Deep Integration.
The Heterogeneity of Free Trade Agreements and their Impact on Bilateral Trade

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Abstract

Regional trade agreements (RTAs) have emerged in an environment of stalled multilateral trade negotiations. Their impact on international trade has been well documented, while scant attention has been paid to empirical studies exploring their heterogeneity from the point of view of deep integration. We set out to determine whether deeper RTAs promote trade more effectively than less ambitious agreements. We generate credible deep integration indicators using two recently available datasets from the World Trade Organization (WTO) and the World Trade Institute (WTI-DESTA). We then test the effect of deepness on trade using a gravity model. We treat additive indicators as factor variables and use Multiple Correspondence Analysis (MCA) to obtain distilled indicators of deep integration in order to offer new insight and confirm recent deep integration findings. We find that deeper agreements increase trade more than shallow agreements, irrespective of whether the provisions they contain are within or beyond the remit of the WTO.

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

JEL: F13, F14, F15, F53

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1. Introduction

Substantial progress has been made to answer the following question: do regional trade agreements (RTAs) increase trade flows (see Rose (2004), Baier & Bergstrand (2007), (Martínez-Zarzoso *et al.* (2009))? Estimates of RTAs frequently overlook thorny issues such as the heterogeneity of free trade agreements and the concept of deep integration. A survey on the subject is provided by Kohl (2014).

One question has raised renewed interest: are all RTAs comparable? This paper seeks to gain insight into the nature of bilateral trade agreements, their design and content, and to shed light on the implications of deep integration for bilateral trade flows.

Although all trade agreements are inherently designed to liberalize and regulate international trade, they also have remarkable differences: they vary in the number of signatories, their economic weight and the distance between them, and in the level of development among partners. No less important, they also vary in their depth, i.e. the number and nature of provisions included in the agreement. In addition to the obvious provisions on tariffs and rules of origin, the agreements often go further into non-tariff barriers subject to agreements administered by the WTO (e.g. intellectual property rights and sanitary and phytosanitary rules) or beyond the remit of the WTO, such as competition or labour standards.

RTAs are designed not only to secure market access. They also seek broader international trade regulation. This does not necessarily mean that they create more trade. In some cases, they might even reduce it. Enforcement of intellectual property rights, included in many RTAs, can also end up reducing non-patented trade, not necessarily offset by a rise in trade in patented goods. The agreement between the European Union (EU), Colombia and Peru (OJEU 354, 2012) includes a provision for disarmament and non-proliferation of weapons of mass destruction, meaning less trade in some minerals and industrial goods such as nuclear reactors.

The current literature has not sufficiently explored the heterogeneity of RTAs. A better understanding of this topic would help raise awareness of its importance, evaluate its implications, and redefine the interpretation of the RTA coefficient and the limitations of trade liberalization. The common practice of using a dummy variable to introduce the effect of an RTA in a gravity model is tantamount to assuming that any pair of countries is treated the same, irrespective of the scope of the trade agreement. Finding a way to measure this heterogeneity and associate it with the extent of depth of the agreements themselves generates indicators that can clarify the impact of this heterogeneity on bilateral trade flows.

This paper improves on previous studies (Shahid, 2011; Orefice & Rocha, 2013; Kohl *et al.*, 2016; Dür *et al.*, 2014)) and revises their results. Our main contribution derives from the use of MCA indicators, which is a Principal Components Analysis (PCA) method better suited to qualitative variable applications (Booysen *et al.*, 2008). A second contribution is that we provide a clearer visualization of the impact of trade deepening on bilateral exports by treating additive indicators as factor variables with clustered ranges. Lastly, this research finds that a 10% increase in the depth of integration raises bilateral trade flows by around 3.0%.

Following this introduction, section 2 reviews the most important contributions made by the literature. Section 3 presents our dataset resources and methodological approach. It introduces our econometric model and the four main specifications used to estimate the impact of agreement depth on bilateral trade flows. Section 4 reports on the results. Section 5 presents a series of robustness checks and section 6 discusses our conclusion.

2. Literature review

We take the WTO (2014) definition of RTAs as largely shared by academics and international trade researchers: "reciprocal trade agreements between two or more partners". These agreements include free trade agreements and customs unions, together with more advanced schemes like the EU single market. "Preferential trade arrangements" (PTAs), on the other hand, are non-reciprocal trade agreements. They include Generalized System of Preferences (GSP) schemes and other schemes granted a waiver by the WTO General Council. This paper focuses essentially on RTAs, although the term "regional" is no longer really relevant to these agreements that frequently involve remote countries distant from each other.

Magee (2008) presents a classification of preferential agreements (PAs), free trade agreements (FTAs), customs unions (CUs) and common markets (CMs) to estimate the impact of the depth of the agreements. Taking a similar classification, Vicard (2009) finds that, "Once self-selection into agreements is controlled for, their trade creation effect does not statistically differ according to the depth of the RTA: creating a FTA, a CU or a CM has a similar impact on trade among members." However, Magee (2008) and Vicard (2011) introduce terms of interaction between RTAs and some country characteristics to find that some trade agreements are more effective than others. Those signed by large, similar neighbouring countries tend to perform better in terms of trade creation than smaller, more remote, dissimilar countries. The authors estimate different RTA effects for CUs, FTAs, and PAs in what could be seen as a measure of their depth. Although Baier, Bergstrand and Feng (2014) do not use exactly the same trade integration categories as previous studies, they provide evidence of the differential partial effect of different levels of economic integration agreement (EIAs) on intensive and extensive trade margins.

These approaches do not focus so much on the reach, design or content of the agreements as on the countries' intrinsic, observable characteristics. At the same time, they use a (Balassa, 1961) similar representation of economic integration levels that is no longer suitable with the degree of complexity introduced by recent generations of RTAs, which include not only provisions directly linked to market access for goods (including tariffs and non-tariff barriers) and services, but also intellectual property rights, "Singapore issues" (investment, public procurement, trade facilitation and competition), labour standards, environmental issues and food standards. (Khor, 2008).

Hoekman and Konan (2001) quantify the implications of a deeper RTA with general equilibrium model simulations for the EU-Egypt RTA. They find a welfare increasing effect for potentially deeper agreements. This effect can be neither generalized nor taken for granted, since developing countries might be forsaking valuable industrial policy tools in exchange for greater market access and subsequently hampering their upward mobility in the international configuration of market specialization (Harrison & Rodríguez-Clare, 2010; Shadlen, 2005; Rodrik *et al.*, 2004).

An interesting approach to assessing the impact of deep integration is to compute the average tariff equivalents of non-tariff measures. Ghoneim *et al.* (2012) take TRAINS-UNCTAD data on non-tariff measures and find evidence of strong trade creation potential based on simulations of deeper integration between Southern Mediterranean countries and the EU. In the same vein, Péridy and Ghoneim (2013) take five Middle Eastern and North African countries and identify very high average tariff equivalents for their non-tariff measures that significantly reduce trade with their partners. Yet this approach is problematic in terms of the small number of countries and time period covered by the available databases.

Bourgeois, Dawar & Evenett (2007) conduct a qualitative legal analysis of the content of 27 RTAs. They compare and describe the discrepancies between these agreements by analysing five provisions (labour market, competition policy, public procurement, environmental laws and non-tariff barriers). Márquez-Ramos *et al.* (2011) find that democratic, free-market-oriented economies are more likely to enhance a RTA. Another qualitative study of ASEAN's external PTAs is provided by Kleimann (2014), who concludes that bilateral PTAs between ASEAN members and the same external partners result in deeper commitments.

