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## Trade Creation and Trade Diversion in Deep Agreements

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*Preferential trade agreements have boomed in recent years and extended their reach well beyond tariff reduction, to cover policy areas such as investment, services, competition and intellectual property rights. This paper uses new information on the content of preferential trade agreements to examine the trade effects of deep agreements and revisit the classic Vinerian question of trade creation and trade diversion. Our results indicate that deep agreements lead to more trade creation and less trade diversion than shallow agreements. Furthermore, some provisions of deep agreements have a public good aspect and increase trade also with non-members.*

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## I. Introduction

If a trade economist were abruptly woken up by somebody shouting, “preferential trade agreements” (PTAs), their first thought is likely to be “*trade creation and trade diversion*”.<sup>2</sup> That is a measure of the influence of Jacob Viner’s classic book *The Customs Union Issue* (Viner, 1950) on the profession and the policy debate on the trade effects and, hence, the desirability of preferential arrangements. However, Vinerian analysis was developed in a world where trade agreements were “shallow” and focused only on bilateral tariff liberalization. Today, PTAs are increasingly “deep” and cover also behind-the-border policy areas, such as competition policy, intellectual property rights and other regulatory issues.<sup>3</sup> In this paper, we empirically investigate how far classic Vinerian logic helps us to understand the trade effects of modern preferential trade arrangements.

Do deep agreements simply lead to *more* trade creation and *more* trade diversion than shallow agreements? Intuitively, Vinerian logic does not fully apply to deep agreements because their nature is in part different from shallow PTAs. Shallow agreements are controversial because they are inherently discriminatory. Members grant tariff concessions to each other, leaving tariffs on imports from non-members unconstrained. The resulting tariff preferences are likely to increase trade between members (trade creation), but they can also lead members to substitute imports previously sourced from non-members for within PTA products (trade diversion).<sup>4</sup> Deep agreements can reduce trade costs and discrimination beyond tariff liberalization and hence are expected to lead to even more trade creation. But differently from tariffs, provisions relating to competition policy or subsidies tend to be non-discriminatory in nature and may reduce trade costs and discrimination also vis-à-vis outsiders, creating a positive spillover effect, or “negative” trade diversion (Baldwin and Low, 2009; Baldwin, 2014). Ultimately, the verdict on what forces dominate is empirical and will crucially depend on the content of the trade agreements.

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<sup>2</sup> We refer to PTAs as any trade agreement between a subset of countries (two or more). PTAs have been also referred to in the literature as Free Trade Agreements, Regional Trade Agreements, Economic Integration Agreements, etc. As we will further clarify below, we will also use the term Deep Agreements to stress the fact that many of these arrangements have features that go beyond trade policy and are not preferential in nature.

<sup>3</sup> The terms “shallow” and “deep” trade agreements were first defined in Lawrence (1996). There is a voluminous literature on the purpose of shallow trade agreements (e.g. Grossman, 2016). The rationale for deep agreements has not received the same attention. Two references that help explain the changing scope of trade agreements include Ederington and Ruta (2016) and Maggi (2016).

<sup>4</sup> As it is well known, preferential tariff liberalizations have an ambiguous welfare effect. Trade creation is welfare improving for members. Trade diversion has a negative impact on the welfare of non-members through lower market access as well as on members through reduced tariff revenue. The net welfare effect of shallow PTAs, therefore, depends on which of these two forces dominates.

To empirically address the question of the trade effects of deep agreements, we exploit a new database on the content of PTAs (Hofmann et al., 2017). Since the early 1990s, a large number of trade agreements have entered into force. Focusing on the PTAs still in force in 2015, the number of preferential arrangements increased from 20 in 1990 to 279 at the end of 2015. The content of PTAs too has changed. Newer agreements are “deeper” in the sense that they generally expand the set of policy areas covered by older agreements. Specifically, older PTAs focused on less than 10 policy areas, mostly commitments on tariffs on industrial and agricultural goods and other border measures such as export taxes. As agreements become deeper, they increasingly extend their reach first to areas such as trade remedies (i.e. countervailing measures, antidumping duties) and subsidies and then to a broader set of behind the border measures such as intellectual property rights and standards.

To assess the impact of deep agreements on members and non-members’ trade, we augment a standard gravity model, which is widely used in the literature to assess the effects of PTAs on trade flows (see Head and Mayer, 2014; Limão, 2016). We include a variable of depth of agreements between PTA members, and a variable that captures the depth of the agreements of a trading partner with other countries. Using information from the content of PTAs database, we construct different measures of depth based on the policy areas regulated by the agreements and their legal enforceability.

As is standard in the literature, we include importer and exporter-year fixed effects to control for country-year specific shocks and for the multilateral resistance terms, and we introduce country-pair fixed effects to address endogeneity concerns (Baier and Bergstrand, 2007).<sup>5</sup> This set of fixed effects account for time invariant determinants of bilateral trade costs and, more importantly, they also capture unobservable country-pair characteristics that could determine both trade intensity and the probability of two countries of signing a trade agreement. To rule out the possibility that estimates of depth are simply capturing episodes of tariff liberalization – with deep agreements reducing tariffs more than shallow agreements – we include measures of bilateral tariffs and preference margins (Kee et al. 2008, 2009; Fugazza and Nicita, 2013) to separate the impact of changes in depth from those in tariffs. We perform

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<sup>5</sup> See Piermartini and Yotov (2016) for a useful guide on estimating trade policy effects with structural gravity models.

several robustness checks to rule out the possibility that the effects we identify are due to pre-existing trends, spurious correlation, or reverse causality. We include additional controls, such as dummies to identify shallow PTAs, PTAs that are no longer in force, and the presence of other international agreements that may affect bilateral trade.

Our sample covers 96 countries, including all major economies, for the period 2002-2014.<sup>6</sup> During this period, the share of country pairs with PTAs increased from 9 to 29 percent, average tariffs were cut by half, while depth (measured as the count of provisions included in the PTA) increased by a factor of three.

We find that the formation of deep agreements has a meaningful positive impact on the trade flows among members. In particular, we find that trade between country pairs that sign a deep agreement increases by 44 percent. As we control for tariffs and for a PTA dummy, the estimate suggests that deep provisions induce more trade creation than shallow PTAs. When we look at the dynamic effects of deep agreements, we find that future levels of PTA depth are statistically uncorrelated with current levels of trade flows, suggesting that depth of agreements is not determined by the closeness of current trade relations. On average, it takes two years for deep agreements to increase trade flows, consistently with the evidence that reforms of behind the border measures take time to be implemented. Finally, we find that deep agreements have a stronger impact on trade for industries that are more vertically fragmented across borders as suggested by Lawrence (1996), Baldwin (2010) and Antràs and Staiger (2012).

Despite this strong evidence of trade creation, the deepening of trade agreements does not appear to happen at the expense of trade with non-members. Specifically, a standard deviation increase in the depth of the partner's trade agreements with other countries increases bilateral trade by around 19 percent. As hypothesized in Baldwin and Low (2009) and Baldwin (2014), we find that this "negative" trade diversion effect of deep agreements is driven by the inclusion of non-discriminatory provisions, such as those that regulate competition policy, subsidies and standards. This positive effect on trade with non-member countries is driven by more fragmented sectors, while less fragmented sectors experience trade diversion. In terms of specific policies, tariff preferences (and other preferential provisions) are still found to divert trade with non-members. For instance, a 1 percent increase in the average tariffs faced by a

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<sup>6</sup> The country coverage is determined by the availability of comprehensive tariff data for the entire period.

non-member relative to a member (i.e. the relative preference margin) decreases bilateral trade by 4 percent. Furthermore, deep agreements tend to moderate the trade diverting effect of tariff preferences: the negative impact of relative preferences on trade becomes insignificant and is eventually reversed for deeper agreements.

Some examples may help put these findings in perspective. We focus on three trade agreements with increasing levels of depth, as measured by the number of policy areas covered by the treaty: Peru-Chile, Korea-US, and the EU. Based on our preferred specifications, a shallow agreement such as Peru-Chile increased bilateral trade by an estimated 10 percent, but had a negligible impact on non-members. Korea-US, a medium depth PTA, increased trade by 14 percent and also raised exports from outsiders by 4 percent. Finally, our estimates suggest that the deepest agreement in our sample, the EU, increased trade flows among members by 44 percent, while exports from non-EU countries would be around 30 percent lower in the absence of the agreement.

This paper contributes to a large body of literature on the trade effects of preferential trade arrangements by including the notion of “depth” in the analysis of PTAs.<sup>7</sup> Previous work in this area suffers from a well-known measurement error problem (Baier and Bergstrand, 2007). Due to lack of data, most studies use dummies to identify the presence of a PTA or distinguish between broad types of trade arrangements (e.g. partial scope agreements, free trade agreements or custom unions, as in Baier et al., 2014). This approach does not adequately capture the variation in the content of preferential trade agreements. Indeed, we show that this variation has important implications for the effects of PTAs both on members and non-members’ trade flows. Our analysis has also relevant implications for the longstanding debate on regionalism versus multilateralism (Bhagwati, 1993). A key question in this debate is whether PTAs are building blocks or stumbling blocks of the multilateral trade system. Both formal models and empirical studies in this literature assume that PTAs are mostly about tariff liberalization.<sup>8</sup> The positive impact of deep PTAs on members and non-members’ trade that

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<sup>7</sup> For recent surveys, see Freund and Ornelas (2010), WTO (2011), Head and Mayer (2014) and Limão (2016). There is a small literature on deep agreements. Osnago, Rocha and Ruta (2017a) look at the impact of deep agreements on countries’ participation in global value chains. Mulabdic, Osnago and Ruta (2017) study the effect of Brexit (i.e. the undoing of a deep agreement) on future EU-UK trade relations. Other studies that have looked at the impact of deep agreements based on a more limited database covering around 100 PTAs are Orefice and Rocha (2014) and Osnago, Rocha and Ruta (2015 and 2017b).

<sup>8</sup> Informal arguments on the relationship between deep PTAs and the multilateral trade system have been made in Baldwin and Low (2009) and WTO (2011).

we find in our analysis supports the view that deep provisions in trade agreements can complement rather than undermine the world trading system (WTO, 2011).

The rest of the paper is organized as follows. The next section discusses the database on the content of trade agreements and the other data used in the analysis. Section 3 presents the empirical strategy. Econometric results are presented in Section 4. Concluding remarks follow.

## II. Data

Our measures of depth of preferential trade agreements are based on detailed information on the content of PTAs from a new database (Hofmann et al., 2017). The database covers 279 treaties, which are all the preferential agreements notified to the WTO and in force up to December 2015.<sup>9</sup> Following the methodology proposed by Horn et al. (2014), the focus is on 52 policy areas (see Table A1 in Annex A), divided into areas that are currently under the mandate of the WTO such as tariffs, antidumping duties and subsidies (referred to as “WTO +”) and areas where the WTO has no comprehensive mandate such as investment and competition policy (“WTO X”).<sup>10</sup> For each agreement, the dataset identifies whether a policy area is covered by the agreement and whether the provision is legally enforceable.<sup>11</sup> This information allows us to capture the expanding scope of trade agreements beyond a narrowly defined set of traditional trade measures.<sup>12</sup>

As noted by Anderson and van Wincoop (2004) “[t]here is extensive evidence that free trade agreements and customs unions increase trade and therefore reduce trade barriers ... but it is less clear what elements of these trade agreements play a role (tariffs, NTB’s, or regulatory issues)”. There are three main advantages of using the information on the content of PTAs (instead of dummy variables) to assess their trade effects. First, the new data help us define *deep* trade agreements more precisely. As discussed below, we define the depth of a PTA based on the extent to which different regulatory issues and policy areas are covered by

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<sup>9</sup> The data are freely accessible at <http://data.worldbank.org/data-catalog/deep-trade-agreements>.

<sup>10</sup> The WTO’s General Agreement on Trade in Services (GATS) covers commercial presence as a mode of supply but there are currently no rules covering investment in goods.

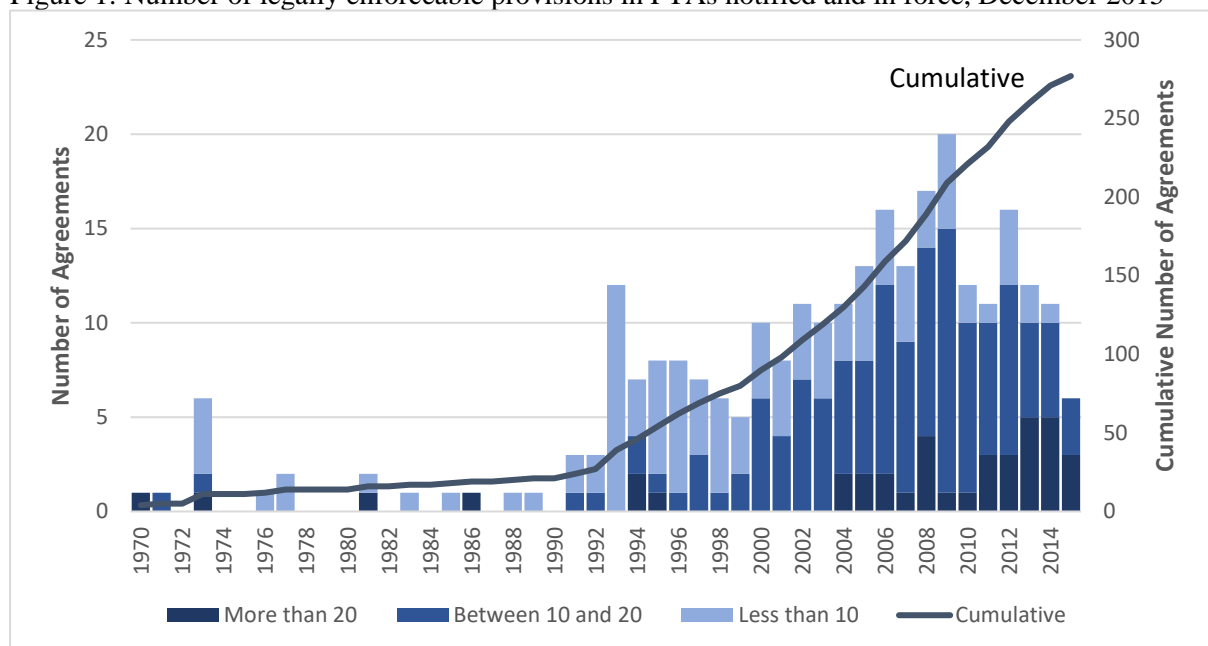
<sup>11</sup> See Hofmann et al. (2017) for a detailed description of the methodology and of the data.

