derived from multilateral resistance[2].

To disentangle the impact of the depth of the RTA, we regress, bilateral trade flows on a set of indicators of depth by the means of a Poisson specification. Poisson Pseudo Maximum Likelihood PPML has been positioned by (Santos Silva & Tenreyro, 2006; 2011) as the most suitable method to estimate a gravity equation. This method deals with the bias caused by the presence of many zeros in bilateral international trade flows data, and is also robust to heteroscedasticity.

[2] Time-varying fixed effects can be introduced into the gravity equation to better account for multilateral resistance. Nevertheless, we do not control for time-varying fixed effects in this paper due to computational limits that stem form the size of the dataset and the software we use.

Our depth indicators, which are our variables of interest, are tested in three different main specifications: in levels as factor variable and in logarithms. Because the log of 0 is not defined, to compute logarithms for our depth indicators we add 1 to the variable

Now, in the pursuit of our goal to disentangle the effect of RTAs heterogeneity we resort to the following four specifications.

Our first specification eq. (4) allows us to include in levels our different kinds of depth indicators: additive, MCA or Rasch. We use the subscript $_m$ to indicate the kind of indicator we estimate (level, logarithmic or mca) :

$$(4) \quad X_{ijt} = \beta_0 + \beta_1 \boldsymbol{dp\_indc_{ijtm}} + \beta_2 lnpib_{it} + \beta_3 lnpib_{jt} + \beta_4 lndist_{ijt} + \varphi \boldsymbol{Z} + \alpha_t + \alpha_i + \alpha_j + u_{ijt}$$

Where **Z** is a vector of other control variables that help us minimize possible bias, composed of: $lnpop_{it}$, $lnpop_{jt}$, $contig_{ijt}$, $comlang\_eth9_{ijt}$, $col45_{ijt}$, $OCDE_{it}$, $OCDE_{jt}$, $GATT_{it}$ and $GATT_{jt}$.

And, φ is a vector of coefficients to be estimated concerning our other control variables. Definitions and sources are available in appendix B and D.

As we are accounting for time invariant country fixed effects, the inclusion of variable as country surface, insular or landlocked status are redundant.

α_t Is a fixed effect for years and α_i and α_j are respectively time-invariant fixed effect for exporter and importer countries. Finally, u_{ijt} is an idiosyncratic error term.

The interpretation of the coefficient of indicator for deep integration in levels, as above, is not straightforward. What do we mean by saying that we increase a depth additive indicator by one unit? What provision do we really change? Similarly, as our MCA and Rasch indicators ranges are low, an increase of one unit on them is also hard to evaluate. One solution is to introduce our indicator in logarithmic form, that way we can reason in terms of percentage variations. We chose to add 1 to the index before taking logarithm to deal with zeros, see eq. (5) specification:

$$(5) \quad X_{ijt} = \beta_0 + \beta_1 \boldsymbol{ln}[\boldsymbol{1} + \boldsymbol{dp\_Ind_{ijtm}}] + \beta_2 lnpib_{it} + \beta_3 lnpib_{jt} + \beta_4 lndist_{ijt} + \varphi \boldsymbol{Z} + \alpha_t + \alpha_i + \alpha_j + u_{ijt}$$

Next, the econometric specification of Eq (6) introduces our additive indicators of depth for WTO, WTO-X and DESTA as factor variables. To address this point we create a dummy variable for every range of RTAs by the number of provisions they possess. As we discussed before, some ranges of provisions present a limited number of RTAs, particularly for WTO, WTO-X, consequently, we also test this specification by regrouping RTAs in fewer ranges.

$$(6) \quad X_{ijt} = \beta_0 + \beta_1 lnpib_{it} + \beta_2 lnpib_{jt} + \beta_3 lndist_{ijt} + \varphi \boldsymbol{Z} + \delta_{n-1} \sum_{1}^{n-1} \boldsymbol{dp\_ind\_add_{nijt}} + \alpha_t + \alpha_i + \alpha_j + u_{ijt}$$

To try to identify possible nonlinearities like diminishing or increasing returns we resort to eq (7) where we test our additive indicators on a quadratic form.

$$(7) \quad X_{ijt} = \beta_0 + \beta_1 lnpib_{it} + \beta_2 lnpib_{jt} + \beta_3 lndist_{ijt} + \varphi \boldsymbol{Z} + \beta_4 \boldsymbol{dp\_indc_{ijt}} + \beta_5 \boldsymbol{dp\_indc^2_{ijt}} + \alpha_t + \alpha_i + \alpha_j + u_{ijt}$$

5. Results

This section presents the results of our regressions procedures. First, we discuss our findings for additive indicators in level and logarithmic form for WTO+, WTO-X and DESTA (Figure 4). Afterwards, Figures 5, 6 and 7 resumes results for the factor variable specification of the depth indicators respectively for WTO+, WTO-X and DESTA. The right side of these figures presents results for regrouped ranges of provisions. Finally, Figure 8 deploys our estimations for distilled depth indicators of the MCA and Rasch family in levels, logarithmic and quadratic form.