Many of the current developments in the field of deep integration come from the work by Horn *et al.* (2010) to codify EU and US RTA provisions and introduce non-traditional WTO provisions into the analysis. They also explore legal enforcement effects by identifying language nuances in RTA texts. This paper avoids this kind of subjective judgment, even at the cost of assuming that all RTA provisions are equally enforceable.

Shahid (2011), Orefice & Rocha (2013) and Kohl (2013) take the agreement content and empirical analysis a step further based on WTO Research Division data for the World Trade Report (2011). Shahid (2011) concludes that the nature of RTAs matters, although the magnitude and direction of the relationship remain unclear as deeper agreements can be exposed to diminishing returns. The results from Orefice & Rocha (2013) using Principal Component Analysis (PCA) and additive indicators show that, on average, deeper agreements increase trade in production networks between member countries by almost 12%. Kohl (2014) finds a positive correlation between the number of institutional quality provisions contained in RTAs and their average treatment effect. Kohl *et al.* (2016) find mixed results where RTA heterogeneity can positively or negatively impact on bilateral trade depending on the scope of the provisions. Traditional WTO provisions are found to have a positive effect with the opposite found for non-traditional clauses. Lastly, Dür *et al.* (2014) construct their own enlarged database of 587 FTAs, 356 of which are listed by the WTO. The authors also conduct a latent trade analysis to compute a distilled indicator for the depth of the agreements. Their results find a significant, positive relationship between deeper agreements and bilateral trade flows.

3. Data and Methodology

One of the main hurdles that deep integration literature is up against is the lack of publicly available datasets documenting the content of a reasonably large sample of RTAs. This problem has recently been solved in part by two independent projects to codify RTAs by the different provisions they contain: the WTO (2011) Research Division for the World Trade Report and the DESTA-WTI (2014) Design of Trade Agreements. We use these two datasets to account for the presence of a provision in an RTA, an invaluable input needed to produce credible deep integration indices.

3.1 Deep integration indicators

Taking the Horn *et al.* (2010) approach, the first dataset is divided into two main categories: WTO+ and WTO-X. The first category (Table 1) covers provisions within the remit of the WTO agreements and the second (Table 2) covers provisions beyond the WTO's current remit, but negotiated in RTAs worldwide as they are trade related. Some of the areas initially proposed by Horn *et al.* (2010) are not included here due to a lack of variability or relevance.

Table 1

WTO+ policy areas negotiated in RTAs
Anti-Dumping
Countervailing Measures
GATS (General Agreement on Trade in Services)
Public procurement
Sanitary and Phytosanitary Measures
State Aid (Subventions)
State Trading Enterprises
Technical Barriers to Trade
Trade Related Aspects of Intellectual Property Rights
TRIMs (Trade-Related Investment Measures)

Source: Authors based on Horn *et al.* (2010)

It is worth noting that TRIPs and IPRs are closely related, as are TRIMs and investment measures since they are negotiated both within and without the scope of the WTO. When we find these provisions present in RTAs, codified under the category WTO-X, we have to assume that these agreements go further than usually provided for by the WTO.

Another problem arises with the WTO-X agricultural provision, since much of the Table 1 provisions also apply to agricultural issues. We address this problem by computing indicators with and without these provisions. When a restricted dimension excluding agriculture, IPRs and investment appears in the analysis, we place an *r* after the variable's name.

Table 2

WTO-X provisions negotiated in RTAs

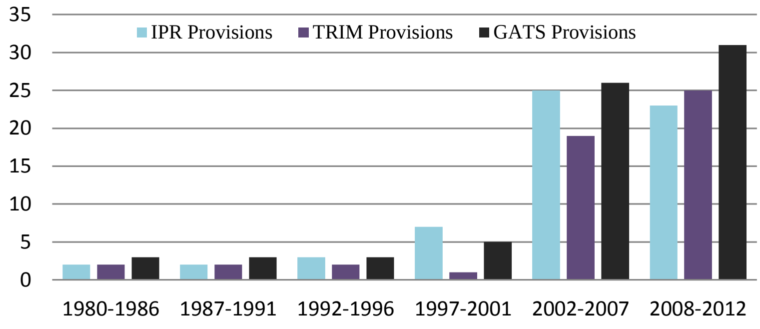
Agriculture	Health	Nuclear safety
Anti-corruption	Human rights	Political dialogue
Approximation of legislation	Illegal immigration	Public administration
Audiovisual	Illicit drugs	Regional cooperation
Competition policy	Industrial cooperation	Research and technology
Consumer protection	Information society	Small and Medium Enterprises
Cultural cooperation	Innovation policies	Social matters
Data protection	Investment measures	Statistics
Economic policy dialogue	Intellectual Property Rights (IPRs)	Taxation
Education and training	Labour market regulation	Terrorism
Energy	Mining	Visa and asylum
Environmental laws	Money laundering	
Financial assistance	Movement of capital	

Source: Authors based on the Horn *et al.* (2010) classification

Figure 1 shows the growth in IPR, TRIM and GATS provisions in new RTAs. Figure 2 presents the growth in environmental and labour market provisions based on our classification of the provisions in our sample of 103 RTAs.

Provisions covering investment and services within the traditional scope of the WTO+ display an increasing trend over time. A similar trend is found for intellectual property rights measures, albeit with a loss of momentum in the 2008-2012 period compared with the 2002-2007 period (see Figure 1). This trend goes hand in hand with an increase in the number of RTAs over time. The percentage weight of these provisions has also risen over the last two decades.

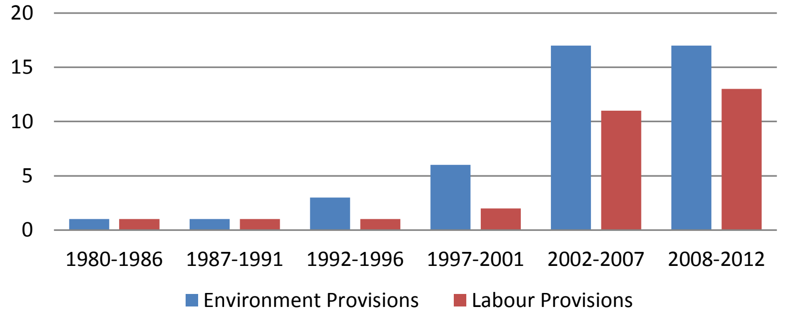
Figure 1
Number of new RTAs including IPR, investment or service provisions, 1980-2012.



Source: Authors based on WTO (2011) Research Division data for the World Trade Report

Figure 2 clearly shows the surge in environmental and labour market regulation provisions, two of the most common WTO-X provisions negotiated in modern RTAs. In percentage terms, labour market regulation provisions have posted a sharper rise than environmental clauses over the last two decades.

Figure 2
Number of new RTAs including environmental or labour market provisions. 1980-2012.



Source: Authors based on WTO (2011) Research Division data for the World Trade Report

Orefice and Rocha (2013) take the WTO (2011) dataset to conduct an empirical analysis of 66 RTAs and 200 countries from 1980 to 2007. The same dataset is also used by Shahid (2011) to analyse 97 RTAs and 132 countries over the 1994-2010 period. We build on the WTO (2011), covering 103 RTAs and 153 countries in our calculations from 1980 to 2012.