<sup>12</sup> Hofmann et al. (2017) refer to the expanding scope of PTAs as “horizontal depth”. Another dimension of the depth of a trade agreement is “vertical”, reflecting the liberalizing content of commitments or the stringency of rules. This information, however, is widely available only for tariffs (see below) and a small subset of policy areas.

the agreement and the legal enforceability of such provisions. Second, the information present in the database also allows us to isolate the trade effect of specific sets of provisions. For instance, we dissect the PTAs to assess the impact of provisions based on their economic relevance (named “core provisions”), or the feasibility of preferential treatment (i.e. whether they improve the conditions for PTA members only or for all trading partners). Finally, the dataset can capture the evolving nature of trade agreements over time. A notable example is the European Union with its enlargements, which cover an increasing number of members and policy areas.

The data show that the number of trade agreements and their content have changed dramatically since the early 1990s (Figure 1). The number of PTAs in force increased slowly in the 1970s and 1980s and then remained constant until the beginning of the 1990s, after which a large number of agreements entered into force. Focusing on the agreements covered in our database (i.e. those still in force in 2015), the number of PTAs has increased exponentially from 20 agreements in 1990 to 279 in 2015. Along with the number, the content of trade agreements has changed. While older PTAs focused on few policy areas (“shallower” trade agreements covering less than 10 policy areas dominated up to the late 1990s), an increasing share of PTAs over time has tended to cover a larger number of policy areas suggesting a deepening of trade agreements.

Figure 1: Number of legally enforceable provisions in PTAs notified and in force, December 2015



Source: Authors' calculations based on the Content of Deep Trade Agreements database.

Table 1 shows that there is an ordering in terms of which provisions are included in trade agreements with different values of depth. Specifically, we divide the agreements into three categories, based on the number of legally enforceable provisions and calculate the share of agreements that include each policy area. We find that policy areas included in shallower agreements (“Less than 10”), are at least as frequent in deeper agreements (cooperation on “statistics” is an exception). The majority of these agreements tend to cover tariffs and other border measures such as export taxes and customs. Competition policy is the only policy area outside the mandate of the WTO appearing in a majority of shallower PTAs. As agreements become deeper (“Between 10-20”), they increasingly extend their reach to a broader set of WTO + areas, including state aid, anti-dumping and countervailing measures. Finally, deeper agreements (“More than 20”) tend to cover areas related to intellectual property rights, movement of capital, and standards, in addition to the areas covered by shallower agreements.<sup>13</sup>

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<sup>13</sup> Figure A1 in Appendix A shows that recent agreements signed by the US and the EU include a larger number of areas than earlier agreements. These new areas were often covered in other countries’ earlier PTAs, suggesting there may be learning from other countries’ PTAs.



Table 1: Share of provisions over different levels of depth

No. Provisions	Less than 10	Between 10 and 20	More than 20
Tariffs on manufacturing goods	97%	100%	100%
Tariffs on agricultural goods	96%	100%	100%
Export taxes	73%	81%	95%
Customs	67%	95%	100%
Competition policy	58%	73%	88%
State aid	39%	69%	88%
Anti-dumping	35%	88%	98%
Countervailing measures	22%	77%	98%
Statistics	20%	0%	23%
TRIPS	18%	75%	98%
STE	18%	69%	68%
TBT	17%	73%	95%
Movement of capital	15%	68%	93%
GATS	14%	67%	98%
SPS	12%	72%	98%
Public procurement	12%	59%	80%
IPR	6%	56%	75%
Environmental laws	3%	14%	83%
Labor market regulations	3%	13%	75%
Investment	2%	58%	75%
TRIMS	2%	42%	73%
Visa and asylum	2%	37%	57%
Industrial cooperation	2%	5%	33%
Social matters	2%	5%	30%
Agriculture	1%	10%	45%
Energy	1%	8%	40%
Data protection	1%	5%	20%
Anticorruption	1%	5%	18%
SME	1%	4%	25%
Regional cooperation	1%	3%	15%
Taxation	1%	2%	30%
Approximation of legislation	1%	2%	25%
Political dialogue	1%	1%	8%
Research and technology	0%	6%	38%
Public administration	0%	6%	5%
Consumer protection	0%	5%	38%
Mining	0%	5%	13%
Education and training	0%	4%	33%
Information society	0%	4%	15%
Innovation policies	0%	4%	5%
Illegal immigration	0%	3%	23%
Illicit drugs	0%	3%	3%
Economic policy dialogue	0%	2%	43%
Cultural cooperation	0%	2%	38%
Financial assistance	0%	2%	25%
Audiovisual	0%	2%	18%
Terrorism	0%	2%	8%
Money laundering	0%	2%	3%
Health	0%	1%	38%
Human rights	0%	1%	3%
Nuclear safety	0%	0%	15%
Civil protection	0%	0%	5%

Based on this evidence, we first build several aggregate measures of the depth of trade agreements which reflect the extent to which the different policy areas are covered and legally enforceable in a PTA.<sup>14</sup> An area is considered as weakly legally enforceable if the language used is sufficiently precise and binding, but the area has been excluded from dispute settlement procedures under the PTA. While strong legal enforceability refers to areas where the language used is sufficiently precise and binding, and if the area is subject to dispute settlement procedures under the PTA. Using this information, we define alternative measures of depth of an agreement. Specifically, the depth variables are equal to the count of all (“depth all”), weakly legally enforceable (“depth wle”), or legally enforceable (“depth le”) provisions included in an agreement. Each measure is normalized between 0 and 1, with 1 indicating the agreement with the highest number of provisions. In characterizing trade agreements, we also consider the policy areas that have been identified in the literature as being more economically relevant (“core” provisions). These core provisions include all WTO + areas and four areas that fall outside the domain of the WTO: competition policy, rules on investment, movements of capital, and intellectual property rights protection.<sup>15</sup> As shown in Hofmann et al. (2017), these policy areas are also the ones that appear more frequently in PTAs.

Finally, a useful distinction for our subsequent discussion is between discriminatory and non-discriminatory policy areas. Here we follow Baldwin and Low (2009) to classify PTA provisions in these two groups. The traditional view of PTAs is that their benefits accrue only to PTA partners. This is indeed the case for traditional trade policies (i.e. tariffs on industrial goods, tariffs on agricultural goods, export taxes, countervailing measures and antidumping duties) that can be implemented on a discriminatory basis based on the origin of the product. Similarly, government procurement provisions in PTAs tend to open state purchasing to foreign firms on a strictly preferential basis. For other policy areas, however, the traditional view does not appear to hold as PTA provisions may improve the conditions of access in a non-discriminatory manner (i.e. on a “most-favoured-nation,” or MFN basis). According to Baldwin and Low (2009), these areas include customs administration, domestic regulation (SPS and TBT measures), competition (state trading enterprises, competition policy), services

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<sup>14</sup> Given the fact that provisions tend to be highly correlated with each other (see Table A2 of Appendix A), regressions that include individual variables indicating the presence of each provision would suffer from the problem of multicollinearity. Appendix B explores the impact of individual provisions on trade. The results show that the inclusion of specific provisions has no significant impact on trade flows once we account for the overall depth of an agreement.

<sup>15</sup> Core areas have been identified in Damuri (2012) based on Baldwin (2008).

(GATS), investment (TRIMS and investment rules), property rights (TRIPS and IPR protection), rules on subsidies and on movements of capital. In some cases, discrimination is simply not possible: if a country limits subsidies to domestic producers or establishes a competition authority in fulfilment of its PTA commitments, these reforms benefit both members and non-members of the PTA. In other cases, discrimination is feasible but unlikely for economic or legal reasons: in services, market access is generally granted through reforms of domestic regulation, such as rules on foreign participation or access to essential facilities, which are hard to undertake in a way that grants privileged access.

The sample covers 96 countries, including all major economies, for the period 2002-2014. The choice of the initial year is due to the poor quality and availability of tariff data before 2002. In addition to the database on the content of deep trade agreements, we use trade and trade policy data from standard sources. Export data at the HS product level are from the *United Nations Commodity Trade Statistics Database* (UN-COMTRADE). Additional data on bilateral time-invariant covariates, used in a series of robustness checks, come from the CEPII *geodist* and *gravity* databases. Tariff data, from the United Nations Conference on Trade and Development TRAINS, and import demand elasticities at the at the 6-digit level, from Kee et al. (2008), are used to construct the Tariff Trade Restrictiveness Index (TTRI) and the Relative Preferential Margin index (RPM). Finally, data on PTAs no longer in force come from Egger and Larch (2008) and Bilateral Investment Treaties (BITs) from the United Nations Conference on Trade and Development's Investment Policy Hub.<sup>16</sup>

Before moving to the econometric analysis, we take a first look at the data. Over the 2002-2014 period, the share of country pairs with PTAs increased from 9 to about 29 percent (Table 2). During the same period, average tariffs (TTRI) were cut by half while depth, irrespective of legal feasibility, increased by a factor of three. As countries reduced bilateral tariffs, the average relative preference margins (RPM) and its standard deviation decreased as well. The two trends together indicate widespread tariff reductions which are less likely to have increased trade diversion. In terms of the content of PTAs, the summary statistics show that there were minor differences (before 2014) between depth constructed using legally enforceable provisions subject to dispute settlement ("Depth LE" or "Depth Legally Enforceable"), and depth constructed on the basis of legally enforceable language ("Depth

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<sup>16</sup> The data are freely accessible at <http://www.ewf.uni-bayreuth.de/en/research/RTA-data/index.html> and <http://investmentpolicyhub.unctad.org/IIA> respectively.

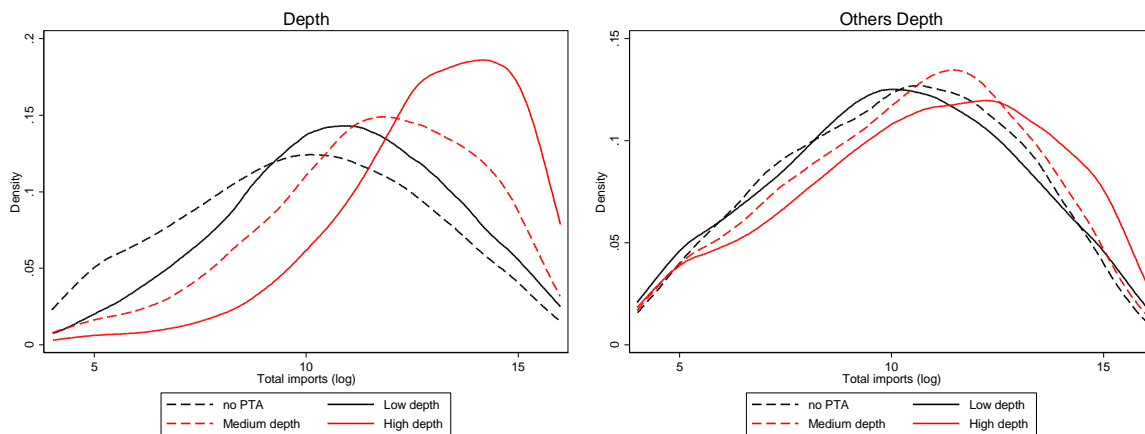
WLE” or “Depth Weakly Legally Enforceable”). There is also some evidence that newest agreements tend to be deeper. The average maximum depth (“max Depth LE” or “max Depth Core LE”) by importer almost doubled from 2002 to 2014. Part of these increases are due to countries signing agreements for the first time, but this trend is also observed when we restrict the sample to country pairs which already have a PTA.

Table 2: Descriptive Statistics (means and standard deviations in parentheses)

	2002	2005	2008	2011	2014
PTA (dummy)	.088 (.283)	.161 (.368)	.196 (.397)	.223 (.416)	.286 (.452)
TTRI (tariffs)	.041 (.195)	.034 (.077)	.028 (.066)	.027 (.08)	.019 (.069)
RPM (relative tariffs)	.009 (.062)	.008 (.036)	.007 (.033)	.007 (.035)	.004 (.029)
Depth All	.054 (.191)	.111 (.272)	.134 (.293)	.145 (.296)	.197 (.344)
Depth WLE (Weakly Legally Enforceable)	.038 (.153)	.083 (.23)	.103 (.251)	.111 (.253)	.142 (.281)
Depth LE (Legally Enforceable)	.038 (.153)	.082 (.229)	.102 (.249)	.108 (.25)	.132 (.273)
Depth Core LE (Legally Enforceable)	.057 (.202)	.118 (.288)	.148 (.318)	.162 (.325)	.199 (.342)
max Depth LE (Legally Enforceable)	.307 (.295)	.423 (.313)	.482 (.291)	.499 (.283)	.529 (.308)
max Depth Core LE (Legally Enforceable)	.493 (.366)	.646 (.319)	.746 (.275)	.769 (.259)	.787 (.246)
max MFN LE (Legally Enforceable)	.445 (.365)	.594 (.35)	.714 (.303)	.733 (.289)	.759 (.275)
max PREF LE (Legally Enforceable)	.596 (.392)	.764 (.297)	.828 (.248)	.861 (.227)	.872 (.207)
Trade (millions of US\$)	631.588 (4829.109)	994.542 (6974.361)	1495.1 (9243.604)	1668.34 (10284.256)	1680.574 (11246.587)

Figure 2 plots the distribution of trade flows for different intervals of “depth all”. In the left panel, groups are defined according to different levels of depth in bilateral agreements, while the right panel uses the average depth of the destination country’s agreements with the rest of the world weighted by imports. Figure 2 shows that country-pairs with higher levels of depth trade more on average. The right panel shows that on average, countries export relatively less to partners involved in shallow agreements (i.e. “Low depth”) than partners without PTAs. However, this negative effect is reversed as partners sign deeper agreements (“Medium depth” and “High depth”) which are associated with distributions shifted to the right of the “no PTA”. This suggests that deep agreements tend to benefit excluded countries as well, possibly due to the inclusion of provisions that are de jure or de facto MFN.