- Additive Indicators

Our interest variables here are: ad_WTO, this is an additive index of provisions under the regular WTO framework. It takes values from 0 (no RTA) to 11 for the flows impacted by the deepest RTAs. Notice that some agreements like ASEAN don't present any provisions.

For convention, the index stars in 1, just for signing a free trade agreement, 2 if it presents one provision and so forth; ad^2_WTO and ln_ad_WTO are its quadratic and logarithmic form. Likewise, ad_WTO_X is an additive index of provisions out of the regular WTO framework, it takes on values from 0 to 32. Again the index starts in 1 for couples just

signing a RTA, 2 if it presents one provision and so forth; ad^2_WTO_X and ln_ad_WTO_X are its quadratic and logarithmic form. Last but not least, ad_DES is an additive index produced from Dür et al. (2014) DESTA data. It varies between 0 and 8 provisions and ad^2_DES and ln_ad_DES are its quadratic and logarithmic form. Variables in level follow eq. 4 and in logarithms eq. 5 specifications.

A positive and significant effect was found for every specification. One possible interpretation for the elasticity in the logarithmic specification could be that an increase of 10% in the number of traditional WTO provisions increase bilateral trade around a 2.5%. A slightly lower effect can be attributed to an increase in non-traditional WTO-X provision. When tested in their quadratic specification, additive indicators show the presence of decreasing returns on the process of integration.

The results represented in Figure 5 and 6 come from the transformation of our additive indicators ad_WTO+ and ad_WTO-X into factor variable as in eq. (6). Figure 5, focus on the traditional WTO+ provisions and Figure 6 on WTO-X provisions. This procedure consists in generating 12 dummies. As we can see in figure 1 we are working with 10 different provisions under the WTO+ framework.

A positive and significant effect was found for every specification. One possible interpretation for the elasticity in the logarithmic specification could be that an increase of 10% in the number of traditional WTO provisions increase bilateral trade around a 2.5%. A slightly lower effect can be attributed to an increase in non-traditional WTO-X provision. When tested in their quadratic specification, additive indicators show the presence of decreasing returns on the process of integration.

Figure 4 - Deep Integration: Additive indicators in levels, logs and quadratic form for WTO+, WTO-X and DESTA. PPML estimator.

	xij	xij	xij	xij	xij	xij	xij	xij	xij
ad_WTO	0.058***	0.107***							
	(0.002)	(0.008)							
ad2_WTO		-0.005***							
		(0.001)							
ln_ad_WTO			0.232***						
			(0.009)						
ad_WTO_X				0.023***	0.072***				
				(0.001)	(0.003)				
ad2_WTO_X					-0.002***				
					(0.000)				
ln_ad_WTO_X						0.184***			
						(0.007)			
ad_DES							0.076***	0.127***	
							(0.003)	(0.009)	
ad2_DES								-0.007***	
								(0.001)	
ln_ad_DES									0.250***
									(0.010)
lnPIBi	0.765***	0.753***	0.748***	0.756***	0.759***	0.749***	0.741***	0.732***	0.731***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
lnPIBj	0.679***	0.665***	0.661***	0.671***	0.670***	0.661***	0.656***	0.646***	0.645***
	(0.023)	(0.023)	(0.023)	(0.024)	(0.023)	(0.023)	(0.022)	(0.022)	(0.022)
lndist	-0.784***	-0.768***	-0.762***	-0.819***	-0.766***	-0.770***	-0.764***	-0.752***	-0.752***
	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Constant	-5.860***	6.864***	7.768***	-5.810***	7.294***	8.108***	5.827***	6.571***	7.260***
	(0.886)	(1.659)	(1.661)	(0.904)	(1.661)	(1.666)	(1.594)	(1.616)	(1.607)
Observations	572,657	572,857	572,857	575,383	575,583	575,583	587,654	587,654	587,654
R-squared	0.900	0.902	0.902	0.894	0.902	0.901	0.900	0.901	0.901
Exporter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Importer FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-pair FE	NO	NO	NO	NO	NO	NO	NO	NO	NO
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The results represented in Figure 5 and 6 come from the transformation of our additive indicators ad_WTO+ and ad_WTO-X into factor variable as in eq. (6). Figure 5, focus on the traditional WTO+ provisions and Figure 6 on WTO-X provisions. This procedure consists in generating 12 dummies. As we can see in figure 1 we are working with 10 different provisions under the WTO+ framework.