Differences in country samples and periods of analysis explain the divergences in the RTAs considered in this paper compared with previous literature. We code and include new agreements for Colombia and Peru,[1] which were not available in the original WTO (2011) database, to offset the loss in RTAs subscribed by countries like the Faroe Islands, Montenegro and San Marino.

The first step in building additive indicators of deepness is to establish a set of provisions likely to appear in an RTA. The second step consists of counting how many of these provisions are found in a particular agreement. The advantage of this approach is that it is easy to compute. The disadvantage is that it assigns an equal weight to all the provisions embodied in an agreement. One RTA might have the same number of provisions as another RTA, but differ entirely in terms of the subjects covered and the kinds of goods liberalized. Additive indicators can also be obtained by assigning different weights. However, in many cases this is done arbitrarily.

The number of provisions an agreement incorporates does not in itself ensure the agreement's enforceability. However, we do not consider legal enforceability due to the subjective nature of its codification process. Neither does an additive indicator guarantee that what we consider to be a very deep agreement, due to its institutional maturity will actually appear as such 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, the Dur *et al.* (2014) indicator gives the 1992 EU single market agreement a second-rate score of 5 while Colombia-USA is assigned a 7. At the same time,

[1] We have coded the following RTAs based on Horn *et al.* (2010): Canada-Colombia, Canada-Peru, Central America-Colombia, Chile-Colombia, Chile-Peru, Colombia-Cuba, Colombia-EFTA, Colombia-Mercosur, Colombia-USA, EFTA-Peru, Group of 3, Japan-Peru, Peru-Mercosur, Peru-Republic of Korea and Peru-USA.

Orefice and Rocha (2013) give the EU_27 a score of 6 in WTO+ and 11 in WTO-X, but EU-Chile a mark of 9 in WTO+ and 27 in WTO-X.

Some statistical methods have been developed to produce indicators that capture the inertia of a set of variables (characteristics) in a single dimension in order to deal with some of the additive indicators by treating all the characteristics as equal. Orefice and Rocha (2013) use a Principal Component Analysis (PCA) indicator. Dür *et al.* (2014) compute a Rasch indicator, which has the advantage of assuming that only one dimension is defined by the dataset's observations.

Because binomial variables, of the kind we address in our analysis, are a particular type of categorical variable, a Multiple Correspondence Analysis (MCA) procedure is considered more suitable than PCA, which is best used for continuous variables (Cahuzac & Bontemps, 2008; Dunteman, 1989). MCA is then used to detect and represent underlying structures in a dataset and arrange data as points in a set of dimensions. (Le Roux and Rouanet, 2010).

The MCA we perform on the traditional WTO-remit provisions (WTO+) shows that a great deal, more than 85%, of the inertia is explained by the first dimension. We equate this dimension with a measure of deep integration. As an MCA procedure does not define the direction of the relationship, we review its coherence such that the shallowest agreements in the MCA indicator take the lowest values. Hence, a higher index value stands for a greater depth of integration. Likewise, we run an MCA for our restricted WTO-Xr provisions (excluding agriculture, IPR and investment) to explore the impact of deeper agreements on provisions not traditionally within the WTO's remit. Here, some 89% of the inertia is explained by the first dimension.

3.2 Gravity Model and Econometric Specifications

In his 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}. Anderson and Van Wincoop (2003) take up a micro-funded mathematical approach to better estimate the gravity equation (eq. 1) where Y^W is world nominal income; θ_i and θ_j are shares of world income for country *i* and country *j*, σ is the elasticity of substitution between all goods, and P_i and Π_j are the price levels respectively in countries *i* and *j*.

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

Anderson and Van Wincoop (2003) consider "multilateral resistance", i.e. the trade openness of countries *i* and *j* to the world as a whole. However, these variables are non-observable. A widely accepted solution is to introduce time-invariant fixed effects for importers and exporters, first to avoid endogeneity due to unobservable heterogeneity and then to partially control for omitted variable bias derived from multilateral resistance (see Anderson, 2011).[2]

[2] Time-varying fixed effects (TVFE) can be introduced into the gravity equation to better account for multilateral resistance. Nevertheless, we do not control for country TVFE in the body of this paper due to computational limitations stemming from the maximum likelihood process for PPML when too many fixed

To estimate the impact of the depth of RTAs, we regress bilateral export flows on a set of indicators of depth and covariates using a Poisson specification. Our gravity model dataset consists of 613030 bilateral trade flows for 153 countries from 1980 to 2012. Santos Silva & Tenreyro (2006; 2011) posit Poisson Pseudo Maximum Likelihood (PPML) as the most suitable method for estimating the gravity equation. This method is robust to heteroskedasticity and deals with bias caused by the presence of many zeros in bilateral international trade data, which are positively related to distance and negatively related to market size (Baldwin and Harrigan, 2011). Fally (2015), Martínez-Zarzoso (2013) and Head and Mayer (2014) provide additional evidence in support of the use of the PPML estimator.

Appendix D presents information on the WTO+, WTO-X and DESTA datasets. It shows the number of RTAs by their number of provisions and clustered number of provisions as well as by the number of bilateral trade flows affected by these RTAs. The DESTA dataset contains the largest number of RTAs, at 269 as opposed to 103 for WTO and WTO-X.

Our depth indicators are tested in terms of level, as factor variables and in logarithms. We use the four following specifications.

Our first eq. (2) specification enables us to express our depth indicators in levels: additive, MCA or Rasch. We use subscript $_m$ to indicate the kind of indicator we are estimating (level, logarithmic or MCA):

$$(2) \qquad X_{ijt} = \exp(\beta_0 + \beta_1 \boldsymbol{dp}_{\boldsymbol{indc}_{\boldsymbol{ijtm}}} + \vartheta_l \boldsymbol{G}_{\boldsymbol{ijt}} + \psi_h \boldsymbol{S}_{\boldsymbol{it}} + \phi_h \boldsymbol{M}_{\boldsymbol{jt}} + \alpha_t + \alpha_i + \alpha_j) u_{ijt}$$

where the dependent variable X_{ijt} represents bilateral Fob exports in current dollars from country *i* to country *j* and $u_{ijt} = \exp((1-\sigma)\mathcal{E}_{ijt})$. $\boldsymbol{S}_{it}$ and $\boldsymbol{M}_{jt}$ are vectors of time varying idiosyncratic controls for exporters and importers respectively composed of *h* control variables.

Control variables are: $lnGDP_{it}$ and $lnGDP_{jt}$ as the natural logarithm for GDP in current dollars; $lnpop_{it}$ and $lnpop_{jt}$ as the natural logarithm for the population; $GATT_{it}$ and $GATT_{jt}$ and $OECD_{it}$ and $OECD_{jt}$ taking the value of 1 if the country belongs to the GATT/WTO and OECD respectively on date *t*.

$\mathbf{G}_{ijt}$ is a vector dyadic variable consisting of $contg_{ij}$, *as* a dummy for sharing a common land border; $comlang_{ijt}$, as a dummy for sharing the same language; $col45_{ijt}$, as a dummy for colonial countries prior to 1945; and $lndist_{ijt}$ as the natural logarithm for distance between countries i and j. Correspondingly, ϑ_l is a vector of coefficients to be estimated for these variables where subscript $_l$ is used to indicate the variables.

We introduce the year fixed effect α_t, time-invariant fixed effects α_i and α_j for exporters and importers, and error term, u_{ijt}.