Figure 2: Distribution of trade over levels of legally enforceable depth (“Depth LE”)



### III. Trade effects of deep agreements: Empirical strategy

In this section, we begin the empirical investigation of the trade impact of deep agreements. A number of policy-related factors contribute to trade costs between countries, which create a gap between the price in the importing country and the export price. Trade agreements allow members to reduce these costs and hence increase bilateral trade. A concern, well understood since Viner (1950), is that this mechanism could also generate trade diversion, that is a substitution of trade away from non-members. Deep agreements can reduce trade costs among members by eliminating tariffs *and* by reducing other frictions. Examples of the latter are contingent protection measures like antidumping, countervailing and safeguard actions, and differences in national regulations that create an adaptation cost for foreign producers. Even other provisions of PTAs, such as disciplines on subsidies or strengthened protection of

intellectual property rights, reduce the risk of exporting due to policy uncertainty, and hence can be seen as reducing trade costs (Limão and Maggi, 2015).<sup>17</sup> We, therefore, expect PTAs that cover more areas, to have a positive impact on members' trade that goes beyond the impact of shallow agreements.

The impact of a deep agreement on non-members is more complicated. The rules in a deep PTA can be implemented either to reduce costs only for members (e.g. by exempting only them from burdensome regulatory requirements) or also for non-members (e.g. by simplifying customs procedures for all trading partners). If these rules are implemented in a discriminatory way, they inflict a further competitive disadvantage on third countries. Since member countries must now pay neither tariffs nor frictional costs, they can expand sales in their markets, driving down prices and hurting exports of third countries. However, if frictional barriers are eliminated in a non-discriminatory way, third countries also benefit from the reduction in associated costs.<sup>18</sup> In these circumstances, third countries still suffer from the decline in price in destination markets due to preferential access granted to members of PTAs, but the price they actually receive is closer to the destination price because the elimination of the frictional costs reduces the total trade tax they pay. If the decline in trade costs for non-members is sufficiently large relative to the preferences members receive, then we may observe “negative trade diversion” (Baldwin, 2014): third countries see an increase in the export price they receive and expand quantity exported as a result of a deep PTA.<sup>19</sup>

Below, we introduce the empirical model and identification strategy used to analyze the effect of deep agreements on members' and non-members' trade. In line with the above discussion, we augment a standard gravity model to include a variable of depth between PTA members and another variable that captures the depth of agreements trading partners conclude with the rest of the world. We also use information on relative tariff preferences (Fugazza and Nicita, 2013) to assess how their impact is affected by existence of deep agreements.

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<sup>17</sup> The assumption that trade agreements reduce trade costs helps us to cast the following discussion in the framework of the gravity model. We recognize that other provisions of agreements, such as those relating to labor or environmental standards, do not necessarily lead to a reduction in trade costs. The extent of the aggregate impact of these heterogeneous provisions is, therefore, an empirical question. We come back to this issue below.

<sup>18</sup> There is some evidence of these positive externalities. Chen and Mattoo (2008) examine the consequences of harmonization and mutual recognition of standards within PTAs. They show that when these agreements are concluded with restrictive rules of origin which deny their benefit to non-members, the latter suffer a decline in exports to PTA countries. However, when the agreements do not have restrictive rules of origin, non-members exports to PTA countries also increase.

<sup>19</sup> Appendix C provides a graphical example of these effects.

### a. Trade creation

Our main specification is based on the gravity model of trade, which is widely used in the literature to assess the effects of policy variables on trade flows (see Head and Mayer, 2014; Limão, 2016). We begin by discussing how the depth of PTAs can be incorporated into the standard gravity framework. As shown in Costinot and Rodríguez-Clare (2013) the following gravity equation emerges from different theoretical frameworks:

$$X_{ij} = \frac{\chi_{ij}(Y_i\tau_{ij})^{-\varepsilon}}{\sum_l \chi_{lj}(Y_l\tau_{lj})^{-\varepsilon}} E_j \quad (1)$$

where  $X_{ij}$  is the bilateral trade flow from country  $i$  to country  $j$ ,  $E_j$  is country  $j$ 's total expenditure,  $Y_i = \sum_j X_{ij}$  is country  $i$ 's income,  $\varepsilon$  is the trade elasticity with respect to variable trade costs  $\tau_{ij}$ , and  $\chi_{ij}$  is a function of structural parameters distinct from  $\tau_{ij}$ .

We can define trade costs  $\tau_{ij}$  as a function of different components:

$$\tau_{ij} = T_{ij}(1 + t_{ij}) \quad (2)$$

where  $t_{ij}$  is the ad-valorem import tariff imposed by country  $j$  on goods imported from  $i$ ,  $T_{ij}$  are the iceberg trade costs that the exporter incurs to ship to country  $j$ . Since deep provisions in PTAs could lower the policy frictions that limit international trade, we assume that the term  $T_{ij}$  in the empirical model is lower the higher the depth of an agreement between country-pairs  $i$  and  $j$ .

Taking the log of both sides of equation (1) and using tariffs and depth to proxy for trade costs in equation (2), we obtain the following modified gravity equation which accounts for the depth of trade agreements as a determinant of bilateral trade:

$$X_{ijt} = \exp\{\beta_1 Depth_{ijt} + \beta_2 \ln(1 + TTRI_{ijt}) + \theta_{it} + \Omega_{jt} + \mu_{ij} + Controls\} + \varepsilon_{ijt} \quad (3)$$

where  $X_{ijt}$  are bilateral exports from country  $i$  to country  $j$  in year  $t$  and  $Depth_{ijt}$  is a measure of the PTA depth between  $i$  and  $j$  (normalized between 0 and 1). As discussed in Section II, we use different definitions of depth based on the legal enforceability and the economic relevance

of the policy areas covered in the agreement.  $\theta_{it}$  and  $\Omega_{jt}$  are importer-year and exporter-year fixed effects, respectively, that control for any country-year specific shocks and also for the theoretically motivated multilateral resistance. As shown in Baldwin and Taglioni (2006), failing to account for the country-specific time-varying multilateral resistance biases downward the effects of PTAs, or in our case the effect of  $Depth_{ijt}$  on trade. Finally, we include several additional controls: dummies to capture the presence of a PTA (i.e. a shallow PTA dummy), of a PTA no longer in force, or of other international agreements that can have an impact on trade flows, such as a Bilateral Investment Treaty (BIT).

An important issue in the estimation of the effects of any policy variable is endogeneity. In the trade literature, it has been shown that countries are more likely to sign agreements with partners with whom they already trade more intensively because of geography or cultural proximity or other common characteristics. If countries tend to sign trade agreements with their “natural” trading partners (Krugman, 1991), this would bias the effects of trade agreements upwards especially with cross-sectional data. This bias may be even stronger for depth to the extent that countries may be more willing to sign deeper agreements with their natural trading partners. The issue of endogeneity of trade policies is well known since Trefler (1993), but it is hard to address due to the lack of reliable instruments for panel data. To partially address the endogeneity problem, we follow Baier and Bergstrand (2007) and introduce country-pair fixed effects,  $\mu_{ij}$ , to capture country-pair time-invariant factors determining bilateral trade such as distance or common language. This set of fixed effects accounts for unobserved time-invariant heterogeneity among country pairs which can bias estimates in cross-sectional studies, and hence attenuates the endogeneity bias stemming from omitted variables.

A limitation of previous work is that the use of a dummy variable to identify the trade effect of a PTA is generally associated with a negative bias in the variable’s coefficient. We improve with respect to earlier studies on the bias due to measurement error of the trade policy variables by following the suggestion outlined in Baier and Bergstrand (2007) “*the best method for eliminating this [measurement error] bias is construction of a continuous variable that would more accurately measure the degree of trade liberalization from various PTAs.*” First, we include a variable for the depth of trade agreements to capture the degree of trade liberalization between PTA partners. Second, we also include the  $TTRI_{ijt}$ , the tariff trade restrictiveness index, to isolate the effect of changes in tariffs between country  $i$  and  $j$  (Kee et



al. 2008, 2009; Fugazza and Nicita, 2013) from the impact of changes in depth. The index is obtained using the following formula:

$$TTRI_{ijt} = \frac{\sum_{hs} X_{ij(95-97),hs} \varepsilon_{j,hs} T_{ijt,hs}}{\sum_{hs} X_{ij(95-97),hs} \varepsilon_{j,hs}} \quad (4)$$

where  $X_{ij}$  is the average product level exports from country  $i$  to country  $j$  between 1995 and 1997,  $\varepsilon$  is the bilateral import elasticity and  $T$  is the applied tariff rate on product  $hs$ . We use export weights based on pre-sample data to reduce the potential endogeneity problem of trade to tariff. The obtained index aggregates bilateral product level tariffs to a uniform tariff equivalent that would maintain exports between  $i$  and  $j$  constant.

As discussed in Section II, the  $Depth_{ijt}$  variable is defined as the count of provisions included in each agreement normalized between 0 and 1. Our baseline specification relies on the count of legally enforceable provisions, i.e. those which have binding language and are subject to dispute settlement (“depth LE”). We also construct alternative measures of depth by counting the areas covered irrespective of their legal enforceability (“depth all”) and by including provisions that are more likely to be economically relevant (“depth core”).<sup>20</sup> The coefficient of depth captures the effect of changes in the coverage of areas in a PTA net of changes in tariffs. Given the set of fixed effects, the identification strategy relies on the variation in depth within country-pairs variation to identify the effect on exports.

#### b. Trade diversion

To capture effects on a trading partner  $i$  from country  $j$ 's trade agreements, we modify the definition of trade cost in equation (2) to

$$\tau_{ij} = T_{ij}^{PREF} T_j^{MFN} (1 + t_{ij}) \quad (5)$$

where iceberg trade costs  $T_{ij}$  are divided into an “MFN” component,  $T_j^{MFN}$  when  $i \neq j$ , which is a destination specific cost common to all exporters, and a preferential component  $T_{ij}^{PREF}$  that can be reduced between specific country-pairs. Deep agreements affect non-members in two

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<sup>20</sup> We also construct a depth variable based on the first component of a Principal Component Analysis (PCA) of the provisions (see Orefice and Rocha, 2014).

different ways. First, as in the case of shallow PTAs, they make non-members less competitive in members' countries by reducing bilateral trade costs of members. This effect results both from the preferential reduction in tariffs ( $t_{ij}$ ) and of other trade costs ( $T_{ij}^{PREF}$ ). Second, deep agreements can have a positive impact on non-members to the extent that they reduce the MFN component of trade costs ( $T_j^{MFN}$ ).

To capture the trade effects of deep agreements on non-members we proceed by steps. First, we augment equation (3) to include the average depth and relative tariffs for each importing partner with respect to the rest of the world.<sup>21</sup> Thus, equation (3) becomes:

$$X_{ijt} = \exp\{\beta_1 Depth_{ijt} + \beta_2 \ln(1 + TTRI_{ijt}) + \beta_3 RPM_{ijt} + \beta_4 Others\ Depth_{ijt} + \theta_{it} + \Omega_{jt} + \mu_{ij} + Controls\} + \varepsilon_{ijt} \quad (3')$$

where the difference with respect to the trade creation model is the inclusion of the relative preference margin ( $RPM$ ) and the importer's average depth of trade agreements ( $Others\ Depth$ ). The two variables are constructed adapting the formula for the trade weighted average tariff from Fugazza and Nicita (2013). In more formal terms,  $RPM$  and  $Others\ Depth$  are defined as follows:

$$RPM_{ijt} = \frac{\sum_{hs} X_{ij(95-97),hs} \varepsilon_{j,hs} (T_{ijt,hs} - T_{wjt,hs})}{\sum_{hs} X_{ij(95-97),hs} \varepsilon_{j,hs}}, \quad (6)$$

$$with\ T_{wjt,hs} = \frac{\sum_v X_{vj(95-97),hs} T_{vjt,hs}}{\sum_v X_{vj(95-97),hs}},\ v \neq i$$

$$Others\ Depth_{ijt} = \frac{\sum_v X_{vj(95-97)} Depth_{vjt}}{\sum_v X_{vj(95-97)}},\ v \neq i \quad (7)$$

$T_{wjt,hs}$  is the average tariff the rest of the world is facing at the HS product level, which is then aggregated at the country pair level by weighting each product by country  $i$ 's exports to country  $j$  during the 1995-1997 period to avoid endogeneity. Note that we can retain importer-year fixed effects because both  $RPM$  and  $Others\ Depth$  vary by origin country  $i$ :  $RPM$  more

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<sup>21</sup> We assume that  $T_j^{MFN} = f(depth_j)$ . In particular, to keep the functional form similar to  $RPM$ , we proxy for  $T_j^{MFN}$  by country  $j$ 's trade weighted depth with the rest of the world. For a theoretical derivation of the  $RPM$ , see Fugazza and Nicita (2013).

obviously because it incorporates the tariff faced by source country  $i$ ; *Others Depth* because it is calculated for any  $ij$  pair by taking the weighted average of  $j$ 's depth vis-à-vis all countries except  $i$ . Intuitively, if trading partner  $j$  gives better market access to countries that export goods that are important for  $i$  we would expect country  $i$ 's exports to decrease; similarly, if  $j$  signs deep agreements with  $i$  competitors, this should have an impact on bilateral trade.

As a second step, we decompose the depth of the PTA into its preferential and MFN components, as suggested in the literature (e.g. Baldwin and Low, 2009). Specifically, an increase in the *RPM* denotes a loss in market access for the exporter relative to the rest of the world, while increases in *Others Depth* capture the deepening of importer's trade relations with other partners. The effect of relative tariffs is unambiguously negative since they directly impact the final prices paid by consumers in destination markets, while deep provisions could have ambiguous effects on trade. On the one hand, if countries can set policies to discriminate between members and non-members and reduce costs for PTA member-countries only, as in the case of tariffs, export taxes or other duties, we would expect a negative impact on third countries. On the other hand, if deeper agreements have a public good component, such as improvements in customs, increased competition or the reduction in subsidies to domestic producers, then the effect on excluded countries could be positive. To capture the two opposing effects that deep agreements may have, we include two variables in equation (3') to capture the depth of preferential and MFN core provisions following the classification provided in Baldwin and Low (2009).