Our reference category is derived from the bilateral flows without agreements, for instance Colombia - Morocco. WTO+ dataset contains agreements like ASEAN, PAFTA, Russian-Ukraine, Ukraine-Kazakhstan, and Ukraine-Turkmenistan that do not present any of the ten provisions considered in figure 1. Yet, we proceed to treat these agreements as presenting 1 provision (tariff reduction). This way we could tell them apart from the bilateral flows without agreement that are codified with 0 provisions. By doing this we had to add a unit to

the additive index for all other agreements. For instance, agreements that included 1 out of figure 1 provisions now take on 2 provisions; agreements with 2 provisions take on 3 and so forth until 11 provisions for the deepest agreements. To avoid the dummy variable trap we have to exclude one of our additive index dummies. We decide to omit ad_WTO1, which is the dummy affecting all bilateral flows without agreements.

Figure 5 - Deep Integration: Additive indicator as a factor variable from WTO+. Divided into 12 and 5 ranges. PPML estimator.

	Xij		Xij
ad_WTO2	0.204***	ad_WTO2b	0.233***
ad_WTO3	0.666***	ad_WTO3b	0.412***
ad_WTO4	0.254***	ad_WTO4b	0.519***
ad_WTO5	0.500***	ad_WTO5b	0.570***
ad_WTO6	-0.115***		
ad_WTO7	0.605***		
ad_WTO8	0.643***		
ad_WTO9	0.408***		
ad_WTO10	0.376***		
ad_WTO11	0.419***		
ad_WTO12	0.635***		
lnPIBi	0.765***		0.753***
lnPIBj	0.680***		0.665***
Indist	-0.738***		-0.759***
Constant	-6.995***		-6.447***
Observations	572,657		572,657
R-squared	0.906		0.903
Exporter FE	YES		YES
Importer FE	YES		YES
Country-pair FE	NO		NO
Time FE	YES		YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Although we can see a predominantly positive result for RTAs, the grouping of 12 categories doesn't let us easily appreciate that more provisions gradually generate more trade. The reason could be that we don't have enough RTAs for each of the 12 categories; consequently a more aggregated grouping was needed to fully capture this behaviour.

Here, it's important to make clear that our results are sensitive to the ranges we select, and they show more coherent results with smaller ranges. Treating the WTO+ additive indicator as a factor variable regrouped in five successive ranges as in the right side of Figure 5 shows us clearly that in so far as RTAs include more and more provisions they tend to have a bigger impact on bilateral trade flows.

To analyse WTO-X additive indicator as factor variable we followed the same procedure described above, so we add 1 to the original WTO-X additive index to avoid having RTAs with 0 WTO-X provisions. This way we preserve our comparison group as the bilateral flows

without agreements. We generated dummy variables for 7 ranges and for 4 ranges. The results are presented in figure 6. Although all our results are positive, we don't achieve here the same conclusive result we got for WTO+. Figure 3 let us see that most of the RTAs are in the sallowest bound of provisions, which could lead us to treat new grouping solutions.

Figure 6 - Deep Integration: Additive indicator as a factor variable for WTO-X provisions: divided into 7 and 4 ranges. PPML estimator.

	Xij		Xij
ad_WTO_X2	0.412***	ad_WTO_X2b	0.447***
ad_WTO_X3	0.472***	ad_WTO_X3b	0.534***
ad_WTO_X4	0.586***	ad_WTO_X4b	0.422***
ad_WTO_X5	0.465***		
ad_WTO_X6	0.709***		
ad_WTO_X7	0.317***		
lnPIBi	0.755***		0.741***
lnPIBj	0.664***		0.650***
Indist	-0.739***		-0.741***
Constant	7.625***		-6.331***
Observations	575,383		575,383
R-squared	0.904		0.903
Exporter FE	YES		YES
Importer FE	YES		YES
Country-pair FE	NO		NO
Time FE	YES		YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Own computations.

Continuing with the additive approach, we pass here to test the same phenomenon that in Figure 5 and 6, but with data coming from DESTA of the World Trade Institute WTI.

DESTA additive index is based on 7 general provision: General Agreement on Trade in Services Gats, Sanitary and Phytosanitary Measures sps, State Aid (Subventions) stateaid, State Trading Enterprises ste, technical barriers to trade tbt, Trade-Related Investment Measures trims, Trade Related Aspects of Intellectual Property Rights trips.

As before in the WTO+ and WTO-X cases we assign a 1 to the agreements that appear in DESTA dataset codified with 0 provisions. It could be understood as a provision common to all agreements to remark the fact that they all negotiate tariffs.

Here we transform ad_DES, an additive indicator based on DESTA classification of the provisions, into factor variable. We test first for the 8 original ranges on left side and then for 4 grouping ranges on the right side of Figure 7. Again, a more aggregated grouping of provisions permit us better appreciate the positive effect of deeper agreements.