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effects are to be computed. For robustness, we check the effects of TVFE with OLS. Using the Baier & Bergstrand method, which contracts the time dimension, we also check the effects of TVFE with PPML for the factor variable indicators.

Sources and definitions are available in appendices A and B. As we account for time-invariant country fixed effects, the inclusion of traditional variables such as the country's surface area or insular or landlocked status is redundant.

We introduce our indicator in logarithmic form so that we can reason in terms of percentage variations. We then choose to add 1 to the index before using a logarithm to deal with zeros, see eq. (3) specification:

$$(3) \quad X_{ijt} = \exp(\beta_0 + \beta_1 \boldsymbol{ln}[\boldsymbol{1} + \boldsymbol{dp_{Ind_{ijtm}}}] + \vartheta_l \boldsymbol{G_{ijt}} + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{jt}} + \alpha_t + \alpha_i + \alpha_j) u_{ijt}$$

Next, the econometric specification of Eq (4) introduces our additive depth indicators for WTO+, WTO-X and DESTA as factor variables. To address this point, we create a dummy variable for each range of RTAs based on the number of provisions they have. As some ranges of provisions concern a limited number of RTAs, particularly with respect to WTO-X, we test this specification by regrouping the RTAs into fewer ranges, where δ_{ijt} represent the coefficients for each of these ranges.

$$(4) \quad X_{ijt} = \exp(\beta_0 + + \vartheta_l \boldsymbol{G_{ijt}} + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{jt}} + \delta_{ijt\,n-1} \sum_{1}^{n-1} \boldsymbol{dp_{ind_{add_{nijt}}}} + \alpha_t + \alpha_i + \alpha_j) u_{ijt}$$

We use eq (5) to identify possible nonlinearities, such as diminishing or increasing returns, where we test our additive indicators on a quadratic form.

$$(5) \quad X_{ijt} = \exp(\beta_0 + \beta_1 \boldsymbol{dp_{Ind}}_{ijt} + \beta_2 \boldsymbol{dp_{Ind}}^{\boldsymbol{2}}_{\boldsymbol{ijt}} + \vartheta_l \boldsymbol{G_{ijt}} + \psi_h \boldsymbol{S_{it}} + \phi_h \boldsymbol{M_{jt}} + \alpha_t + \alpha_i + \alpha_j) u_{ijt}$$

4. Results

We first discuss our findings for the additive indicators before moving on to the factor variable specification. We then present our estimates of distilled depth indicators using the MCA and Rasch models.

4.1. Deep Integration Additive Indicators

Our variables of interest here are (ad_WTO+) and (ad_WTO_X) consisting of the additive index of provisions within and without the regular WTO framework respectively. We also test the variable (ad_DES), which is the additive index based on DESTA database.

These variables take the value 0 when there is no RTA, 1 when a signed trade agreement has no provisions (ASEAN), 2 when the agreement has one provision and so forth, up to the index of deepest RTAs, which is 11 for ad_WTO+, 32 for ad_WTO_X and 8 for ad_DES. Thus, ad^2_WTO+, ad^2_WTO_X and ad^2_DES are their quadratic form. Likewise, ln_ad_WTO, ln_ad_WTO_X and ln_ad_DES are their logarithmic expression. Variables expressed in levels take the eq. 2 specification and the log variables the eq. 3 specification.

A positive, significant effect is found for every specification (Table 3). An 10% increase in the number of traditional WTO+ provisions increases bilateral trade by approximately 2.5%, as it does for the DESTA classification of provisions. A slightly smaller effect can be attributed to an increase in non-traditional WTO-X provisions. When tested in their quadratic specification, additive indicators reveal decreasing returns to the process of integration.

Table 3

Deep Integration: Additive indicators in level, log and quadratic form for WTO+, WTO-X and DESTA. PPML estimator.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}	X_{ijt}
ad_WTO+	0.058***	0.107***							
ad2_WTO+		-0.005***							
ln_ad_WTO+			0.231***						
ad_WTO_X				0.023***	0.071***				
ad2_WTO_X					-0.002***				
ln_ad_WTO_X						0.183***			
ad_DES							0.077***	0.127***	
ad2_DES								-0.007***	
ln_ad_DES									0.250***
$lnGDP_{it}$	0.764***	0.751***	0.747***	0.755***	0.758***	0.748***	0.740***	0.731***	0.730***
$lnGDP_{jt}$	0.678***	0.664***	0.661***	0.670***	0.670***	0.661***	0.655***	0.645***	0.644***
$lndist_{ijt}$	-0.785***	-0.768***	-0.762***	-0.819***	-0.766***	-0.770***	-0.764***	-0.751***	-0.751***
$lnpop_{it}$	-0.162**	-0.154**	-0.175**	-0.159**	-0.166**	-0.178**	-0.132*	-0.142*	-0.158**
$lnpop_{jt}$	-0.324***	-0.325***	-0.349***	-0.327***	-0.343***	-0.358***	-0.287***	-0.309***	-0.327***
$contig_{ijt}$	0.495***	0.502***	0.497***	0.530***	0.497***	0.506***	0.479***	0.483***	0.481***
$comlang_{ijt}$	0.245***	0.242***	0.239***	0.278***	0.267***	0.262***	0.265***	0.263***	0.261***
$col45_{ijt}$	0.144***	0.152***	0.157***	0.125***	0.182***	0.163***	0.236***	0.244***	0.245***
$ocde_{it}$	0.212***	0.220***	0.212***	0.253***	0.220***	0.214***	0.254***	0.248***	0.243***
$oecd_{jt}$	0.192***	0.197***	0.189***	0.223***	0.193***	0.187***	0.167***	0.161***	0.156***
$gatt_{it}$	0.351***	0.338***	0.334***	0.348***	0.337***	0.336***	0.326***	0.311***	0.305***
$gatt_{jt}$	0.219***	0.204***	0.200***	0.221***	0.211***	0.204***	0.223***	0.208***	0.200***
Observations	572,924	572,924	572,924	575,650	575,650	575,650	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 time invariant FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Importer time invariant 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; Source: Own calculations.

The results displayed in Table 4 come from the transformation of our ad_WTO+, ad_WTO-X and DESTA additive indicators into factor variables as in eq. (4). Ranking the number of RTAs available by number of provisions identifies that most of the RTAs are in the shallowest ranges of provisions. See appendix.

For WTO+ provisions, this procedure consists of generating 12 dummies including the no-agreement case (ad_WTO+1), which is chosen as the excluded category; the RTA with no-provisions case[3] (ad_WTO+2) and (ad_WTO+3 to ad_WTO+12) for the 10 different

[3] For example: ASEAN, PAFTA, Russia-Ukraine, Ukraine-Kazakhstan, and Ukraine-Turkmenistan

provisions within the WTO+ framework. Then, to ensure sufficient RTA representation in each cluster of factor variables, we regroup the provisions into four ranges. Hence the effect of deeper integration on bilateral exports is increasing with the number of provisions included in the RTAs.

We use the same above-described procedure to analyse the WTO-X additive indicator as a factor variable. Because of the large number of provisions, we generate dummy variables for 4 ranges. The results are presented in column 2 of table 4. The same choice is made for the DESTA additive index, which is based on 8 general provisions before being clustered into 4 ranges.

Although all our results are positive for WTO-X provisions, we do not find the same increasing pattern here as obtained for WTO+.

Column 3 in table 4 shows that introducing DESTA additive depth indicators into our gravity equation as factor variables in a four-range ranking produces a pattern that is consistent with those obtained from WTO+ provisions when we test them as factor variables under a four-range ranking.