Apart from their direct impact on third countries, deep provisions in agreements may also influence the impact on these countries of conventional tariff preferences. How an MFN reduction in the frictional trade tax for all trading partners influences the marginal effect of tariff preferences on third countries is analytically ambiguous. Therefore, it is worth examining the empirical evidence. We test the following equation:

$$X_{ijt} = \exp\{\beta_1 Depth_{ijt} + \beta_2 \ln(1 + TTRI_{ijt}) + \beta_3 RPM_{ijt} + \beta_4 (RPM_{ijt} * Depth_{jt}) + \theta_{it} + \Omega_{jt} + \mu_{ij}\} + \varepsilon_{ijt} \quad (3'')$$

where  $Depth_{jt}$  is interpreted in two different ways. The first is, as before, an average of the depth of the importers' agreements with the rest of the world. The second is the maximum

number of provisions that importer  $j$  has in its deepest agreement at time  $t$ . This captures the idea that MFN provisions, once introduced in a PTA, may have an impact on all partners because of their intrinsic public good nature. Coefficient  $\beta_4$  of the interaction term in equation (3'') identifies the effect of deep agreements on tariff preferences. A negative coefficient would suggest that tariff preferences have a stronger marginal effect once the importing country signs deeper agreements, whereas a positive coefficient would suggest that tariff preferences matter less when trading partners implement deep agreements.

#### IV. Econometric results

In this section we present the results of the estimations from the gravity model. The first subsection focuses on the impact of deep agreements on members' trade. We then study how deep agreements affect trade with non-members.

##### a. Trade creation

This subsection discusses and presents the estimates from equation (3) and its extensions. The objective is to identify the effect of deep trade agreements on member countries' trade flows.

Table 3 reports the PPML estimates from the gravity equation (3). Results point to a significant effect of depth on bilateral trade. In the first column we use the count of all the legally enforceable provisions included in PTAs and normalize the variable between 0 and 1 for ease of interpretation. Results suggest that trade between country pairs that sign an agreement with the highest depth (43 provisions) increases by around 12.5 percent.<sup>22</sup> The effect changes only slightly when we include all provisions whether legally enforceable or not (*Depth All*). The effects are reduced by half once we count the strictly economically relevant provisions (*Depth Core*). Since the maximum number of provisions in *Depth Core* is about half the maximum number of provisions in the other variables, the impact of an additional provision is similar across all the depth variables. The finding that even measures which a priori seem peripheral, like cooperation on health and human rights, matter for bilateral trade on average as much as core provisions is puzzling. One explanation could be that the inclusion of non-economic areas in trade agreements facilitates deeper commitments in more directly trade

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<sup>22</sup> Since the *Depth* variables are normalized between 0 and 1, the following formula provides the percentage change in trade flows of signing the deepest agreement:  $e^{\beta_{depth}} - 1$ .

related areas – a form of “issue-linkage” (Maggi, 2016) that is not adequately captured by binary representation of provisions in this paper.<sup>23</sup>

Table 3. PPML Regression: Trade Creation

VARIABLES	Depth PPML						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Trade	Trade	Trade	Trade	Trade	Trade	Trade
Depth LE	0.118** (0.053)				0.195*** (0.065)	0.366*** (0.125)	0.356*** (0.122)
Depth All		0.099** (0.042)					
Depth Core LE			0.059* (0.034)				
Depth Core All				0.053* (0.030)			
old PTAs					0.143*** (0.050)	0.185*** (0.057)	0.171*** (0.055)
PTA						-0.074 (0.049)	-0.079* (0.048)
ln(1+TTRI)							-0.206 (0.562)
N	110,739	110,739	110,739	110,739	110,739	110,739	94,057
Exp.-Year	yes	Yes	yes	yes	yes	yes	yes
Imp.-Year	yes	Yes	yes	yes	yes	yes	yes
Exp.-Imp.	yes	Yes	yes	yes	yes	yes	yes
Period	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14

Note: LE stands for legally enforceable. Robust standard errors, clustered at the country-pair level, are in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

We find that controlling for *old PTAs* (columns 5 to 7), agreements that are no longer in force and on the content of which we have no information, increases the magnitude and statistical significance of the impact of depth on trade. Specifically, in this specification trade between country pairs that sign an agreement with the highest depth increases by 44 percent. Intuitively, the inclusion of the *old PTA* variable increases the magnitude and precision of the *depth* estimates because it allows us to distinguish between country-pairs in the control group

<sup>23</sup> In a series of robustness checks, we find similar results when controlling for the presence of bilateral investment treaties (BITs) and using alternative definitions of depth based on the legal language. Results for *depth core LE* become insignificant in a specification where we include controls for *old PTA*, *PTA*, and bilateral tariffs together, for which there is limited variation within country-pairs. Finally, results are robust to an alternative definition of depth base on the principal component analysis “PCA,” as in Orefice and Rocha (2014). Moreover, we find that results are also robust to the exclusion of crises years (i.e., 2008 and 2009) with coefficients around 10 percent higher than those in specifications using the full sample.

that had a PTA at some point in time and those that never had a PTA and for which *depth* is equal to zero.<sup>24</sup>

In columns 6 and 7 of Table 3, we capture the effect of variations in depth within country-pairs with PTAs. The inclusion of the PTA dummy further alleviates concerns stemming from omitted variables. This dummy variable could be interpreted either as a trade agreement fixed effect, which captures country-pair confounding factors determining the timing of trade agreements being signed and changes in trade flows, or as an interaction variable that captures the effect of an agreement with zero provisions. Therefore, the positive and significant coefficient indicates that country-pairs with deep agreements trade more with respect to those that have shallower agreements. This suggests that results in the first four columns are not merely due to the presence of a PTA. Moreover, results are robust to the inclusion of bilateral tariffs as well, which suggests that the finding that deep trade agreements increase bilateral trade is not driven by tariff liberalization.

It has been suggested that the rise of deep agreements and the increasing importance of production fragmentation are related (see, e.g., Lawrence, 1996; Baldwin, 2010; WTO, 2011; Antràs and Staiger, 2012). Intuitively, the unbundling of stages of production across borders creates new forms of cross-border policy spillovers and time consistency problems that deeper forms of integration help to address. For instance, provisions like investment and intellectual property rights protect the physical and intellectual capital used in production sites overseas, SPS and TBT disciplines facilitate trade in intermediate goods used in complex production processes, visa provisions allow for the exchange of technical staff and the traveling of managers to oversee production. To test this hypothesis, we use industry level data to investigate the impact of deep agreements on trade in goods involving more fragmented production chains. We follow the literature and define “fragmentation” as the number of production stages embodied in each product (Fally, 2011) while controlling for

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<sup>24</sup> The old PTA dummy captures the pre-accession agreements for countries that joined the EU after 2002 and a small number of other PTAs no longer in force: the trade agreement between Mexico and the three Northern Triangle countries – El Salvador, Guatemala and Honduras – that was active between 2001 and 2012, the trade agreement between Mexico and Nicaragua (1998-2012), and Closer Economic Partnership Arrangement (CEPA) between China and Hong Kong. The coefficient on old PTAs in column 5 is 0.18 which suggests that older PTAs increased bilateral trade by around 20 percent on average during the 2002-2014 period. This impact is equivalent to signing an agreement that includes 30 legally enforceable provisions and reflects the depth of EU pre-accession agreements.

“upstreamness”, the number of stages to final demand (Antràs et al., 2012; Costinot et al., 2013).<sup>25</sup>

We find that deep agreements disproportionately benefit industries that are more vertically fragmented regardless of their upstreamness (see Table 4). Industry level data allow us to include additional controls for sector level characteristics, which increase the precision of our estimate, and to identify the effect of deep agreements on different industries. Overall, results in Table 4 confirm the positive impact of deep agreements on trade flows. Results in Table 4 show that the impact of deep agreements is amplified for fragmented sectors. For instance, results in column 3 suggest that the impact of deep agreements on industrial chemicals is around 8 percent higher than for the wood products industry.<sup>26</sup> Results are robust to the exclusion of agriculture goods and controls for industries’ upstreamness.

Table 4. PPML Regression: Trade Creation and Industry Fragmentation

VARIABLES	Depth PPML			
	(1) All Trade	(2) Manf. Trade	(3) All Trade	(4) Manf. Trade
Depth LE	0.086** (0.040)	0.095** (0.040)	0.086** (0.043)	0.115*** (0.041)
Depth LE * Fragmentation	0.138*** (0.042)	0.141*** (0.045)	0.138*** (0.045)	0.112** (0.047)
Depth LE * Upstreamness			0.001 (0.043)	0.046 (0.037)
Observations	3,771,899	3,054,426	3,771,899	3,054,426
R-squared	0.979	0.979	0.979	0.979
Importer-Sector-Year FE	yes	yes	yes	yes
Exporter-Sector-Year FE	yes	yes	yes	yes
Country-Pair-Sector FE	yes	yes	yes	yes
Period	2002-2014	2002-2014	2002-2014	2002-2014
Industry	All	Manufacturing	All	Manufacturing

Note: LE stands for legally enforceable. Robust standard errors, clustered at the country-pair level, are in parentheses. The *Fragmentation* and *Upstreamness* variables are standardized to have a mean of 0 and standard deviation of 1.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

<sup>25</sup> We concord the original BEA's 2002 I-O industry classification to ISIC Rev. 3.

<sup>26</sup> The production of industrial chemicals involves 2.714 stages, while the production of wood products involves only 2.549 stages.

Our baseline specification could suffer from several econometric problems. On the one hand, the relatively small effects of *Depth* on trade we find in Table 3 compared to the literature may suggest a downward bias in our coefficients.<sup>27</sup> On the other hand, the potential endogeneity of deep agreements and trade could bias our estimates in the opposite direction. More specifically, a first econometric issue could be that trade flows tend to adjust slowly to trade cost changes and by using annual data without lags we may not capture the full effect of trade agreements.<sup>28</sup> The issue may be particularly relevant for deep agreements as they tend to have longer implementation phases, which could bias downwards the estimates of depth. Second, coefficients of the anticipation effects of PTAs may also be a confounding factor in our regression analysis. If trade flows increase in anticipation of the agreement even before its entry into force, we would fail to assign these effects to the agreements when using contemporaneous variables. Evidence of anticipatory effects could also raise concerns about the identification strategy and causality because of the difficulty in distinguishing between anticipation effects and pre-existing trends. Finally, a third concern is that the absence of intra-national trade flows limits the identification to the comparison between PTA member countries and county-pairs without PTAs in a way that is not completely consistent with the theoretical basis of the gravity equation (Larch et al., 2017).

To address these concerns, we extend our baseline specification in equation (3) in several directions. First, we use yearly data and include lags and leads of the depth variables to estimate the dynamic effects of PTAs. Figure 3 presents the results on the dynamic effects of deep agreements. Results are based on specifications (1) to (4) in Table 3, modified to include two leads and four lags of the depth variables to accommodate heterogeneous effects over time and to test for anticipatory effects of agreements. The inclusion of the leads thus also provides for an informal test for the “strict exogeneity” of trade agreements (see Bergstrand et al.,

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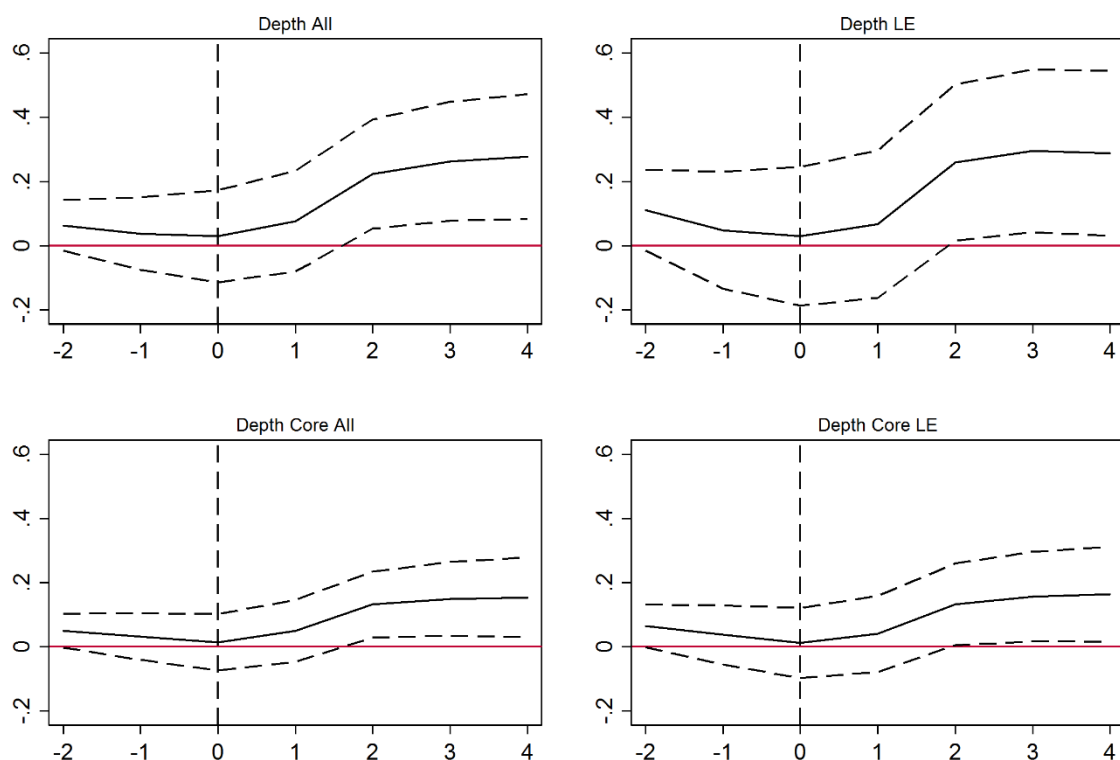
<sup>27</sup> According to a meta-analysis of the effect of trade agreements on trade by Head and Mayer (2014), the median coefficient of a PTA dummy is 0.28. In the case of deep trade agreements such as the EU, the coefficient found in the literature is 0.98, which is higher than our estimate for the trade effect of the agreement with highest depth.