Confirming our findings that deeper RTAs have a bigger impact in bilateral trade than shallow ones, Figure 7 let us see that introducing DESTA depth additive indicators in our gravity equation as a factor variable, especially with a reduced grouping of RTAs, results in a pattern that is coherent with those obtained from WTO database when we tested them also as factor variable. See Figure 5 and 6 above.

Figure 7 - Deep Integration: Additive indicator as a factor variable from DESTA: divided into 9 and 4 ranges. PPML estimator.

	Xij		Xij
ad2_DES	0.170***	ad2b_DES	0.264***
ad3_DES	-0.189***	ad3b_DES	0.428***
ad4_DES	0.466***	ad4b_DES	0.531***
ad5_DES	0.385***		
ad6_DES	0.455***		
ad7_DES	0.528***		
ad8_DES	0.496***		
ad9_DES	0.560***		
lnPIBi	0.735***		0.733***
lnPIBj	0.651***		0.647***
Indist	-0.753***		-0.764***
Constant	5.611***		8.103***
Observations	587,654		587,654
R-squared	0.903		0.9
Exporter FE	YES		YES
Importer FE	YES		YES
Country-pair F	NO		NO
Time FE	YES		YES
Time Varying	NO		NO
Time Varying	NO		NO

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

- Distilled Indicators

This section presents the results for a set of distilled deep integration variables, obtained from the first dimension of a multiple correspondence analysis MCA procedure, as well as a set of variables produced from the Rasch methodology computed by Dür ***et al.*** with DESTA inputs that we integrate in our gravity model. We also explore the possibility of nonlinearities in the process of trade integration by introducing quadratics terms on our MCA indicators for WTO and WTO-X provisions, as well as on Rasch indicators, see Figure 8.

Concerning the MCA[3] approach we have developed two separate set of indicators, the first based on WTO traditional provisions and the second based on WTO-X provisions. We have tried specifications in levels, logarithms and quadratics to test the sensibility of these indicators.

We use the character ***r*** at the end of the name of three WTO-X mca deep indicator variables mca_WTO_Xr, mca^2_WTO_Xr and ln_mca_WTO_Xr to make clear that these variables are restrained. In other words, the MCA first dimension, here doesn't take into account agriculture, investment and IPR, because these provisions are in a certain way treated under the traditional WTO framework, and is important to clarify if their inclusion is sensible.

Here, our interest variables are the following: mca_WTO and mca_WTO_X, which are MCA index obtained from their first dimension of inertia which captures the RTA degree of depth based on the number and combination of traditional WTO+ and WTO-X provisions they respectively embody; mca^2_WTO and mca^2_WTO_X are their squared forms and ln_mca_WTO and ln_mca_WTO_X are their natural logarithms. Rasch variable names follow these same conventions.

Turning to estimation results, these are congruent with a positive and significant impact for the MCA indicators on trade, and they suggest the presence of decreasing returns in the process of deepening integration no matter if the set of provisions negotiated are inside or outside of the framework of the WTO.

The exclusion of agriculture, investment and IPR from our MCA calculations doesn't change the sign or the significance of these indicators, but it increases the size of the coefficients in all specifications, see Figure 8. This could suggest a negative impact of some of these three provisions or their combination on trade.

[3] Regarding traditional WTO policy areas, the MCA indicator for the first dimension of the inertia captures 85.6%. It captures 88.8% of the inertial in the case of WTO-X provisions. We also compute an MCA for WTO-X excluding agriculture, investment and IPR, from the set of provisions presented in Figure 2. The first dimensions of this restrained MCA accounts for 89.7% of the inertia.

Figure 8 - Deep Integration Distilled Indicators : MCA and Rasch indicators in levels quadratics and log. PPML estimator.