Treating the WTO+ and DESTA additive indicators as factor variables clustered into four successive ranges clearly shows that RTAs tend to have a greater impact on bilateral trade flows where they include an increasing number of provisions.

In section 6.1, where the robustness checks are presented, we test whether our results are sensitive to the number of ranges we select.

Henceforth, to make the tables lighter, our results focus on our variables of interest (depth indicators). Covariate estimates are available in the working paper.

Table 4
Deep Integration: Additive indicators as factor variables by WTO+, WTO-X and DESTA provisions. Divided into 4 ranges. PPML estimator.

	(1)		(2)		(3)
	X_{ijt}		X_{ijt}		X_{ijt}
ad_WTO+2	0.249***	ad_WTO_X2	0.449***	ad_DES2	0.267***
ad_WTO+3	0.486***	ad_WTO_X3	0.533***	ad_DES3	0.429***
ad_WTO+4	0.488***	ad_WTO_X4	0.344***	ad_DES4	0.532***
Observations	572,924		575,65		587,654
R-squared	0.902		0.900		0.900
Time-invariant exporter FE	YES		YES		YES
Time-invariant importer FE	YES		YES		YES
Country-pair FE	NO		NO		NO
Time FE	YES		YES		YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1; Source: Own calculations

4.2 Distilled Deep Integration 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)[4] procedure, and a set of variables generated by the Rasch methodology computed by Dür *et al.* (2014) with DESTA inputs. We also explore the possibility of non-linearities in the process of trade integration by introducing quadratic terms on our MCA indicators for WTO and WTO-X provisions and Rasch indicators (Table 5). We develop two separate sets of indicators, based on WTO+ provisions and WTO-X provisions. We try out specifications in levels, logarithms and quadratics to test the sensitivity of these indicators.

We consider mca_WTO+ and mca_WTO_X, which are MCA indices obtained from their first dimension of inertia to capture RTA 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 use these same conventions.

Table 5

Distilled Deep Integration Indicators: MCA and Rasch indicators in levels, quadratics and logs. PPML estimator.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij
mca_WTO+	0.147***	0.252***										
mca2_WTO+		-0.029***										
ln_mca_WTO+			0.351***									
mca_WTO_X				0.163***	0.450***							
mca2_WTO_X					-0.086***							
ln_mca_WTO_X						0.409***						
mca_WTO_Xr							0.162***	0.463***				
mca2_WTO_Xr								-0.091***				
ln_mca_WTO_Xr									0.412***			
rasch_DES										0.132***	0.268***	
rasch2_DES											-0.047***	
ln_raschs_DES												0.285***
Observations	575,583	575,583	575,583	575,587	575,587	575,587	575,587	575,587	575,587	587,654	587,654	587,654
R2	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 TIFE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Importer TIFE	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 Fixed Effects	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. Source: Own calculations. Note: TIFE stands for time-invariant fixed effects.

Use of the character *r* (as *restrained*) at the end of a variable (mca_WTO_Xr, mca^2_WTO_Xr and ln_mca_WTO_Xr) means that it excludes agriculture, investment and IPR, because these provisions are already covered to all intents and purposes by the traditional WTO+

[4] 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 Table 2. The first dimensions of this restrained MCA accounts for 89.7% of the inertia.

framework. This restriction does not change the sign or the significance of these indicators, but increases the value of the coefficients in all specifications (Table 6). The Rasch index in (Table 6) is positive and significant. When tested in their quadratic form, diminishing returns are found to the deepening of trade integration.

5. Robustness Checks

In this section, we check the sensitivity of our results to the clustering of provisions, the introduction of time-variant country fixed effects and the use of Principal Component Analysis.

5.1 Additive depth indicator factor variable clustering sensitivity analysis

Here, we analyse the sensitivity of the WTO+ clusters. Column 2 in table 6 reproduces the breakdown presented in table 3 to make the analysis easier. A comparison of results in column 2 of table 6, which presents 5 ranges, and in column 3, which presents 3 ranges, finds that the WTO+ results are robust to an increase from 4 to 5 ranges as well as to a decrease from 4 to 3 ranges. This confirms that introducing more WTO+ provisions into the RTAs can be expected to have a larger impact on trade.

Table 6

Deep Integration: Additive indicator as a factor variable from WTO+. Divided into 5, 4 and 3 ranges. PPML estimator

	(1) Xijt		(2) Xijt		(3) Xijt
ad_WTO+2a	0.231***	*ad_WTO+2*	0.249***	*ad_WTO+2b*	0.345***
	(0.028)		(0.028)		(0.021)
ad_WTO+3a	0.411***	*ad_WTO+3*	0.486***	*ad_WTO+3b*	0.543***
	(0.021)		(0.021)		(0.019)
ad_WTO+4a	0.518***	*ad_WTO+4*	0.488***		
	(0.022)		(0.023)		
ad_WTO+5a	0.565***				
	(0.029)				
Observations	572924		572,924		572,924
R-squared	0,903		0.902		0.903
Taime invariant exporter FE	YES		YES		YES
Time invariant importer FE	YES		YES		YES
Country-pair FE	NO		NO		NO
Time FE	YES		YES		YES

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

Letters a and b at the end of a variable's name means that the ranges are grouped together

Source: Own calculations

Moving on to the sensitivity of the WTO-X provisions, table 8, column 2 reproduces the results presented in table 6. A reduction in the number of ranges clustering the provisions from 4 to 3 (column 3) produces a result where deeper agreements raise trade more than shallow ones.

Nevertheless, this finding is not confirmed when we raise the number from 4 to 5 ranges (see column 1), whereas deeper agreements seem to increase trade more than shallow ones up to a certain point in column 2 where more integration appears to raise trade, but to a lesser extent than before.

Table 8

Mis en forme : Surlignage

Deep Integration: Additive indicator as a factor variable from WTO-X. Divided into 5, 4 and 3 ranges. PPML estimator

	(1)		(2)		(3)
	Xijt		Xijt		Xijt
ad_WTO_X2a	0.306***	*ad_WTO_X2*	0.449***	*ad_WTO_X2b*	0.407***
	(0.024)		(0.019)		(0.020)
ad_WTO_X3a	0.456***	*ad_WTO_X3*	0.533***	*ad_WTO_X3b*	0.502***
	(0.023)		(0.021)		(0.019)
ad_WTO_X4a	0.551***	*ad_WTO_X4*	0.344***		
	(0.022)		(0.028)		
ad_WTO_X5a	0.426***				
	(0.021)				
Observations	575,650		575.650		575,650
R-squared	0.903		0,9		0.903
Time invariant exporter FE	YES		YES		YES
Time invariant importer FE	YES		YES		YES
Country-pair FE	NO		NO		NO
Time FE	YES		YES		YES

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

Letters a and b at the end of a variable's name means that the ranges are grouped together

Source: Own calculations

As above, column 2 of table 9 presents the sensitivity results for the four-range breakdown displayed in column 3 of table 3. We compare these results with the clusters including five and three ranges (see columns 1 and 3). A five-range classification, as in column 1, suggests a positive, increasing impact on bilateral exports induced by the increase in the number of provisions in an RTA. Reducing the number of ranges to three, as in column 3, confirms the same pattern as columns 1 and 2 where RTAs with more provisions generate a greater increase in bilateral exports. Our results for the DESTA additive RTA classification are robust to changes in the factor variable specification clusters.