<sup>28</sup> Trefler (2004) suggests that trade flows adjust slowly to changes in trade costs and criticizes the use of yearly data. Therefore, we use 3-year intervals to allow more time for trade to adjust to changes in depth of trade agreements. We find that results in Table A3, in Appendix A, are qualitatively and quantitatively similar to results obtained using consecutive years, with the exception for core depth which becomes statistically insignificant. In the rest of the paper, we favor yearly data over 3-year intervals because it is more common in the gravity literature.



2015).<sup>29</sup> The results suggest that both current and future levels of PTA depth are statistically uncorrelated with current levels of trade flows. It takes at least two years for a deep agreement to increase trade flows and the effects are twice as large as the ones we find in specifications without lags and leads (Table 3). As shown in Figure 3, these results are robust to the use of different measures of depth.

Figure 3: Dynamic effects of Depth



Note: LE stands for legally enforceable. Results are based on specifications (1) to (4) in Table 2 which is modified to include two leads and four lags of the depth variables. The solid lines depict the cumulative effect and the broken lines the 95% confidence intervals. Results are robust to alternative numbers of lags and leads.

Second, to further test that coefficients on depth are not capturing a positive export trend between PTA country pairs, we test the significance of future levels of depth at different points prior to the entry into force of trade agreements.<sup>30</sup> A positive and significant coefficient could suggest that there is a positive export trend, or that trade flows increase due to expectations of future reductions in trade costs, or that countries sign agreements because of

<sup>29</sup> As an alternative way to address the problem of reverse causality, we check whether previous trade flows predict depth. In results available upon request, we find no significant relationship between past trade flows and depth in both OLS and PPML regressions.

<sup>30</sup> See Arnold et al. (2016) for a similar falsification test in the context of a services reform in India.

increases in trade flows. All these scenarios would invalidate a causal interpretation of our results. Specifically, we augment specifications 1 to 4 of Table 3 by the following variable

$$Depth\ 1\ year\ prior\ to\ agreement_{ijt} = Depth_{ij(t+1)} * IPTA_{ijt} \quad (8)$$

where  $Depth_{ij(t+1)}$  is the future level of depth between country  $i$  and  $j$ , and  $IPTA_{ijt}$  is an indicator variable equal to one in the year prior to an agreement entering into force and zero otherwise. If results in Table 3 are due to the presence of trends or if country pairs sign agreements because of increases in trade flows, we would expect the coefficient on the variable in equation (8) to be positive and significant. As an additional check, we also define a similar variable two years prior an agreement takes effect. Table 5 shows that trade flows are not statistically correlated with future levels of depth. Depth estimates obtained in Table 3 are unaffected by the inclusion of these additional variables. This evidence suggests a causal relationship between depth and trade.<sup>31</sup>

Table 5: Trade Creation Falsification Test

VARIABLES	Depth PPML							
	(1) Depth LE	(2) Depth LE	(3) Depth All	(4) Depth All	(5) Depth Core LE	(6) Depth Core LE	(7) Depth Core All	(8) Depth Core All
Depth	0.133** (0.064)	0.124** (0.058)	0.107** (0.049)	0.104** (0.045)	0.062 (0.039)	0.062* (0.036)	0.057* (0.034)	0.057* (0.031)
Falsification test: Depth 1 year prior to agreement	0.077 (0.058)		0.052 (0.042)		0.035 (0.037)		0.035 (0.032)	
Falsification test: Depth 2 years prior to agreement		0.042 (0.037)		0.033 (0.027)		0.019 (0.023)		0.021 (0.019)
Observations	105,107	104,696	105,107	104,696	105,107	104,696	105,107	104,696
Importer-Year FE	yes	Yes	yes	yes	yes	yes	Yes	yes
Exporter-Year FE	yes	Yes	yes	yes	yes	yes	Yes	yes
Country-Pair FE	yes	Yes	yes	yes	yes	yes	Yes	yes
Period	2002-2014	2002-2014	2002-2014	2002-2014	2002-2014	2002-2014	2002-2014	2002-2014

Note: Robust standard errors, clustered at the country-pair level, are in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Another concern with our main specification is that the absence of intra-national trade flows limits the identification to the comparison between members of a PTA and county-pairs

<sup>31</sup> In an additional falsification test, we assign random levels of depth to trade agreements in our sample. Figure A2 of Appendix A shows the distribution of the coefficients of random depth variable obtained from 500 random draws of depth, obtained from a PPML model that includes a PTA dummy, is normally distributed.

without PTAs. To address this concern, we follow Bergstrand et al. (2015) and construct intra-national trade flows using GDP data from the Penn World Tables.<sup>32</sup> In this specification, the control group comprises country-pairs without trade agreements and countries' trade with themselves, neither of which see any change in depth. Results in Table 6 suggest that the exclusion of internal flows plays an important role in explaining the relatively small effects of depth we found earlier, as already documented in the trade gravity literature for the PTA dummy (e.g. Dai et al., 2014; Larch et al., 2017). The coefficients of depth on trade are around three times larger than those presented in Table 3. These results are more in line with the literature in which, for instance, the coefficient for a common currency is 0.98 while we find in column 6 that the coefficient for the deepest agreement in our sample (the European Union) is 0.97. Additionally, we find the expected negative and significant impact of tariffs on trade which is not captured in regressions with international flows only. Unfortunately, due to data limitations on product level output, we limit our analysis to international trade when we study the effects of trade diversion.

Table 6. PPML Regression: Trade Creation Internal Flows

VARIABLES	Depth PPML Internal Flows						
	(1) Trade	(2) Trade	(3) Trade	(4) Trade	(5) Trade	(6) Trade	(7) Trade
Depth LE	0.849*** (0.045)				1.023*** (0.070)	0.972*** (0.132)	0.996*** (0.130)
Depth All		0.722*** (0.041)					
Depth Core LE			0.555*** (0.033)				
Depth Core All				0.483*** (0.032)			
old PTAs					0.282*** (0.061)	0.267*** (0.067)	0.261*** (0.066)
PTA						0.026 (0.055)	-0.031 (0.055)
ln(1+TTRI)							-2.131*** (0.551)
N	116,134	116,134	116,134	116,134	116,134	116,134	97,825
Exp.-Year FE	yes	yes	yes	yes	yes	yes	yes
Imp.-Year FE	yes	yes	yes	yes	yes	yes	yes
Exp.-Imp. FE	yes	yes	yes	yes	yes	yes	yes
Period	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14

Note: LE stands for legally enforceable. Robust standard errors, clustered at the country-pair level, are in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

<sup>32</sup> The main advantage of constructing intra-national flows with GDP data is the extensive time and country coverage compared to gross output data (e.g. CEPII's TradeProd data are available until 2006). The drawback is that GDP is measured as value added which is an imperfect proxy of gross output.

To better understand the impact, and to quantify the effect, of additional provisions in trade agreements, we consider three agreements that are characterized by different levels of depth. First, we calculate the trade impact of the Peru-Chile FTA, a relatively shallow agreement signed in 2009, which includes 11 legally enforceable provisions. Second, we calculate the trade impact of the United States-Korea Free Trade Agreement (KORUS FTA) signed in 2007, an agreement with a medium level of depth which includes 15 provisions. Third, we estimate the impact of the EU which comprises eight agreements, Treaty of Rome and successive enlargements, which cover 43 legally enforceable provisions.<sup>33</sup>

Based on estimates in columns 6 of Table 3 and 6 we find that the Peru-Chile FTA increased members' bilateral trade between 10 and 30 percent. For the case of KORUS FTA, which includes additional provisions on state trading enterprises, public procurement, and provisions on intellectual property rights, we find a larger effect, ranging between 14 and 40 percent. Finally, we find that the inclusion of all depth core provisions and 25 other provisions spanning from taxation and money laundering to labor market regulation and visa and asylum, increased trade between 44 and 164 percent among EU countries.

#### **b. Trade diversion**

Table 7 presents the results on the effect of deep trade agreements on excluded countries. Note first that the depth of PTAs (depth LE) continues to have a consistently significant impact on trade between member countries. Even though the coefficients in Table 7 are slightly different from those in Table 5, the difference is not statistically significant. To ease interpretation all *Others* variables are standardized and the coefficients capture one standard deviation shocks. We find that the importer's average depth, when counting all the 52 areas, has a positive effect on bilateral trade. In column 2 we limit the analysis to core provisions and find that while the magnitude drops, the estimates increase in statistical significance. The results suggest that a standard deviation increase in partner's depth (depth core LE) increases trade by around 19 percent. These positive effects on third-countries could potentially explain the difference between trade creation estimates with and without internal flows. If deep trade agreements benefit all trade partners, then the effect of signing a deep trade

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<sup>33</sup> Details on the policy areas covered by the Peru-Chile FTA, KORUS FTA and the EU Treaties are in Table A4 in the Annex.

agreement (or unilaterally reducing tariffs) would be absorbed by the country-year fixed effects when using international trade flows only.

We find that the positive effect of deep agreements on third countries is driven by the inclusion of MFN provisions, while the inclusion of preferential provisions has a negative but insignificant impact (columns 3 and 6). The negative effect of preferential provisions becomes significant once we account for the presence of *old PTA*, agreements for which we do not have information on their content, in columns 9 and 12. Results in columns 7 to 12 reveal that *old PTA* is associated with a negative average effect on third-countries' trade. This finding suggests that early agreements were more trade diverting, which is consistent with the evidence presented in Section II that PTAs have become deeper over time. Both results for depth and older PTAs are robust to the inclusion of relative and bilateral tariff preferences, which are insignificant for different specifications.

A comparison of the effects of trade creation and trade diversion is helpful to put these results in perspective. As before, we focus on three trade agreements with different levels of depth: Peru-Chile, United States-Korea and the EU. Using estimates from column 9, we find that a medium depth agreement such as KORUS FTA increased exports from excluded countries to members by around 4 percent. We find large effects of the European Union (the deepest agreement in our data) for non-member countries. Estimates suggest that exports from non-EU countries would be around 30 percent lower in the absence of the agreement. Finally, we find shallow agreements between smaller countries such as the Peru-Chile agreement increased trade between members but had a negligible impact on non-members trade. In general, the positive impact on non-members' trade flows is driven by the inclusion of MFN provisions, while preferential provisions have a negative effect.

Table 7. PPML Regression: Trade Diversion

VARIABLES	Depth PPML Diversion											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Trade	Trade	Trade	Trade	Trade	Trade	Trade	Trade	Trade	Trade	Trade	Trade
Depth LE	0.177*** (0.064)	0.177*** (0.060)	0.157** (0.062)	0.173*** (0.065)	0.172*** (0.062)	0.149** (0.063)	0.232*** (0.080)	0.240*** (0.078)	0.238*** (0.078)	0.229*** (0.081)	0.235*** (0.079)	0.229*** (0.080)
Others Depth LE	0.290* (0.151)			0.295* (0.153)			0.284* (0.152)			0.290* (0.154)		
Others Depth Core LE		0.181** (0.078)			0.185** (0.078)			0.180** (0.078)			0.183** (0.078)	
Others MFN LE			0.661** (0.315)			0.670** (0.313)			0.769*** (0.297)			0.780*** (0.295)
Others PREFER LE			-0.476 (0.312)			-0.479 (0.312)			-0.590** (0.294)			-0.594** (0.294)
RPM.				-0.255 (0.899)	-0.295 (0.892)	-0.515 (0.863)				-0.240 (0.899)	-0.280 (0.892)	-0.536 (0.860)
ln(1+TTRI)				-0.116 (0.689)	-0.112 (0.686)	-0.050 (0.678)				-0.120 (0.689)	-0.115 (0.686)	-0.046 (0.677)
old PTAs							0.066 (0.060)	0.078 (0.061)	0.061 (0.061)	0.065 (0.059)	0.077 (0.060)	0.058 (0.061)
Others old PTAs							-0.044* (0.026)	-0.044* (0.025)	-0.116*** (0.042)	-0.045* (0.026)	-0.045* (0.025)	-0.117*** (0.042)
N	100,157	100,157	100,157	94,057	94,057	94,057	100,157	100,157	100,157	94,057	94,057	94,057
Exp.-Year FE	Yes	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Imp.-Year FE	Yes	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Exp.-Imp. FE	Yes	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Period	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14

Note: LE stands for legally enforceable. Robust standard errors, clustered at the country-pair level, are in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Using industry-level data, we find evidence of trade diversion for the average industry (Table 8 column 1). This result differs from the country-level results reported in Table 7, but the results are not necessarily inconsistent because of the different levels of aggregation and controls used in the two specifications. When we test for heterogeneous effects on sectors with different levels of fragmentation, we find that third country exports increase in more fragmented sectors (column 2 of Table 8). Non-member countries also experience an increase in trade in more upstream industries (column 3 of Table 8). A possible interpretation is based on our earlier finding that fragmented industries benefit disproportionately from deep provisions that allow governments to address coordination and commitment problems associated with cross-border production, thus facilitating the functioning of global supply chains as discussed in the previous section (Lawrence, 1996; Baldwin, 2010; WTO, 2011; Antràs and Staiger, 2012). The results in Table suggest that this positive trade effect between members could spill over to firms in non-member countries that are related through global supply chains.