	xij	xij	xij	xij	xij	xij	xij	xij	xij	xij	xij	xij
mca_WTO	0.147***	0.252***										
	(0.006)	(0.020)										
mca2_WTO		-0.029***										
		(0.005)										
ln_mca_WTO			0.351***									
			(0.013)									
mca_WTO_X				0.163***	0.449***							
				(0.006)	(0.018)							
mca2_WTO_X					-0.086***							
					(0.004)							
ln_mca_WTO_X						0.409***						
						(0.015)						
mca_WTO_Xr							0.162***	0.463***				
							(0.006)	(0.018)				
mca2_WTO_Xr								-0.091***				
								(0.004)				
ln_mca_WTO_Xr									0.412***			
									(0.015)			
rasch_DES										0.132***	0.269***	
										(0.006)	(0.026)	
rasch2_DES											-0.048***	
											(0.008)	
ln_raschs_DES												0.285***
												(0.013)
lnPIBi	0.768***	0.757***	0.756***	0.747***	0.741***	0.742***	0.747***	0.739***	0.741***	0.729***	0.721***	0.725***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
lnPIBj	0.679***	0.667***	0.667***	0.662***	0.651***	0.654***	0.662***	0.650***	0.654***	0.646***	0.636***	0.640***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.022)	(0.023)	(0.023)	(0.022)	(0.023)	(0.023)	(0.023)	(0.023)
lndist	-0.780***	-0.765***	-0.764***	-0.800***	-0.736***	-0.766***	-0.804***	-0.736***	-0.768***	-0.801***	-0.791***	-0.794***
	(0.009)	(0.009)	(0.009)	(0.008)	(0.010)	(0.009)	(0.008)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)
Constant	6.077***	6.588***	7.011***	8.543***	8.959***	9.071***	8.950***	9.354***	9.474***	5.304***	6.025***	5.872***
	(1.639)	(1.646)	(1.645)	(1.674)	(1.667)	(1.674)	(1.677)	(1.669)	(1.676)	(1.619)	(1.633)	(1.621)
Observations	575,579	575,580	575,583	575,582	575,583	575,587	575,585	575,586	575,587	587,652	587,653	587,654
R-squared	0.901	0.902	0.902	0.897	0.904	0.901	0.897	0.904	0.901	0.891	0.891	0.891
Exporter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Importer FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-pair FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The Rasch index in Figure 8 is positive and significant. When tested in their quadratic form it suggests the presence of diminishing returns as trade integration goes deeper. Because Rasch indicators are produced from a provisions database DESTA that is closer to the set of provisions embodied in the WTO+ framework of negotiation than to the WTO-X set of provision, this result is coherent with what we find for our MCA indicators on a quadratic specification.

6. Conclusion

This chapter investigates the hypothesis that deeper RTAs contribute more to increase bilateral trade than shallow ones. Applying the PPML method of estimation on a gravity equation that tested different indicators for the depth of the agreements we have not found enough evidence to refuse this hypothesis.

Deep integration indicators were computed from two different data sets: one provided by the WTO and the other known as WTI- DESTA. The indicators for deep integration were tested in different specifications. They were plugged respectively into the gravity equations in levels, quadratic and logarithmic form. Besides, for the additive indicators they were tested as factor variable too.

Trials to link provisions, individually, with a bigger likelihood to increase bilateral trade, as we did in the previous chapter, present many flaws and might not be robust enough.

We are now more aware that not all RTA are equal, and that their heterogeneity plays an important role to explain bilateral trade flows. This could imply that estimations on the average effect of PTA on trade interpretation should be nuanced as its effect will depend on the dose of the treatment. The average treatment effect of an RTA is around 0.4. It means the average effect for the whole number of observations of bilateral trade flows; not the effect of an average RTA because we don't really know for sure what an average RTA should be.

Consequently, our findings tell us that a bigger dose of integration bears a more positive impact on trade than just the application of a shallow agreement. Additive indicators presented as factor variable contribute greatly to clearly capture this behaviour. Hence, if the intention of signing a RTA is to increase trade, now we know that a deeper agreement will work better, at least, up to a certain limit. This chapter also contribute to clarify the question about the importance of other provisions related to trade but out of the traditional WTO framework of negotiation to expand trade. It shows that to introduce more provisions is profitable, in terms of trade creation.

However, the quadratic specification of the MCA and Rasch indicators suggests that as we advance in the process of integration, in or outside of the WTO traditional framework of provisions, the return of further liberalization on trade is decreasing. This could mean that the persistence in some developing countries of certain low standards, for instance, in environment protection, labour market regulation or IPR should be generating more international trade, but at the expense of other laudable objectives.

What does deeper really means continue to be a challenge to better define. A more reliable deep integration indicator should present the European Union integration model as the deepest or very close to the deepest. Meanwhile, although not completely accurate, these depth indicators present enough power to give us good clues about the direction of the impact of the heterogeneity of the agreements on trade.

In the end, our research results for different indicators of the depth of RTAs have allowed us to confirm that deeper RTAs promote trade more than shallow ones. A 10% increase on a measure of the depth of the integration increases bilateral international trade flows around a 4.0%.

More research is on this field will be worthwhile specially to try to identify which provisions or combinations of provisions produce a higher impact on trade creation.

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Appendix A : Depth Indicator Variable Definitions

ad_WTO : additive index of provisions under the regular WTO framework, takes on values from 0 to 11. Note: some agreements like asean doesn't present any of the provisions, so the index stats in 1 for just signing a free trade agreement, 2 if it presents one provision and so forth

ad2_WTO: is ad_WTO squared

ln_ad_WTO: is the natural logarithm of (1+ ad_WTO).

ad_WTO_X : additive index of provisions out of the regular WTO framework, takes on values from 0 to 32. Note: some agreements like ASEAN don't present any of the provisions, so the index stats in 1 for just signing a free trade agreement, 2 if it presents one provision and so on.

ad2_WTO_X: is ad_WTO_X squared

ln_ad_WTO_X : is the natural logarithm of (1+ ad_WTO_X) .