Table 9

Mis en forme : Surlignage

Deep Integration: Additive indicator as a factor variable from DESTA. Divided into 5, 4 and 3 ranges. PPML estimator

	(1)		(2)		(3)
	Xijt		Xijt		Xijt
ad2_DESa	0.189***	*ad2_DES*	0.267***	*ad2_DESb*	0.277***
	(0.045)		(0.024)		(0.024)
ad3_DESa	0.281***	*ad3_DES*	0.429***	*ad3_DESb*	0.465***
	(0.025)		(0.019)		(0.018)

ad4_DESa	0.398***	*ad4_DES*	0.532***	
	(0.020)		(0.028)	
ad5_DESa	0.506***			
Observations	587.654		587.654	587,654
R-squared	0,901		0.900	0.900
Time invariant exporter FE	YES		YES	YES
Time invariant importer FE	YES		YES	YES
Country-pair FE	NO		NO	NO
Time FE	YES		YES	YES

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

Letters a and b at the end of a variable's name means that the ranges are grouped together

Source: Own calculations

5.2 OLS and PPML estimators of time-varying fixed effects

We worked previously on time-invariant country fixed effects. The introduction of time-varying fixed effects into the analysis gives us elements to assess the robustness of the results hitherto presented as they reduce omitted variable bias. Estimation of the entire set of indicators using PPML and time-varying fixed effects for the full 33-year period is not feasible for the time being due to PPML convergence difficulties when a large number of fixed effects has to be evaluated. Conversely, the OLS procedure for time-varying fixed effects is easily practicable (Guimaraes and Portugal, 2010). Our set of additive depth indicators is then re-estimated using OLS and introducing time-varying country fixed effects. Our previous results are robust (see table 10). WTO-X provisions display lower coefficients than WTO+ provisions. This remains valid irrespective of whether the specification is in level, quadratic form or logarithm.

Table 10

Deep Integration: Additive indicators in level, log and quadratic form for WTO+, WTO-X and DESTA. OLS estimator with TVFE.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	lnXij	lnXij	lnXij	Lnxij	lnXij	lnXij	lnXij	lnXij	lnXij
ad_WTO+	0.063***	0.151***							
ad2_WTO+		-0.011***							
ln_ad_WTO+			0.223***						
ad_WTO_X				0.018***	0.032***				
ad2_WTO_X					-0.001**				
ln_ad_WTO_X						0.134***			
ad_DES							0.069***	0.355***	
ad2_DES								-0.051***	
ln_ad_DES									0.259***
Observations	396,794	396,794	396,794	399,560	399,560	399,560	410,612	399,389	410,612
R-squared	0.734	0.734	0.734	0.733	0.733	0.733	0.733	0.734	0.733
Time-varying exporter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time-varying 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; Source: Own calculations.

We also test the specification including time-varying fixed effects together with country-pair fixed effects on four-year intervals in keeping with the Baier and Bergstrand (2007) technique. Estimates (available on demand) revise levels, quadratics and logs downwards slightly in all three main specifications, as well as across the WTO domains and databases.

Although the inclusion of country-pair fixed effects usually reduces the previous RTA-related estimates, our results remain robust to the Baier and Bergstrand technique and the inclusion of time-varying country fixed effects and country-pair fixed effects.

Table 11 presents a sensitivity analysis for our factor variable breakdown of WTO+, WTO_X and DESTA additive indicators based on the introduction of time-varying country fixed effects. We compare the results with OLS and PPML. Column 1 is estimated with OLS and time-varying fixed effects. Columns 2 uses Baier and Bergstrand's technique and puts country-pair fixed effects together in the same equation as time-varying fixed effects estimated by OLS over four-year intervals. Column 3 uses PPML and time-varying fixed effects over four-year intervals, but not country-pair fixed effects.

At first glance, the OLS-based estimates including time-varying country fixed effects do not appear to sustain the Table 4 results computed using PPML and time-invariant fixed effects, where progression to RTA ranges with more provisions promotes trade in an increasing pattern. Yet the introduction of time-varying fixed effects using the PPML method, as in column 3, suggests that results sensitivity stems from the estimation method, but not the presence of time-varying country fixed effects. Therefore, we can claim that the results are robust to the introduction of time-varying fixed effects under the PPML method, which is acknowledged as being one of the methods better suited to the estimation of gravity equations.

With respect to the WTO-X provisions, using PPML with the inclusion of time-varying country fixed effects, as in column 6 of table 11, produces estimates that are very close to the PPML time-invariant country fixed effects estimates in table 3. This confirms that deepening the integration of non-traditional WTO-X provisions has a greater impact on bilateral exports at an early stage in the integration process than it does at the final stage when diminishing returns seem to be at play.

The Baier and Bergstrand technique with OLS, time-varying fixed effects and country-pair fixed effects in column 5 seems to amplify the effects found with PPML and time-varying country fixed effects on the four-year interval as presented in column 6, but the main conclusion of positive, significant results still stands despite an apparent downturn in the advantages of WTO-X deepening of integration in the final stage.

As can be seen in column 7 and 8 of Table 11, changing the estimation method to OLS with time-varying fixed effects produces sensitive variations. In contrast, column 9 bears out our Table 3 results and shows that the DESTA-based provision classifications are robust to the introduction of time-varying fixed effects while maintaining the PPML estimator for the four-range grouping of provisions.

Table 11

Deep Integration: Additive indicator as a factor variable from WTO+, WTO_X and DESTA. In 4 ranges.

TVFE robustness test. OLS, PPML, and Baier and Bergstrand Method

Variables	(1) OLS *lnXijt*	(2) OLS *lnXijt*	(3) PPML *Xijt*		(4) OLS *lnXijt*	(5) OLS *lnXijt*	(6) PPML *Xijt*		(7) OLS *lnXij*	(8) OLS *lnXij*	(9) PPML *Xij*
ad_WTO+2	0.074	0.059	0.188***	*ad_WTO_X2*	0.466***	0.146***	0.428***	*ad2_DES*	0.781***	0.123***	0.169***
	(0.086)	(0.069)	(0.060)		(0.056)	(0.041)	(0.040)		(0.058)	(0.042)	(0.055)
ad_WTO+3	0.580***	0.589***	0.468***	*ad_WTO_X3*	0.418***	0.590***	0.528***	*ad3_DES*	0.275***	0.562***	0.395***
	(0.060)	(0.051)	(0.042)		(0.059)	(0.047)	(0.050)		(0.047)	(0.038)	(0.039)
ad_WTO+4	0.265***	0.128***	0.511***	*ad_WTO_X4*	0.425***	0.277***	0.363***	*ad4_DES*	0.327***	-0.044	0.621***
	(0.048)	(0.044)	(0.047)		(0.068)	(0.079)	(0.057)		(0.089)	(0.068)	(0.059)
Observations	396794	102,931	161,015		399560	108,109	161,791		410612	110,917	164,869
R-squared	0,734	0.358	0.907		0,733	0.365	0.908		0,734	0.369	0.901
Exporter TVFE	YES	YES	YES		YES	YES	YES		YES	YES	YES
Importer TVFE	YES	YES	YES		YES	YES	YES		YES	YES	YES
Country-pair FE	NO	YES	NO		NO	YES	NO		NO	YES	NO
Time FE	NO	NO	NO		NO	NO	NO		NO	NO	NO

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Note: TVFE stands for time-varying fixed effects

As in the case of additive indicators in Table 10, distilled indicators of depth are robust to the introduction of country time-varying fixed effects under the OLS estimator. The same general conclusions pointing to a positive, significant impact of agreement depth on bilateral exports remain valid. The specifications in terms of level find a slight upturn for the WTO+ and Rasch indicator, with the latter being more pronounced. The log specification of the WTO+ MCA remains virtually unchanged, while the log specification of the Rasch depth indicator presents an upturn. The WTO-X provisions show a slight downturn in terms of level. They also display a more pronounced decrease in the log specification. The quadratic specification also reacts to this sensitivity analysis without making any change to the basic interpretation. See Table 12.