Table 8. PPML Regression: Trade Diversion and Industry Fragmentation

VARIABLES	Depth PPML		
	(1) Trade	(2) Trade	(3) Trade
Depth LE	0.073 (0.046)	0.018 (0.048)	0.030 (0.050)
Depth LE * Fragmentation		0.195*** (0.045)	0.171*** (0.047)
Depth LE * Upstreamness			0.043 (0.044)
Others Depth LE	-0.222** (0.101)	-0.297*** (0.114)	-0.228** (0.106)
Others Depth LE * Fragmentation		0.253*** (0.078)	0.138* (0.074)
Others Depth LE * Upstreamness			0.164*** (0.060)
Observations	3,697,539	3,691,444	3,697,539
R-squared	0.979	0.979	0.979
Importer-Sector-Year FE	yes	yes	yes
Exporter-Sector-Year FE	yes	yes	yes
Country-Pair-Sector FE	yes	yes	yes
Period	2002-2014	2002-2014	2002-2014
Sector	All	All	All

Note: LE stands for legally enforceable. Robust standard errors, clustered at the country-pair level, are in parentheses. The *Fragmentation* and *Upstreamness* variables are standardized to have a mean of 0 and standard deviation of 1.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Finally, we investigate if the depth of trade agreements concluded by countries influences the marginal effect of trade preferences on third countries. Specifically, we identify the effect of deep PTAs on tariff preferences by estimating equation (3''). Results are reported in Table 9. We interact the *RPM* variable with the importer's average depth of trade agreements with the rest of the world and with the importer's maximum value of depth (i.e. its deepest trade agreement) in a given year. Therefore, we test if commitments, for instance, to improve customs efficiency or to reduce subsidies, soften the consequences of trade preferences for excluded countries.

Table 9. PPML Regression: The Influence of Depth on the Impact of Trade Preferences

VARIABLES	Depth PPML Diversion Revisited							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Trade	Trade	Trade	Trade	Trade	Trade	Trade	Trade
Depth LE	0.189*** (0.064)	0.184*** (0.060)	0.234*** (0.080)	0.231*** (0.079)	0.191*** (0.064)	0.185*** (0.063)	0.236*** (0.080)	0.229*** (0.079)
RPM	-0.254 (0.864)	-0.546 (0.909)	-0.242 (0.865)	-0.532 (0.910)	-2.169 (1.543)	-3.659* (1.871)	-2.131 (1.550)	-3.609* (1.882)
(RPM * Others Depth LE)	1.618*** (0.617)		1.608*** (0.619)					
(RPM * Others Depth Core LE)		1.903*** (0.676)		1.893*** (0.678)				
(RPM * Max Depth LE)					3.776** (1.790)		3.726** (1.799)	
(RPM * Max Depth Core LE)						4.174*** (1.554)		4.127*** (1.564)
ln(1+TTRI)	-0.009 (0.671)	0.057 (0.668)	-0.013 (0.671)	0.052 (0.668)	-0.052 (0.685)	-0.063 (0.687)	-0.057 (0.685)	-0.068 (0.687)
Others Depth LE	0.278* (0.151)		0.274* (0.152)		0.292* (0.153)	0.285* (0.153)	0.286* (0.154)	0.281* (0.154)
old PTAs			0.039 (0.060)	0.044 (0.062)			0.044 (0.060)	0.042 (0.059)
Others old PTAs			-0.049* (0.027)	-0.050** (0.025)			-0.047* (0.027)	-0.048* (0.027)
Others Depth Core LE		0.167** (0.076)		0.165** (0.077)				
N	94,057	94,057	94,057	94,057	94,057	94,057	94,057	94,057
Exp.-Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Imp.-Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Exp.-Imp. FE	yes	yes	yes	yes	yes	yes	yes	yes
Period	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14

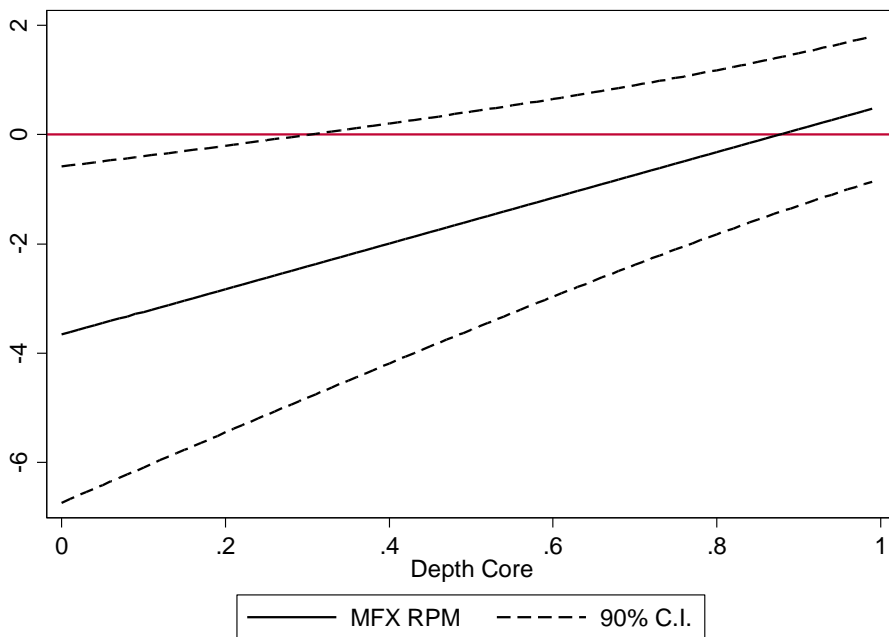
Note: LE stands for legally enforceable. Robust standard errors, clustered at the country-pair level, are in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1



We find that the effect of tariff preferences does depend on the depth of trade agreements concluded by an importing country. The interaction of the relative preference margin is significant with measures of both the average depth vis-à-vis the rest of the world (*Others Depth LE* or *Others Core Depth LE*) and of maximum level of commitments that importers undertake (*Max Depth LE* and *Max Depth Core LE*) (Table 9). Figure 4, based on results in column 6 of Table 9, shows that when maximum depth core is close to zero, a 1 percent increase in RPM decreases bilateral trade by 4 percent. This negative impact of relative preferences on trade is statistically significant for values of depth core lower than 0.3, while it is completely offset when more than 80 percent of depth core provisions are included. This suggests that tariff preferences have a discriminatory effect in countries that have “shallow” agreements, while the effect is reversed when a country undertakes deep commitments. The statistical insignificance of relative tariffs preferences we find in some of our specifications may, therefore, be due to pooling across agreements with different levels of depth.

Figure 4. Marginal Effect of Relative Tariff Preferences (90% C.I.)



## **V. Concluding remarks**

Most of the work on PTAs in the literature is based on the implicit assumption that trade agreements are about tariff liberalization. In this literature, the impact of preferential trade agreements is captured by the standard Vinerian analysis of trade creation and trade diversion. Recent data on the content of trade agreements shows, however, that PTAs are deepening, in the sense that they include an expanding set of provisions, often covering behind the border policy areas. The evidence presented in this paper confirms the view that Vinerian logic may provide an incomplete guide to the effects of deep agreements. Intuitively, the reason is that deep provisions do not necessarily act as preferential tariffs. In fact, we find that deep agreements create more trade than shallow agreements and that they can have a positive spillover effect on trade with outsiders when they are non-discriminatory in design or implementation.

The increasing number and complexity of preferential trade agreements justifies the growing interest in this area. This paper is only a first step to better understand the trade effects of deep agreements. Many questions remain open. First, we would like to uncover the specific channels through which the depth of PTAs affects trade flows. Deep agreements can influence the ability of firms to produce different products, to engage in global value chains, and to access new markets – as suggested by the results for fragmented industries. They can also have different impact on developed and developing economies, particularly as they have different institutional capacities. Second, the detailed content of PTAs, i.e. the legal commitments embedded in different policy areas covered by the agreement, are likely to matter for trade and beyond. Deep provisions on services and competition will influence the ability of countries to integrate in trade markets, investment rules will affect the ability to attract and retain foreign investment, the protection granted to intellectual property rights will have an impact on the ability to innovate. As new data are collected on the detailed content of PTAs, an exciting research agenda lies ahead.

## REFERENCES

- Anderson, James E., and Eric Van Wincoop. 2004. "Trade costs." *Journal of Economic literature* 42 (3): 691-751.
- Antràs, Pol, Davin Chor, Thibault Fally, and Russell Hillberry. 2012. "Measuring the Upstreamness of Production and Trade Flows." *American Economic Review Papers and Proceedings* 102 (3): 412-416.
- Antràs, Pol, and Robert W Staiger. 2012. "Trade Agreements and the Nature of Price Determination." *American Economic Review Papers and Proceedings* 102 (3): 470-476.
- Arnold, Jens Matthias, Beata Javorcik, Molly Lipscomb, and Aaditya Mattoo. 2016. "Services Reform and Manufacturing Performance: Evidence from India." *Economic Journal* 126 (590): 1-39, 02
- Baier, Scott L., and Jeffrey H. Bergstrand. 2007. "Do free trade agreements actually increase members' international trade?." *Journal of International Economics* 71 (1): 72-95.
- Baier, Scott L., Jeffrey H. Bergstrand, and Michael Feng. 2014. "Economic integration agreements and the margins of international trade." *Journal of International Economics* 93 (2): 339-350.
- Baldwin, Richard. 2008. "Big-Think Regionalism: A Critical Survey." NBER Working Paper 14056. National Bureau of Economic Research, Inc.
- . 2010. "21st Century Regionalism: Filling the gap between 21st century trade and 20<sup>th</sup> century trade rules", Geneva, Geneva Graduate Institute, Working Paper No. 2010-31.
- . 2014. "Multilateralising 21st Century Regionalism." Paper prepared for the OECD conference "Global Forum on Trade Reconciling Regionalism and Multilateralism in a Post-Bali World." <http://www.oecd.org/tad/events/OECD-gft-2014-multilateralising-21st-century-regionalism-baldwin-paper.pdf>.
- Baldwin, Richard, and Patrick Low, eds. 2009. *Multilateralizing regionalism: challenges for the Global Trading System*. Cambridge University Press.
- Baldwin, Richard and Charles Wyplosz, 2012. *The Economics of European Integration*. McGraw-Hill Higher Education, Berkshire, UK.
- Baldwin, Richard, and Daria Taglioni. 2006. "Gravity for Dummies and Dummies for Gravity Equations." NBER Working Paper 12516. National Bureau of Economic Research, Inc.
- Bergstrand, Jeffrey H., Mario Larch, and Yoto V. Yotov. 2015. "Economic integration agreements, border effects, and distance elasticities in the gravity equation." *European Economic Review* 78 (C): 307-327.
- Bhagwati, Jagdish. 1993. "Regionalism and Multilateralism: An Overview." In *New Dimensions in Regional Integration*, edited by Jaime de Melo and Arvind Panagariya. Cambridge: Cambridge Univ. Press.

- Chen, Maggie Xiaoyang, and Aaditya Mattoo. 2008. "Regionalism in Standards: Good or Bad for Trade." *Canadian Journal of Economics* 41: 838-863
- Costinot, Arnaud, and Andrés Rodríguez-Clare. 2013. "Trade Theory with Numbers: Quantifying the Consequences of Globalization." NBER Working Paper 12516. National Bureau of Economic Research, Inc.
- Costinot, Arnaud, Jonathan Vogel, and Su Wang. 2013. "An Elementary Theory of Global Supply Chains." *The Review of Economic Studies*, Volume 80, Issue 1, Pages 109–144.
- Dai, Mian, Yoto V. Yotov, and Thomas Zylkin. 2014. "On the trade-diversion effects of free trade agreements." *Economics Letters* 122 (2): 321-325.
- Damuri, Yose Rizal. 2012. "21st Century Regionalism and Production Sharing Practice." Center for Trade and Economic Integration Working Paper No. CTEI-2012-4.
- Ederington, Josh and Michele Ruta. 2016. "Non-Tariff Measures and the World Trading System." In Kyle Bagwell and Robert W. Staiger (eds.), *The Handbook of Commercial Policy*, vol 1B. Amsterdam, Netherlands: Elsevier, North Holland, 211-277 (chapter 5).
- Egger, Peter, and Mario Larch. 2008. "Interdependent preferential trade agreement memberships: An empirical analysis." *Journal of International Economics* 76 (2): 384-399.
- Fally, Thibault. 2011. "On the Fragmentation of Production in the U.S." Unpublished.
- Freund, Caroline, and Emanuel Ornelas. 2010. "Regional Trade Agreements." *Annual Review of Economics* 2 (1): 139-166.
- Fugazza, Marco, and Alessandro Nicita. 2013. "The Direct and Relative Effects of Preferential Market Access." *Journal of International Economics* 89 (2): 357–68.
- Grossman, Gene M. 2016. "The Purpose of Trade Agreements." In Kyle Bagwell and Robert W. Staiger (eds.), *The Handbook of Commercial Policy*, vol 1A. Amsterdam, Netherlands: Elsevier, North Holland, 379-434 (chapter 7).
- Head, Keith, and Thierry Mayer. 2014. "Gravity Equations: Workhorse, Toolkit, and Cookbook." *Handbook of International Economics*. Elsevier.
- Hofmann Claudia, Alberto Osnago, and Michele Ruta. 2017. "Horizontal Depth: A New Database on the Content of Preferential Trade Agreements." Policy Research Working Paper Series 7981, World Bank, Washington, DC.
- Horn, Henrik, Petros C. Mavroidis, and André Sapir. 2009. "Beyond the WTO? An Anatomy of EU and US Preferential Trade Agreements." Blueprints. Bruegel. Accessed August 25.
- Kee, Hiau Looi, Alessandro Nicita, and Marcelo Olarreaga. 2008. "Import Demand Elasticities and Trade Distortions." *The Review of Economics and Statistics* 90 (4): 666–82.
- . 2009. "Estimating Trade Restrictiveness Indices." *Economic Journal* 119 (534): 172–99.