mca_WTO : is a multiple component analysis index from its first dimension of inertia that captures the free trade agreements degree of depth based on the number and combination of traditional WTO provisions it presents.

mca2_WTO : is mca_WTO squared.

ln_mca_WTO : is the natural logarithm of (1+ mca_WTO).

mca_WTO_X : is a multiple component analysis index from its first dimension of inertia that captures the free trade agreements degree of depth based on the number and combination of provisions it presents out of the traditional WTO framework.

mca2_WTO_X : is mca_WTO_X squared.

ln_mca_WTO_X : is the natural logarithm of (1+ mca_WTO_X).

mca_WTO_Xr : is a multiple component analysis index from its first dimension of inertia that captures the free trade agreements degree of depth based on the number and combination of provisions it presents out of the traditional WTO framework, it doesn't include agro, ipr and investment as they are comomly negotiatited under the WTO framework.

mca2_WTO_Xr : is depth_mca_WTO_Xr squared.

ln_mca_WTO_Xr : : is the natural logarithm of (1 + mca_WTO_Xr).

ad_DES : is an additive indicator based on DESTA classification of the provisions that are present in the agreements

ad2_DES : is ad_DES squared.

ln_ad_DES : is the natural logarithm of (1 + ad_DES)**rasch_DES** : is an index based on the rash latent trade analysis from DESTA team that captures the depth of the integration.

rasch2_DES : is rasch_DES squared.

ln_rasch_DES : : is the natural logarithm of (1 + rasch_DES).

Appendix B: Gravity Model List of Variables

- expoij : value of the fob merchandise exports from country i to country j in dollars
- lnxij : natural logarithm for usd fob exports values from country i to country j.
- lnpibi : natural logarithm for usd current gdp from country i
- lnpibj : natural logarithm for usd current gdp from country j
- lnpopi : natural logarithm for the population of country i
- lnpopj : natural logarithm for the population of country j
- lndist : natural logarithm for distance between I and j
- lnpopi : natural logarithm for population i
- lnpopj : natural logarithm for population j
- contig : 1 if there is a common land frontier between i and j
- comlang_eth9 : 1 if at least 9% of the pair population share the same language
- col45: 1 if both countries were under a colonial relationship before 1945.
- cci : numerical code for exporter country
- ccj : numerical code for importer country
- gatti : 1 if country if belongs to the GATT
- gattj : 1 if country if belongs to the GATT
- rta : 1 If both countries share a free trade agreement.
- ocdei : 1 if the country belongs to the OCDE
- ocdej : 1 if the country belongs to the OCDE
- α_t Is a fixed effect for years and
- α_i and α_j are respectively time-invariant fixed effect for exporter and importer countries.
- u_{ijt} is an idiosyncratic error term.