Table 12
Distilled Deep Integration Indicators: MCA and Rasch indicators in level, quadratics and log. OLS estimator with TVFE.

VARIABLES	(1) *lnXij*	(2) *lnXij*	(3) *lnXij*	(4) *lnXij*	(5) *lnXij*	(6) *lnXij*	(7) *lnXij*	(8) *lnXij*	(9) *lnXij*	(10) *lnXij*	(11) *lnXij*	(12) *lnXij*
mca_WTO+	0.159***	0.408***										
mca2_WTO+		-0.079***										
ln_mca_WTO+			0.357***									
mca_WTO_X				0.137***	0.311***							
mca2_WTO_X					-0.050***							
ln_mca_WTO_X						0.334***						
mca_WTO_Xr							0.140***	0.318***				
mca2_WTO_Xr								-0.051***				
ln_mca_WTO_Xr									0.341***			
rasch_DES										0.151***	0.996***	
rasch2_DES											-0.335***	
ln_raschs_DES												0.360***
Observations	399,560	399,561	399,562	399,563	399,564	399,565	399,566	399,567	399,568	410,612	410,613	410,614
R-squared	0.733	0.733	0.733	0.733	0.734	0.735	0.736	0.737	0.738	0.739	0.734	0.739
Country-pair FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Time FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Time-varying exporter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time-varying importer 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; Source: Own calculations.

The Baier and Bergstrand technique facilitates the introduction of country-pair fixed effects together with time-varying country fixed effects. Here again, the Table 5 results for the distilled indicators remain robust as can be seen in table 13. The Rasch indicators bounce slightly upward in their level and log specifications with little quadratic variation. The WTO+ and WTOx MCA depth indicators post a slight downturn in level with a more pronounced variation in their log specifications.

The downward shift in the MCA depth indicators induced by the Bair and Bergstrand technique is more marked than without the inclusion of country-pair fixed effects. The quadratic forms post a downturn without making any change to their main implications of diminishing returns in the integration process.

Table 13

Distilled Deep Integration Indicators: MCA and Rasch indicators in level, quadratics and log. OLS estimator with TVFE and country-pair FE using the Baier and Bergstrand method.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Lnxij	lnxij	lnxij	lnxij	lnxij	lnxij	lnxij	Lnxij	lnxij	lnxij	lnxij	lnxij
mca_WTO+	0.111***	0.414***										
mca2_WTO+		-0.090***										
ln_mca_WTO+			0.262***									
mca_WTO_X				0.127***	0.308***							
mca2_WTO_X					-0.051***							
ln_mca_WTO_X						0.303***						
mca_WTO_Xr							0.126***	0.313***				
mca2_WTO_Xr								-0.053***				
ln_mca_WTO_Xr									0.301***			
rasch_DES										0.161***	0.267***	
rasch2_DES											-0.040**	
ln_raschs_DES												0.324***
Observations	108,109	108,109	108,109	108,109	108,109	108,109	108,109	108,109	108,109	110,917	110,917	110,917
R-squared	0.365	0.365	0.365	0.365	0.365	0.365	0.365	19,416	0.365	0.368	0.368	0.368
Exporter TIFE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Importer TIFE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Country-pair FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Exporter TVFE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Importer TVFE	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. Source: Own calculations.

5.3 Principal Components Analysis (PCA) robustness check

We perform a PCA on the WTO (2011) database to obtain an RTA depth indicator. This indicator is based on the first dimension predicted by the procedure, which is that which captures most of the variability in the provision-based distribution of the RTAs. The first dimension of the PCA explains 39.9% of the variability in the data for the WTO+ provisions, 34.2% for WTO-X and 35.7% for WTO-Xr. We test the PCA depth indicator in our gravity model using specifications in level, quadratic form and logarithm.

The first dimension of the PCA depth indicators is strongly correlated with the first dimension of the MCA depth indicators. One difference between the MCA and PCA results is that PCA produces substantially lower estimates for the WTO+ and WTO-X provisions.

The PCA results for the WTO-X provisions tested in terms of level are positive and statistically significant, but their economic significance is strongly reduced. The general conclusions drawn from the MCA are borne out by the PCA results presented in Table 14, pointing to around a 2.3% increase in bilateral exports following a 10% increase in the PCA indicator of agreement depth.

Table 14

Distilled Deep Integration Indicators: PCA indicators in level, quadratics and log. PPML estimator.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij	Xij
pca_WTO+	0.073***	0.124***							
pca2_WTO+		-0.008***							
Ln_pca_WTO+			0.235***						
pca_WTO_X				0.043***	0.147***				
pca2_WTO_X					-0.010***				
ln_pca_WTO_X						0.225***			
pca_WTO_Xr							0.042***	0.156***	
pca2_WTO_Xr								-0.011***	
ln_pca_WTO_Xr									0.229***
Observations	588,262	588,262	588,262	588,262	588,262	588,262	588,262	588,262	588,262
R2	0.900	0.901	0.901	0.892	0.901	0.899	0.892	0.900	0.899
Time-invariant exporter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time-invariant 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. Source: Own calculations.

6. Discussion and Conclusion

This article investigates the hypothesis that deeper RTAs do more to increase bilateral trade than shallow agreements. After testing different indicators for agreement depth, we find no evidence to refute this hypothesis. Deep integration indicators are computed from two different datasets and tested in different specifications. They are plugged respectively into the gravity equations in level, quadratic and logarithmic form. Additive indicators are also tested as factor variables.

Our research results for the different indicators of RTA depth confirm that deeper, rather than shallow, RTAs promote trade. A 10% increase in the depth of integration raises bilateral trade flows by some 3.0%.

However, the quadratic specification of the MCA and Rasch indicators suggests that the returns of further liberalization on trade are decreasing further along the process of integration.

Our additive, MCA depth indicator results are robust to changes in the method of estimation to OLS, the Baier and Bergstrand technique and the introduction of time-varying country fixed effects. Additive indicators, when treated as factor variables, are sensitive to computations using the OLS method and time-varying fixed effects. Nevertheless, they are robust to the introduction of time-varying country fixed effects maintaining PPML as the method of estimation.

An analysis of the sensitivity of the additive depth indicators presented as factor variables confirms the finding that deeper agreements increase trade more than shallow agreements for the WTO+ DESTA classification of RTA provisions. A three-provision breakdown confirms this pattern for the WTO-X classification of RTAs, although a positive and decreasing impact of non-traditional WTO-X provisions on trade is found in the last stage of integration for the clusters of 4 and 5 ranges.

Lastly, Principal Components Analysis depth indicators tested in the gravity model produce substantially lower estimates than those obtained with Multiple Correspondence Analysis (MCA), but still point to a positive, significant effect of deeper agreements on bilateral exports.

Defining the meaning of *deeper* and establishing which agreements are really enforceable continues to be a challenge However, although not entirely accurate, the depth indicators presented in this research provide enough elements to give reliable clues as to the direction of the impact of the heterogeneity of the agreements on trade.