- Krugman, Paul R. 1991. "The Move Toward Free Trade Zones." *Proceedings - Economic Policy Symposium - Jackson Hole*, 7–58.
- Larch, Mario, Joschka Wanner, Yoto V. Yotov, and Thomas Zylkin. 2017. "The Currency Union Effect: A PPML Re-assessment with High-Dimensional Fixed Effects." Mimeo.
- Lawrence, R. Z. 1996. *Regionalism, Multilateralism, and Deeper Integration*, Washington, DC: Brookings Institution Press.
- Limão, Nuno. 2016. "Preferential Trade Agreements." In Kyle Bagwell and Robert W. Staiger (eds.), *The Handbook of Commercial Policy*, vol 1B. Amsterdam, Netherlands: Elsevier, North Holland, 279-367 (chapter 6).
- Limão, Nuno, and Giovanni Maggi, 2015. "Uncertainty and Trade Agreements." *American Economic Journal: Microeconomics* 7 (4): 1-42.
- Maggi, Giovanni. 2016. "Issue Linkage." In Kyle Bagwell and Robert W. Staiger (eds.), *The Handbook of Commercial Policy*, vol 1B. Amsterdam, Netherlands: Elsevier, North Holland, 513-564 (chapter 9).
- Mulabdic, Alen, Alberto Osnago, and Michele Ruta. 2017. "Deep integration and UK-EU trade relations." Policy Research Working Paper Series 7947, World Bank, Washington, DC.
- Orefice, Gianluca, and Nadia Rocha. 2014. "Deep Integration and Production Networks: An Empirical Analysis." *The World Economy* 37: 106–136.
- Osnago, Alberto, Nadia Rocha, and Michele Ruta. 2015. "Deep trade agreements and vertical FDI: the devil is in the details." Policy Research Working Paper Series 7464, World Bank, Washington, DC.
- . 2017a. "Deep Trade Agreements and Global Value Chains." Mimeo, World Bank.
- . 2017b. "Do Deep Trade Agreements Boost Vertical FDI?." *World Bank Econ Review* 30, SUPPLEMENT: S119–S125.
- Piermartini, Roberta, and Yoto Yotov. 2016. "Estimating Trade Policy Effects with Structural Gravity." WTO Working Paper ERSD-2016-10.
- Trefler, Daniel. 1993. "Trade Liberalization and the Theory of Endogenous Protection: An Econometric Study of U.S. Import Policy." *Journal of Political Economy* 101 (1): 138–60.
- . 2004. "The Long and Short of the Canada-U. S. Free Trade Agreement." *American Economic Review* 94 (4): 870–95.
- Viner, Jacob. 1950. *The Customs Union Issue*. New York: Carnegie Endowment for International Peace.
- World Trade Organization (WTO). 2011. *World Trade Report 2011: The WTO and Preferential Trade Agreements: From Co-Existence to Coherence*, Geneva: WTO.

## APPENDIX A – ADDITIONAL TABLES AND FIGURES

Table A1: Description of the 52 provisions in the Content of Deep Trade Agreements Database

<i>WTO-plus areas</i>	
FTA Industrial	Tariff liberalization on industrial goods; elimination of non-tariff measures
FTA Agriculture	Tariff liberalization on agriculture goods; elimination of non-tariff measures
Customs	Provision of information; publication on the Internet of new laws and regulations; training
Export Taxes	Elimination of export taxes
SPS	Affirmation of rights and obligations under the WTO Agreement on SPS; harmonization of SPS measures
TBT	Affirmation of rights and obligations under WTO Agreement on TBT; provision of information; harmonization of regulations; mutual recognition agreements
STE	Establishment or maintenance of an independent competition authority; nondiscrimination regarding production and marketing condition; provision of information; affirmation of Art XVII GATT provision
AD	Retention of Antidumping rights and obligations under the WTO Agreement (Art. VI GATT).
CVM	Retention of Countervailing measures rights and obligations under the WTO Agreement (Art VI GATT)
State Aid	Assessment of anticompetitive behaviour; annual reporting on the value and distribution of state aid given; provision of information
Public Procurement	Progressive liberalisation; national treatment and/or non-discrimination principle; publication of laws and regulations on the Internet; specification of public procurement regime
TRIMs	Provisions concerning requirements for local content and export performance of FDI
GATS	Liberalisation of trade in services
TRIPs	Harmonisation of standards; enforcement; national treatment, most-favoured nation treatment
<i>WTO-X areas</i>	
Anti-Corruption	Regulations concerning criminal offence measures in matters affecting international trade and investment
Competition Policy	Maintenance of measures to proscribe anticompetitive business conduct; harmonisation of competition laws; establishment or maintenance of an independent competition authority
Environmental Laws	Development of environmental standards; enforcement of national environmental laws; establishment of sanctions for violation of environmental laws; publications of laws and regulation
IPR	Accession to international treaties not referenced in the TRIPs Agreement
Investment	Information exchange; Development of legal frameworks; Harmonisation and simplification of procedures; National treatment; establishment of mechanism for the settlement of disputes
Labour Market Regulation	Regulation of the national labour market; affirmation of International Labour Organization (ILO) commitments; enforcement
Movement of Capital	Liberalisation of capital movement; prohibition of new restrictions
Consumer Protection	Harmonisation of consumer protection laws; exchange of information and experts; training
Data Protection	Exchange of information and experts; joint projects
Agriculture	Technical assistance to conduct modernisation projects; exchange of information
Approximation of Legislation	Application of EC legislation in national legislation
Audio Visual	Promotion of the industry; encouragement of co-production
Civil Protection	Implementation of harmonised rules
Innovation Policies	Participation in framework programmes; promotion of technology transfers
Cultural Cooperation	Promotion of joint initiatives and local culture
Economic Policy Dialogue	Exchange of ideas and opinions; joint studies
Education and Training	Measures to improve the general level of education
Energy	Exchange of information; technology transfer; joint studies
Financial Assistance	Set of rules guiding the granting and administration of financial assistance
Health	Monitoring of diseases; development of health information systems; exchange of information
Human Rights	Respect for human rights
Illegal Immigration	Conclusion of re-admission agreements; prevention and control of illegal immigration
Illicit Drugs	Treatment and rehabilitation of drug addicts; joint projects on prevention of consumption; reduction of drug supply; information exchange

Industrial Cooperation	Assistance in conducting modernisation projects; facilitation and access to credit to finance
Information Society	Exchange of information; dissemination of new technologies; training
Mining	Exchange of information and experience; development of joint initiatives
Money Laundering	Harmonisation of standards; technical and administrative assistance
Nuclear Safety	Development of laws and regulations; supervision of the transportation of radioactive materials
Political Dialogue	Convergence of the parties' positions on international issues
Public Administration	Technical assistance; exchange of information; joint projects; Training
Regional Cooperation	Promotion of regional cooperation; technical assistance programmes
Research and Technology	Joint research projects; exchange of researchers; development of public-private partnership
SME	Technical assistance; facilitation of the access to finance
Social Matters	Coordination of social security systems; non-discrimination regarding working conditions
Statistics	Harmonisation and/or development of statistical methods; training
Taxation	Assistance in conducting fiscal system reforms
Terrorism	Exchange of information and experience; joint research and studies
Visa and Asylum	Exchange of information; drafting legislation; training

Source: World Trade Report 2011

Figure A1: Evolution of US and EU agreements

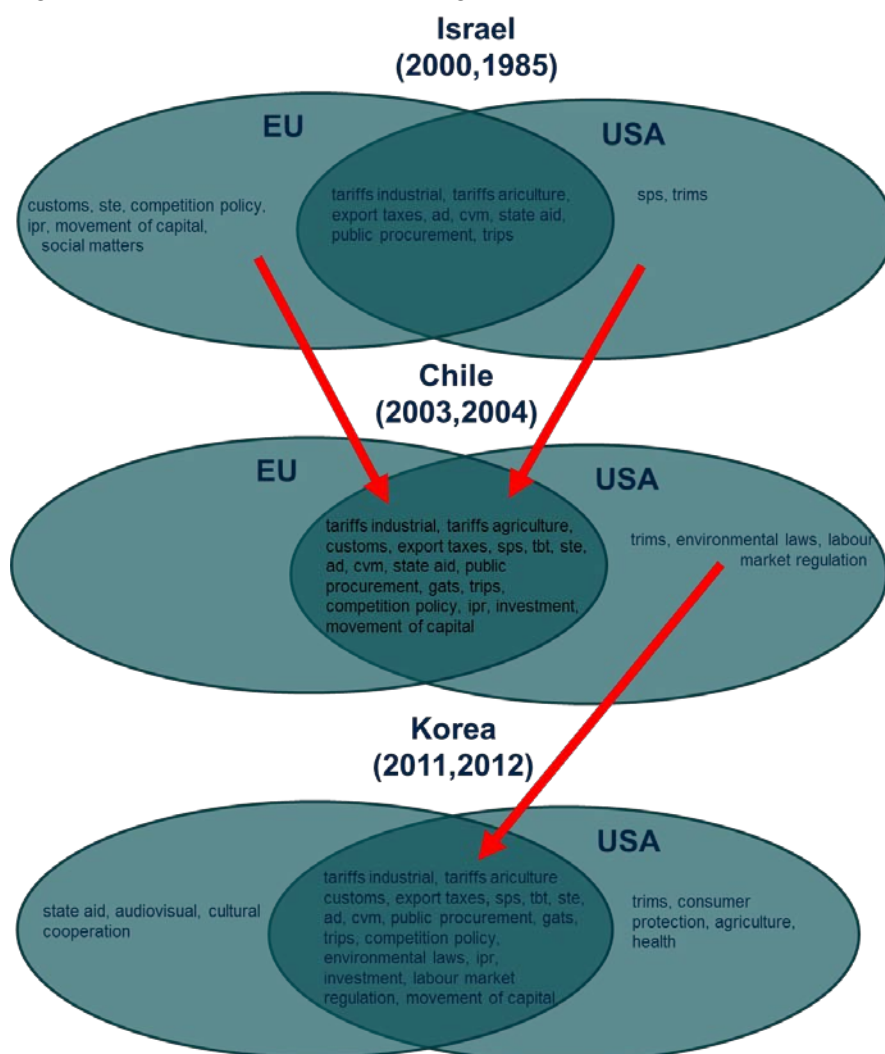


Table A2: Correlation matrix

	Tariffs on manufact uring goods	Tariffs on agricultur al goods	Customs	Export taxes	SPS	TBT	STE	Anti- dumping	Counterv ailing measures
Tariffs on manufacturing goods	1.00	0.99	0.95	0.93	0.69	0.74	0.79	0.86	0.82
Tariffs on agricultural goods	0.99	1.00	0.95	0.93	0.69	0.74	0.80	0.87	0.83
Customs	0.95	0.95	1.00	0.94	0.72	0.73	0.83	0.89	0.85
Export taxes	0.93	0.93	0.94	1.00	0.72	0.73	0.80	0.85	0.82
SPS	0.69	0.69	0.72	0.72	1.00	0.86	0.66	0.70	0.68
TBT	0.74	0.74	0.73	0.73	0.86	1.00	0.68	0.66	0.70
STE	0.79	0.80	0.83	0.80	0.66	0.68	1.00	0.83	0.84
Anti-dumping	0.86	0.87	0.89	0.85	0.70	0.66	0.83	1.00	0.95
Countervailing measures	0.82	0.83	0.85	0.82	0.68	0.70	0.84	0.95	1.00
State aid	0.82	0.83	0.85	0.83	0.69	0.71	0.84	0.84	0.81
Public procurement	0.73	0.74	0.73	0.78	0.77	0.85	0.71	0.63	0.66
TRIMS	0.55	0.55	0.57	0.58	0.75	0.73	0.62	0.62	0.65
GATS	0.75	0.75	0.74	0.77	0.84	0.92	0.66	0.67	0.68
TRIPS	0.86	0.86	0.90	0.87	0.72	0.78	0.86	0.86	0.89
Competition policy	0.84	0.84	0.84	0.84	0.64	0.64	0.86	0.86	0.83
IPR	0.80	0.80	0.84	0.81	0.67	0.75	0.89	0.80	0.82
Investment	0.74	0.74	0.73	0.78	0.81	0.84	0.68	0.68	0.67
Movement of capital	0.86	0.87	0.87	0.90	0.72	0.70	0.80	0.85	0.80

	State aid	Public procurem ent	TRIMS	GATS	TRIPS	Competiti on policy	IPR	Investme nt	Moveme nt of capital
Tariffs on manufacturing goods	0.82	0.73	0.55	0.75	0.86	0.84	0.80	0.74	0.86
Tariffs on agricultural goods	0.83	0.74	0.55	0.75	0.86	0.84	0.80	0.74	0.87
Customs	0.85	0.73	0.57	0.74	0.90	0.84	0.84	0.73	0.87
Export taxes	0.83	0.78	0.58	0.77	0.87	0.84	0.81	0.78	0.90
SPS	0.69	0.77	0.75	0.84	0.72	0.64	0.67	0.81	0.72
TBT	0.71	0.85	0.73	0.92	0.78	0.64	0.75	0.84	0.70
STE	0.84	0.71	0.62	0.66	0.86	0.86	0.89	0.68	0.80
Anti-dumping	0.84	0.63	0.62	0.67	0.86	0.86	0.80	0.68	0.85
Countervailing measures	0.81	0.66	0.65	0.68	0.89	0.83	0.82	0.67	0.80
State aid	1.00	0.73	0.63	0.65	0.88	0.87	0.82	0.76	0.84
Public procurement	0.73	1.00	0.70	0.85	0.76	0.67	0.73	0.86	0.78
TRIMS	0.63	0.70	1.00	0.73	0.62	0.56	0.61	0.71	0.62
GATS	0.65	0.85	0.73	1.00	0.73	0.63	0.73	0.84	0.76
TRIPS	0.88	0.76	0.62	0.73	1.00	0.81	0.89	0.74	0.82
Competition policy	0.87	0.67	0.56	0.63	0.81	1.00	0.79	0.70	0.86
IPR	0.82	0.73	0.61	0.73	0.89	0.79	1.00	0.71	0.78
Investment	0.76	0.86	0.71	0.84	0.74	0.70	0.71	1.00	0.80
Movement of capital	0.84	0.78	0.62	0.76	0.82	0.86	0.78	0.80	1.00



Table A3: PPML Regression: Trade Creation data every 3 years

VARIABLES	Depth PPML 3yrs						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Trade	Trade	Trade	Trade	Trade	Trade	Trade
Depth LE	0.117*				0.136	0.298*	0.291*
	(0.060)				(0.084)	(0.162)	(0.159)
Depth All		0.098**					
		(0.050)					
Depth Core LE			0.062				
			(0.041)				
Depth Core All				0.056			
				(0.037)			
old PTAs					0.036	0.094	0.083
					(0.062)	(0.072)	(0.071)
PTA						-0.067	-0.077
						(0.073)	(0.070)
ln(1+TTRI)							-0.286
							(0.608)
N	41,925	41,925	41,925	41,925	41,925	41,925	35,724
Exp.-Year	yes	yes	yes	yes	yes	yes	yes
Imp.-Year	yes	yes	yes	yes	yes	yes	yes
Exp.-Imp.	yes	yes	yes	yes	yes	yes	yes
Period	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14	2002-14
	3yrs	3yrs	3yrs	3yrs	3yrs	3yrs	3yrs