Appendix C: Gravity Model Data Set: List of Countries and their codes

Country Name	Code_3	Code_3	Country Name	Code_3L	Code_3N	Country Name	Code_3L	Code_3N
ALBANIA	ALB	914	GAMBIA	GMB	648	NICARAGUA	NIC	278
ALGERIA	DZA	612	GEORGIA	GEO	915	NIGER	NER	692
ANGOLA	AGO	614	GERMANY	DEU	134	NIGERIA	NGA	694
ARGENTINA	ARG	213	GHANA	GHA	652	NORWAY	NOR	142
AUSTRALIA	AUS	193	GREECE	GRC	174	OMAN	OMN	449
AUSTRIA	AUT	122	GRENADA	GRD	328	PAKISTAN	PAK	564
AZERBAIJAN	AZE	912	GUATEMALA	GTM	258	PANAMA	PAN	283
BAHRAIN	BHR	419	GUINEA	GIN	656	PAPUA NEW GUINEA	PNG	853
BANGLADESH	BGD	513	GUINEA-BISSAU	GNB	654	PARAGUAY	PRY	288
BARBADOS	BRB	316	GUYANA	GUY	336	PERU	PER	293
BELARUS	BLR	913	HAITI	HTI	263	PHILIPPINES	PHL	566
BELGIUM	BEL	124	HONDURAS	HND	268	POLAND	POL	964
BELIZE	BLZ	339	HONG KONG	HKG	532	PORTUGAL	PRT	182
BENIN	BEN	638	HUNGARY	HUN	944	QATAR	QAT	453
BERMUDA	BMU	319	ICELAND	ISL	176	ROMANIA	ROM	968
BOLIVIA	BOL	218	INDIA	IND	534	RUSSIAN FEDERATION	RUS	922
BRAZIL	BRA	223	INDONESIA	IDN	536	RWANDA	RWA	714
BRUNEI DARUSSALAM	BRN	516	IRAN, ISLAMIC REPUBLIC OF	IRN	429	SAMOA	WSM	862
BULGARIA	BGR	918	IRAQ	IRQ	433	SAUDI ARABIA	SAU	456
BURKINA FASO	BFA	748	IRELAND	IRL	178	SENEGAL	SEN	722
BURUNDI	BDI	618	ISRAEL	ISR	436	SIERRA LEONE	SLE	724
CAMBODIA	KHM	522	ITALY	ITA	136	SINGAPORE	SGP	576
CAMEROON	CMR	622	JAMAICA	JAM	343	SLOVAKIA	SVK	936
CANADA	CAN	156	JAPAN	JPN	158	SLOVENIA	SVN	961
CAPE VERDE	CPV	624	JORDAN	JOR	439	SOUTH AFRICA	ZAF	199
CENTRAL AFRICAN REPUBLIC	CAF	626	KAZAKHSTAN	KAZ	916	SPAIN	ESP	184
CHAD	TCD	628	KENYA	KEN	664	SRI LANKA	LKA	524
CHILE	CHL	228	KOREA, REPUBLIC OF	KOR	542	SWEDEN	SWE	144
CHINA	CHN	924	KUWAIT	KWT	443	SWITZERLAND	CHE	146
COLOMBIA	COL	233	KYRGYZSTAN	KGZ	917	SYRIAN ARAB REPUBLIC	SYR	463
CONGO	COG	634	LATVIA	LVA	941	TAJIKISTAN	TJK	923
CONGO, DEMOCRATIC	ZAR	636	LEBANON	LBN	446	TANZANIA	TZA	738
COSTA RICA	CRI	238	LIBERIA	LBR	668	THAILAND	THA	578
COTE D'IVOIRE	CIV	662	LIBYA	LBY	672	TOGO	TGO	742
CROATIA	HRV	960	LITHUANIA	LTU	946	TONGA	TON	866
CUBA	CUB	928	LUXEMBOURG	LUX	137	TRINIDAD AND TOBAGO	TTO	369
CYPRUS	CYP	423	MADAGASCAR	MDG	674	TUNISIA	TUN	744
CZECH REPUBLIC	CZE	935	MALAWI	MWI	676	TURKEY	TUR	186
DENMARK	DNK	128	MALAYSIA	MYS	548	TURKMENISTAN	TKM	925
DJIBOUTI	DJI	611	MALI	MLI	678	UGANDA	UGA	746
DOMINICAN REPUBLIC	DOM	243	MALTA	MLT	181	UKRAINE	UKR	926
ECUADOR	ECU	248	MAURITANIA	MRT	682	UNITED ARAB EMIRATES	ARE	466
EGYPT	EGY	469	MAURITIUS	MUS	684	UNITED KINGDOM	GBR	112
EL SALVADOR	SLV	253	MEXICO	MEX	273	UNITED STATES	USA	111
EQUATORIAL GUINEA	GNQ	642	MOLDOVA	MDA	921	URUGUAY	URY	298
ESTONIA	EST	939	MONGOLIA	MNG	948	UZBEKISTAN	UZB	927
ETHIOPIA	ETH	644	MOROCCO	MAR	686	VENEZUELA	VEN	299
FIJI	FJI	819	MOZAMBIQUE	MOZ	688	VIETNAM	VNM	582
FINLAND	FIN	172	NEPAL	NPL	558	YEMEN	YEM	474
FRANCE	FRA	132	NETHERLANDS	NLD	138	ZAMBIA	ZMB	754
GABON	GAB	646	NEW ZEALAND	NZL	196	ZIMBABWE	ZWE	698

These countries were selected mainly on the basis of their export's and GDP data availability. To avoid selection bias we verify that enough heterogeneity was granted, so the list includes countries of different size, development level, cultural profile, geographical position, etc.

Appendix D: Gravity Model Variables Sources:

- Bilateral Exports: International Monetary Fund (IMF), Direction of Trade Statistics Database DOTS (2013).

- Current GDP, population and urban participation : World Development Indicators (WDI) database, World Bank, (2013)

- Area, Island and Landlocked, constructed by the author based on the World Factbook from the Central Intelligence Agency of the United States of America (CIA)

- Weighted distance, contiguity, col45 and comlang_eth9 : CEPII (2013): Head, K., Mayer, T. & Ries, J. (2010), Gravity dataset, obs. till 2006.

- Regional Trade Agreements: constructed by the author, based on the Regional Trade Agreements Information System (RTA-IS), World Trade Organization WTO (2013)

- Generalized System of Preferences SGP: constructed by the author, based on the Database on Preferential Trade Arrangements of the World Trade Organization WTO (2013).

CEPII: Head, K., Mayer, T. & Ries, J. (2010), Gravity dataset, obs. Till 2006.
Rose, A. (2005) data set on The Multilateral (GATT/WTO) System and Trade obs. Till 1999
- GATT membership: constructed by the author based on the World Trade Organization WTO information (2013).