More research is still needed to identify the impact on trade creation of particular provisions or combinations of provisions.

Hence, if the intention of signing a RTA is to increase trade, we now know that a deeper agreement will work better, at least, up to a certain limit. This study also contributes to clarifying the question of the importance of other provisions related to trade, but outside the traditional WTO framework of negotiation to expand trade. It shows that to introduce more provisions is profitable, in terms of trade creation.

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Appendix A

Variable Sources for the Gravity Model

Bilateral Exports: International Monetary Fund (IMF), Direction of Trade Statistics Database DOTS (2013).
Current GDP and population: 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 authors, based on the Regional Trade Agreements Information System (RTA-IS), World Trade Organization WTO (2013)

CEPII: Head, K., Mayer, T. & Ries, J. (2010), Gravity dataset.
Rose, A. (2005) data set on The Multilateral (GATT/WTO) System and Trade obs.
GATT membership: constructed by the authors based on the World Trade Organization WTO information (2013).
OCDE membership: constructed by the authors based on the Organisation for Economic Co-operation and Development OECD (2013) information.
Provisions analysis: WTO (2011) Research division for the World Trade Report and Design of Trade Agreements DESTA-WTI (2014).

https://www.wto.org/english/res_e/booksp_e/.../wtr11-anatomy_ptas_e.xls
http://www.designoftradeagreements.org/?page_id=884

Appendix B

Variable Definitions of Depth Indicators

ad_WTO: additive index of provisions under the regular WTO framework

ad2_WTO: ad_WTO squared

ln_ad_WTO: natural logarithm of (1+ ad_WTO).

ad_WTO_X: additive index of provisions out of the regular WTO framework.

ad2_WTO_X: 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 that captures the degree of depth of free trade agreements based on the number and combination of traditional WTO+ provisions.

mca2_WTO+: is mca_WTO+ squared.

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

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

mca2_WTO_X: mca_WTO_X squared.

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

mca_WTO_Xr: a multiple component analysis index from its first dimension of inertia that captures the degree of depth of free trade agreements 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 commonly negotiated under the WTO framework.

mca2_WTO_Xr: depth_mca_WTO_Xr squared.

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

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

ad2_DES: ad_DES squared.

ln_ad_DES: the natural logarithm of (1 + ad_DES)

rasch_DES: index based on the Rash latent trade analysis from DESTA team that captures the depth of the integration.

rasch2_DES: rasch_DES squared.

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

pca_WTO+ : is a principal component analysis index that captures the degree of depth of free trade agreements based on the number and combination of traditional WTO+ provisions.

pca2_WTO+ : is pca_WTO+ squared.

Ln_pca_WTO+ : the natural logarithm of (1 + pca_WTO+)

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

pca2_WTO_X : is pca_WTO_X squared

ln_pca_WTO_X :is the natural logarithm of (1 + pca_WTO_X).

pca_WTO_Xr : is a principal component analysis index from its first dimension of inertia that captures the degree of depth of free trade agreements 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 commonly negotiated under the WTO framework.

pca2_WTO_Xr : is pca_WTO_Xr squared

ln_pca_WTO_Xr : is the natural logarithm of (1 + pca_WTO_Xr).

Appendix C Gravity Model Data Set: List of Countries

Albania	Djibouti	Korea, South	Russia
Algeria	Dominican Republic	Kuwait	Rwanda
Angola	Ecuador	Kyrgyzstan	Samoa
Argentina	Egypt	Latvia	Saudi Arabia
Australia	El Salvador	Lebanon	Senegal
Austria	Equatorial Guinea	Liberia	Sierra Leone
Azerbaijan	Estonia	Libya	Singapore
Bahrain	Ethiopia	Lithuania	Slovakia
Bangladesh	Fiji	Luxembourg	Slovenia
Barbados	Finland	Madagascar	South Africa
Belarus	France	Malawi	Spain
Belgium	Gabon	Malaysia	Sri Lanka
Belize	Gambia, The	Mali	Sweden
Benin	Georgia	Malta	Switzerland
Bermuda	Germany	Mauritania	Syria
Bolivia	Ghana	Mauritius	Tajikistan
Brazil	Greece	Mexico	Tanzania
Brunei	Grenada	Moldova	Thailand
Bulgaria	Guatemala	Mongolia	Togo
Burkina Faso	Guinea	Morocco	Tonga
Burundi	Guinea-Bissau	Mozambique	Trinidad and Tobago
Cambodia	Guyana	Nepal	Tunisia
Cameroon	Haiti	Netherlands	Turkey
Canada	Honduras	New Zealand	Turkmenistan
Cape Verde	Hong Kong	Nicaragua	Uganda
Central African Republic	Hungary	Niger	Ukraine
Chad	Iceland	Nigeria	United Arab Emirates
Chile	India	Norway	United Kingdom
China	Indonesia	Oman	United States
Colombia	Iran	Pakistan	Uruguay
Congo, Deomocratic	Iraq	Panama	Uzbekistan
Congo, Republic of the	Ireland	Papua New Guinea	Venezuela
Costa Rica	Israel	Paraguay	Vietnam
Cote d'Ivoire	Italy	Peru	Yemen
Croatia	Jamaica	Philippines	Zambia
Cuba	Japan	Poland	Zimbabwe
Cyprus	Jordan	Portugal	
Czech Republic	Kazakhstan	Qatar	
Denmark	Kenya	Romania	

Appendix D (Table 15)
Number of RTAs and its associated bilateral trade flows by number of provision and regrouped number of provisions for WTO+, WTO-X and WTI-DESTA data sets

WTO+						WTO-X									WTI-DESTA					
Number of provisions	Number of RTAs	Number of Flows	Regrouped ranges of provisions	Regrouped Number of RTAs	Regrouped Number of Flows	Number of provisions	Number of RTAs	Number of Flows	Regrouped ranges of provisions	Regrouped Number of RTAs	Regrouped Number of Flows	Regrouped ranges of provisions	Regrouped Number of RTAs	Regrouped Number of Flows	Number of provisions	Number of RTAs	Number of Flows	Regrouped ranges of provisions	Regrouped Number of RTAs	Regrouped Number of Flows
1	5	1,036	1-3	14	6,804	1	11	5,598	1-5	38	13,458	1-10	77	16,777	1	25	4,236	1-3	136	20,827
2	3	1,588	4-7	31	19.944	2	8	4,246	6-10	39	3,353	11-20	15	18.048	2	43	6,317	4-6	93	26,601
3	6	4,180	8-11	58	9.083	3	4	232	11-15	11	10,336	21-37	11	3.962	3	68	10,274	7-8	40	3,186
4	7	6,244				4	7	1,198	16-20	4	6,478				4	34	8,461			
5	7	902				5	8	2,184	21-26	5	2,268				5	33	4,962			
6	8	4,126				6	5	242	27-37	6	2,894				6	26	13,178			
7	9	8,672				7	8	2,133							7	26	1,233			
8	17	4,030				8	8	80							8	14	1,953			
9	11	694				9	14	864												
10	14	4,104				10	4	34												
11	16	258				11	2	58												
						12	4	4,715												
						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												
						33-37	0	-												
Totals						Totals									Totals					
	103	35.831		103	35.831		103	38.787		103	38.787		103	38.787		269	50.614		269	50.614

Source: Own calculations on data from WTO (2011) and WTI-DESTA (2014)