Note: LE stands for legally enforceable. Robust standard errors, clustered at the country-pair level, are in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Figure A2: Falsification test with random levels of depth (500 reps)

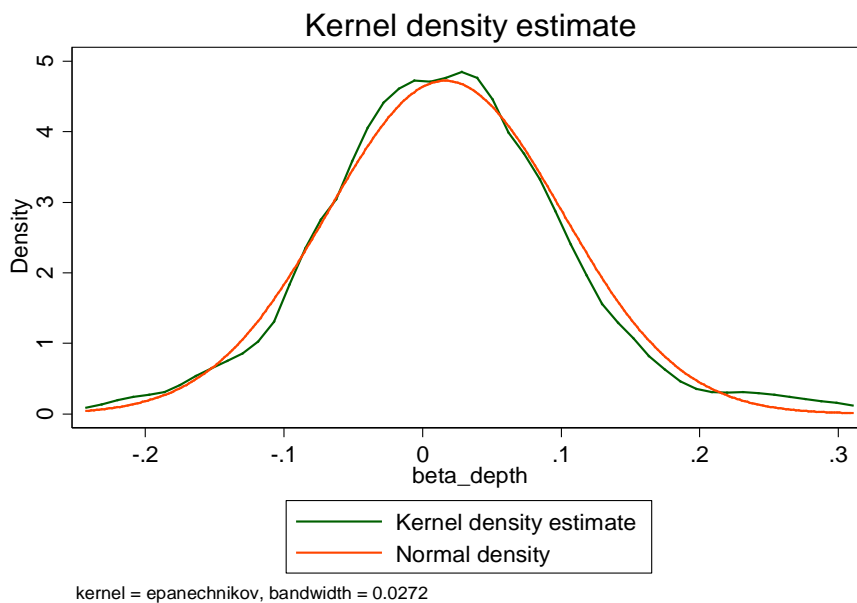


Table A4: Content of the EU Treaties, Korea-US FTA, and Peru-Chile FTA

Provision	EU	Korea - US	Peru - Chile
	Legally enforceable		
Tariffs on agricultural goods	Yes	Yes	Yes
Tariffs on industrial goods	Yes	Yes	Yes
Customs	Yes	Yes	Yes
Export taxes	Yes	Yes	Yes
GATS	Yes	Yes	Yes
TBT	Yes	Yes	Yes
TRIMS	Yes	Yes	Yes
Public procurement	Yes	Yes	No
SPS	Yes	No	Yes
STE	Yes	Yes	No
TRIPS	Yes	Yes	No
Anti-dumping	Yes	No	No
Countervailing measures	Yes	No	No
State aid	Yes	No	No
Investment	Yes	Yes	Yes
Movement of capital	Yes	Yes	Yes
Agriculture	Yes	Yes	Yes
IPR	Yes	Yes	No
Energy	Yes	No	No
Environmental laws	Yes	No	No
Labor market regulations	Yes	No	No
Anticorruption	Yes	No	No
Approximation of legislation	Yes	No	No
Audiovisual	Yes	No	No
Competition policy	Yes	No	No
Consumer protection	Yes	No	No
Cultural cooperation	Yes	No	No
Data protection	Yes	No	No
Economic policy dialogue	Yes	No	No
Education and training	Yes	No	No
Financial assistance	Yes	No	No
Health	No	Yes	No
Illegal immigration	Yes	No	No
Industrial cooperation	Yes	No	No
Mining	Yes	No	No
Nuclear safety	Yes	No	No
Regional cooperation	Yes	No	No
Research and technology	Yes	No	No
SME	Yes	No	No
Social matters	Yes	No	No
Statistics	Yes	No	No
Taxation	Yes	No	No
Terrorism	Yes	No	No
Visa and asylum	Yes	No	No

Table A5: OLS Regression: Trade Creation

VARIABLES	Depth OLS 2002-14			Depth OLS 2002-14 3yrs				Depth OLS 2002-14 w/Internal Flows				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Trade	Trade	Trade	Trade	Trade	Trade	Trade	Trade	Trade	Trade	Trade	Trade
Depth LE	0.273*** (0.036)				0.273*** (0.044)				0.291*** (0.036)			
Depth All		0.152*** (0.028)				0.148*** (0.036)				0.167*** (0.028)		
Depth Core LE			0.161*** (0.027)				0.169*** (0.034)				0.175*** (0.026)	
Depth Core All				0.114*** (0.023)				0.122*** (0.029)				0.126*** (0.023)
N	87,579	87,579	87,579	87,579	33,118	33,118	33,118	33,118	88,767	88,767	88,767	88,767
Exp.-Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Imp. -Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Exp.-Imp. FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Note: LE stands for legally enforceable. Robust standard errors, clustered at the country-pair level, are in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## **APPENDIX B - IMPACT OF INDIVIDUAL PROVISIONS ON TRADE**

Table B1 explores the impact of individual provisions on trade. We start by including one provisions at the time. Thus, results in column 1 should be interpreted as the total impact of an agreement that includes a specific provision rather than the impact of a specific provision on bilateral trade. In other words, agreements with a competition policy provision, for instance, a provision almost always included in deeper agreements, increase trade by around 10 percent.

When we attempt to identify the impact of individual provisions by including all core provisions at the same time, we find that results are not easily interpretable. For instance, the inclusion of a provision on export taxes does not appear to have a significant effect on trade flows. There may be several explanations for the lack of statistical significance. First, we may not be able to identify the impact of export taxes as there is limited variation in the data as most trade agreements include this provision. Second, the effect of the provision may be largely accounted for by other variables (i.e., multicollinearity). Or it could also be that export taxes do not have an impact on trade flows.

Finally, we test for presence of disproportionate returns, in terms of increases in trade flows, attributable to specific provisions. We find that the inclusion of specific provisions has no significant impact on trade flows once we control for the overall depth of agreements. This suggests that for aggregate flows what appears to matter is the overall depth of trade agreements rather than the individual provisions.<sup>34</sup> This result gives support to the use of synthetic indicators of the depth of trade agreements.

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<sup>34</sup> The only exception is the provision on GATS which is estimated to decrease trade flows for any given level of depth.

Table B1: Impact of individual provisions on trade.

	(1)	(2)	(3)	(4)
	One-by-one	All together	One-by-one with Depth	All together with Depth
Tariffs on industrial / agriculture goods	0.030 (0.028)	0.115* (0.063)	-0.034 (0.047)	0.112* (0.062)
Customs	0.043* (0.026)	0.021 (0.065)	0.003 (0.039)	0.033 (0.068)
Export taxes	0.060** (0.025)	-0.011 (0.051)	0.036 (0.039)	-0.019 (0.055)
SPS	0.029 (0.028)	0.063 (0.048)	-0.027 (0.038)	0.053 (0.052)
TBT	0.030 (0.027)	-0.100* (0.060)	-0.043 (0.044)	-0.098* (0.059)
STE	0.014 (0.032)	-0.092** (0.043)	-0.075 (0.046)	-0.098** (0.045)
Anti-dumping	0.025 (0.033)	-0.019 (0.100)	-0.042 (0.048)	-0.022 (0.100)
Countervailing measures	0.019 (0.033)	-0.151 (0.092)	-0.052 (0.046)	-0.152* (0.093)
State aid	0.073** (0.030)	0.143*** (0.039)	0.047 (0.041)	0.136*** (0.041)
Public procurement	0.052* (0.027)	-0.024 (0.059)	0.016 (0.039)	-0.030 (0.061)
TRIMS	0.055** (0.027)	0.228*** (0.052)	0.028 (0.049)	0.218*** (0.054)
GATS	0.013 (0.030)	-0.280*** (0.075)	-0.126** (0.059)	-0.280*** (0.075)
TRIPS	0.066*** (0.024)	0.074 (0.061)	0.066 (0.046)	0.077 (0.062)
Competition policy	0.110** (0.047)	0.052 (0.063)	0.068 (0.062)	0.038 (0.067)
IPR	0.045** (0.022)	0.034 (0.025)	0.018 (0.025)	0.030 (0.024)
Investment	0.036 (0.029)	-0.046 (0.053)	-0.017 (0.043)	-0.054 (0.056)
Movement of capital	0.064** (0.025)	0.151*** (0.052)	0.052 (0.040)	0.151*** (0.052)
Importer-Year FE	yes	yes	yes	yes
Exporter-Year FE	yes	yes	yes	yes
Country-Pair FE	yes	yes	yes	yes
Period	2002-2014	2002-2014	2002-2014	2002-2014

Note: All provisions are legally enforceable. Columns 1 and 3 (one-by-one) provide coefficients obtained from several regressions in which we include one provision variable at the time. Columns 2 and 4 (All together) present the results obtained estimating a model that includes all provisions together. Columns 3 and 4 include controls for the total number of legally provisions covered in the agreement. Robust standard errors, clustered at the country-pair level, are in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## APPENDIX C - A MOTIVATING EXAMPLE OF DEEP AGREEMENTS

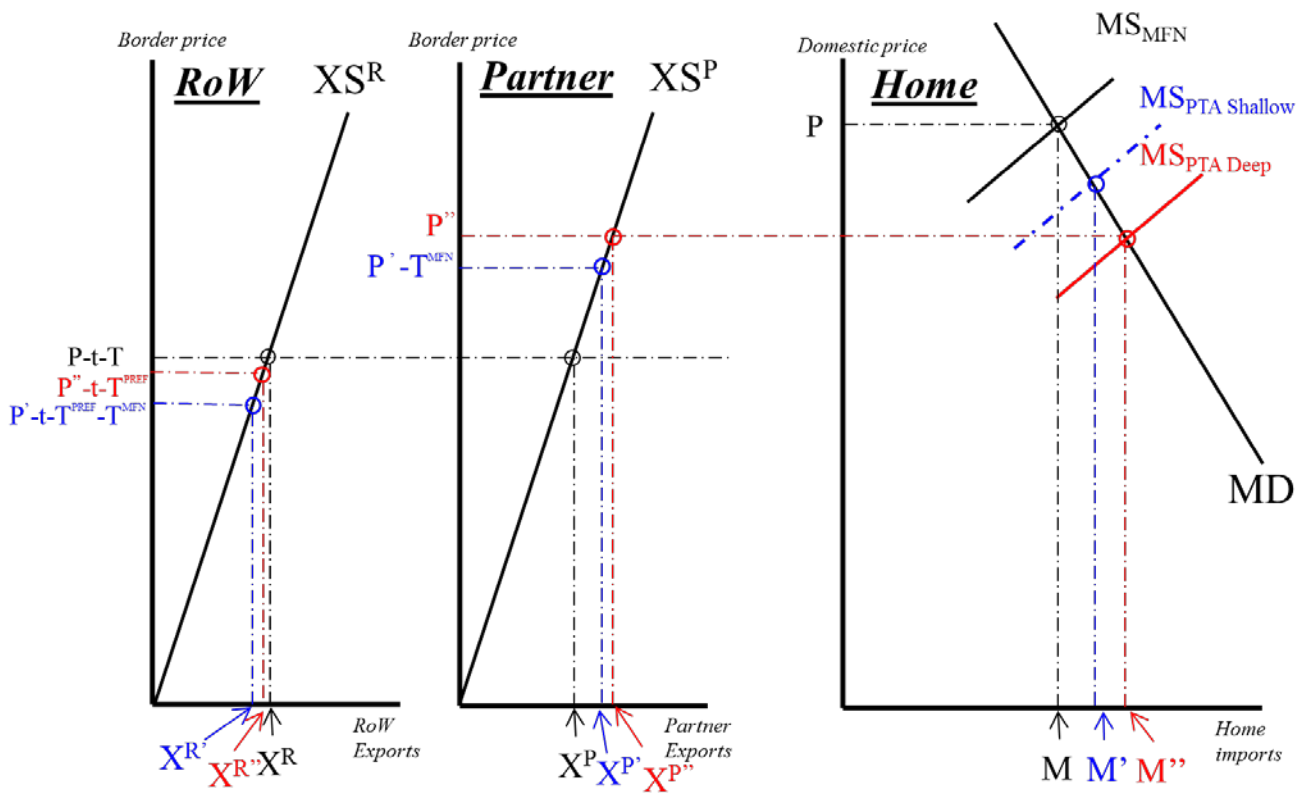
Trade creation and trade diversion in deep agreements can be illustrated using a standard diagram of the impact of PTAs.<sup>35</sup> The diagram assumes that there are three countries symmetric in size (Home, Partner and RoW), each country exports two goods and imports the other. The diagram displays the market for the good imported by Home, showing the export supply curves (XS) and the import demand curve MD (Figure B1). All countries have a specific import tariff,  $t$ , on all imports. In addition, and for simplicity, assume that the frictional barriers created by non-tariff measures have an ad valorem equivalent tariff  $T$ . This implies that the gap between Home's domestic price  $P$  and the price of the two exporting countries is precisely given by the sum of the tariff and the frictional barrier, so that the export price is  $P-t-T$ .

In this framework, the trade impact of a deep relative to a shallow PTA can be easily assessed. While a shallow agreement would only eliminate the tariff between members, a deep agreement eliminates both the tariff and the frictional barriers, resulting in larger trade creation. In the diagram, the shift to the right of the export supply curve is larger under a deep relative to a shallow agreement and Partner sees a sharper increase in its export price, leading to a larger increase in exports to Home. Now consider the impact of the agreement on non-members. The deep PTA still eliminates tariffs and other trade costs preferentially, but also reduces part of the frictional barriers on an MFN basis ( $T^{MFN}$ , Figure B1). The ultimate impact of a deep PTA on RoW's price and export is ambiguous. The figure also shows that the larger is the proportion of  $T^{MFN}$  in total trade costs, the greater is the positive impact of PTAs' on third countries' exports and the lower is the trade diverting effect of preferential tariffs.

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<sup>35</sup> See Chapter 5 in Baldwin and Wyplosz (2012).

Figure B1: Trade Creation and Trade Diversion



Note: Based on Baldwin (2014).