- OCDE membership: constructed by the author based on the Organisation de coopération et de développement économiques OCDE (2013) information.

Appendix E: Micro-foundation of the gravity model mathematical development by Anderson-Van Wincoop (2003).

Assumptions

- Homothetic CES (constant elasticity of substitution) consumers' preferences.
- Unitary income elasticity.
- Goods are differentiated by place of origin
- Each region is specialized in the production of only one good
- The Supply of each good is fixed.
- Prices differ between locations due to trade cost.
- Trade costs (shipping, transport and others) are borne by the exporter.
- For each good shipped from i to j the exporter incurs export cost $t_{ij} - 1$
- All supply prices p_i are equal to 1 and so the scaled price $[\beta_i p_i] = 1$
- Trade barriers are symmetric $t_{ij} = t_{ji}$, then $\Pi_i = P_i$

Variable definition

- $\alpha_{1\ldots n}$ *are parameters to estimate*
- σ *is the elasticity of substitution between all goods*
- t_{ij} *trade cost factor between i and j*
- p_i *is the exporter supply price, net of trade cost*
- P_{ij} *is the price of region i goods for region j consumers*
- Π_j *and* P_j *represent the average multilateral resistente to trade for countries i and j*
- c_{ij} *is consumption by region j of goods from region i*
- β_i *is a distribution parameter,* $\beta_i > 0$
- δ_i *is a dummy variable that takes* 1 *for interprovincial, and* 0 *for state − province trade*
- x_{ij} *is export from region i to region j*
- y_i *and* y_j *are GDP in region i and region j*
- $y^W = \sum_j y_j$ is world nominal income ; $\theta_j = y_j / y^W$ is region j's income share.
- d_{ij} *is the distance between i and j* , b_{ij} is 1 for a same country border and one plus a tariff when i and j are different countries.
- REM_i *reflect the average distance of region i from all tradeing partners other than j*
- k is a constant, $(1 - \sigma)$ and $(1 - \sigma)\rho$ are coefficients.

Framework

- (1) $lnx_{ij} = \alpha_1 + \alpha_2 \ln y_i + \alpha_3 \ln y_j + \alpha_4 \ln d_{ij} + \alpha_5 \ln \delta_{ij} + \varepsilon_{ij}$
- (2) $lnx_{ij} = \alpha_1 + \alpha_2 \ln y_i + \alpha_3 \ln y_j + \alpha_4 \ln d_{ij} + \alpha_5 \ln REM_i + \alpha_6 \ln REM_j \; \alpha_7 \ln \delta_{ij} + \varepsilon_{ij}$
- (3) $REM_i = \sum_{m \neq j} d_{ij} / y_m$
- (4) $\sum_i (\beta_i^{(1-\sigma)/\sigma} \; c_{ij}^{(1-\sigma)/\sigma})^{\sigma/(1-\sigma)}$
- (5) $\sum_i p_{ij} \, c_{ij} = y_j$, $\quad then \; p_{ij} = p_i t_{ij}$

  Equation (6) shows nominal demand for country i goods by country j consumers satisfying maximization of (4) subject to (5)

- (6) $x_{ij} = \left(\frac{\beta_i p_i t_{ij}}{p_j}\right)^{(1-\sigma)} y_j$
- Where P_j is the consumer price index of j given by,
- (7) $P_j = \left[\sum_i \left(\beta_i p_i t_{ij}\right)^{(1-\sigma)}\right]^{1/(1-\sigma)}$
- Market clearance as a consequence of the general-equilibrium structure implies:
- (8) $y_i = \sum_j x_{ij}$
- $= \sum_j \left(\beta_i t_{ij} p_j / P_j\right)^{1-\sigma} y_j$
- $= \left(\beta_i p_i\right)^{1-\sigma} \sum_j \left(t_{ij}/p_j\right)^{1-\sigma} y_i \quad , \forall\, i.$

- (9) $x_{ij} = \frac{y_i y_j}{y^W} \left(\frac{t_{ij}}{\Pi_i P_j}\right)^{1-\sigma}$
- Where
- (10) $\Pi_i = \left(\sum_j \left(t_{ij} / P_j \right)^{1-\sigma} \theta_j \right)^{1/(1-\sigma)}$
- Substituting the equilibrium scaled prices into (7), we obtain:
- (11) $P_j = \left(\sum_i \left(t_{ij} / \Pi_i \right)^{1-\sigma} \theta_i \right)^{1/(1-\sigma)}$
- From (10) and (11) we obtain:
- (12) $P_j^{1-\sigma} = \sum_i P_i^{\sigma-1} \theta_i t_{ij}^{1-\sigma} \quad , \forall\, j \,,$
- The gravity equation then becomes:
- (13) $x_{ij} = \frac{y_i\, y_j}{y^w} \left(\frac{t_{ij}}{P_i \Pi_j}\right)^{1-\sigma}$