'New Age' Preferential Trade Agreements (PTAs): Implications for Value Added Trade

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Abstract

The global economy witnessed an exceptional rise in the number and scope of PTAs, over the past 25 years. Their scope has been deepening, with inclusion of provisions such as investment, competition, services, IPRs etc as well as unprecedented participation by emerging economies. These 'deeper' PTAs are more desirable for developing nations as they act as a commitment device for them to lock-in domestic reforms and streamline their regulations and institutions to global standards. Alongside this proliferation, is another phenomenon- the emergence of international production networks (IPNs) and global value chains (GVCs), as firms have fragmented their production process across geographies. With the rising significance of GVCs, 'deeper integration' assumes importance. PTAs can play a significant part in standardizing rules and regulations across members since addressing 'behind the border measures' is easier in such preferential arrangements than through multilateral negotiations. However, there is a scarcity of studies analyzing the impact of PTAs on trade flows, taking into account its content as per the provisions of the agreement. Further, most studies, assess the impact of PTAs on gross trade flows and not on intermediate trade flows and trade in value added, thus not measuring the extent of GVC and IPN participation of countries. We aim to address aforementioned gaps by empirically assessing the impact of 'deeper PTAs' on intermediate trade flows, trade in value added at aggregated as well as disaggregated level for the automotive and textiles sector, using an augmented gravity equation, based on an extensively constructed panel dataset of trade in value added and PTAs.

Keywords: Trade Agreements, Global Value Chains, International Production Networks, Fragmentation, Economic Integration

JEL Classification Codes: F02, F12, F13

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1. Introduction

The past 25 years observed an exponential rise in the quantity as well as scope of PTAs (Preferential Trade Agreements)[1] across the globe. As seen in Figure 1[2], from about 23 PTAs (physical number of PTAs in force, counting goods & services together) notified to the WTO in 1990, the number rose to 86 in 2000 and crossed 280[3] in 2016. With Japan and Mongolia, entering into a bilateral PTA in 2016, every WTO member now has a PTA in force.

Figure 1: PTAs signed per year, (1948-2016)
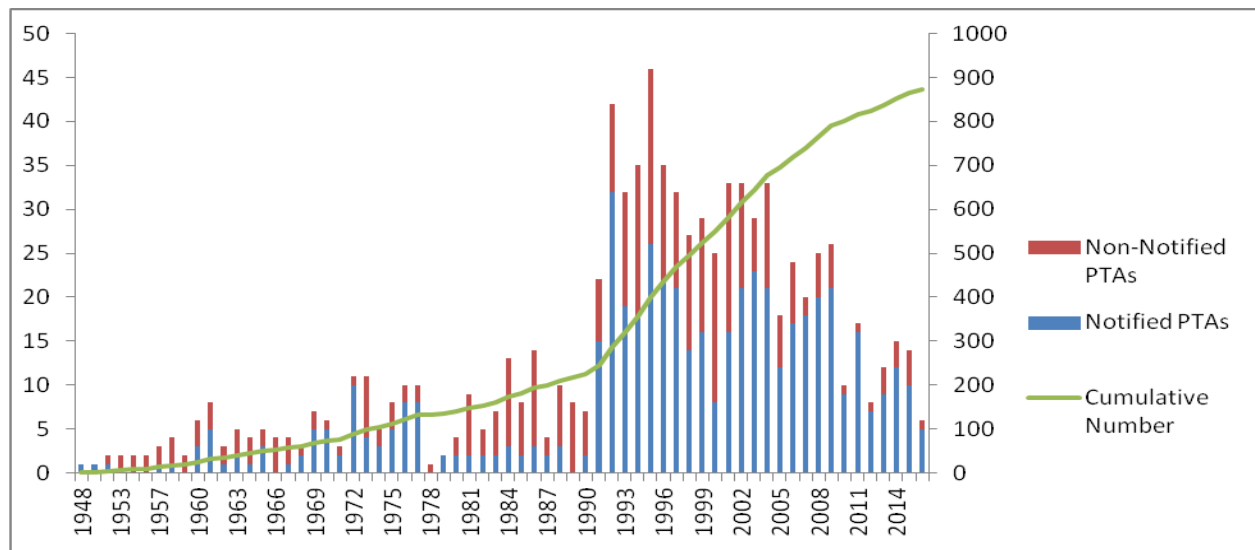
Source: Author's calculation based on augmented DESTA Dataset

This proliferation in the number of PTAs, also involved a surging diversity in their attributes, with a rising number of developing countries becoming a member of these preferential

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[1] A Preferential Trade Agreement (PTA) is the term used for the union of two or more countries, where the goods produced within this union are subject to lower tariffs than the goods produced outside it. PTAs are often complemented with agreements in areas other than trade in goods like competition policy, IPR issues, standards etc. Free Trade Agreement/ Area (FTA) is a type of PTA where the goods produced within this union face zero tariffs (Panagariya, 1999). In this paper we will use the term PTAs throughout, as it has a wider scope and covers FTAs, CUs etc.

[2] This chart is constructed The Design of Trade Agreements (DESTA) project, which commenced in 2009 within the NCCR Trade Regulation Network and has primarily been led by the World Trade Institute. The DESTA dataset draws from the list of agreements which have been notified to the WTO and the 'Hufbaeur List' at the World Trade Institute. Further, it includes agreements from various sources such as Organization of American States' Foreign Trade Information System, the Asian Regional Integration Centre and the World Bank. It, however, excludes interim agreements, trade and cooperation agreements and agreements with small island states. They further broadened its scope by adding on agreements from websites of trade, commerce, foreign and economic ministries of countries. We augment this dataset by including the interim agreements, accessions, services agreements, early notifications (signed) and other agreements not already existent in the DESTA dataset, but present in the list of agreements notified to the WTO, to come at a total of 871 agreements. The exact number of agreements and their status: in force, under negotiation, in initial stages of implementation or inactive, is difficult to ascertain individually as many of them are not notified to the WTO. Therefore, for the purpose of our study, for computational ease, we carry out the analysis for the 872 agreements in total.

[3] Source: Regional Trade Agreements Information System, WTO (RTA-IS, WTO)

arrangements. Although the objective of all PTAs primarily lies in pruning the barriers to trade between the members, over the years, the provisions under a PTA have expanded as well as deepened, with the inclusion of chapters and provisions pertaining to areas such as investment, sanitary and phytosanitary measures, competition, services, IPRs, government procurement, e-commerce and labor mobility, among other issues. These 'deeper' disciplines, transcend the scope of conventional PTAs which involved covering only merchandise trade and achieving low tariffs. These provisions aim to improve the harmonization and compatibility in rules and regulations across partners to smoothen movement of goods, services, capital etc. across borders. The slow pace of the various multilateral Rounds of negotiations, an inability to reach a consensus and the risk of free riding are seen as major reasons for this spurt in their quantity and content. NAFTA[4] came out to be the first PTA with 'deep' provisions pertaining to services and investment which went even beyond certain BITs in scope (Kotschwar, 2009). However, the effects of countries reeling under the pressure of protectionism are being seen in the form of relatively fewer trade agreements being signed for the years subsequent to the global economic crisis in 2008.

For areas like services, investment, competition etc. the success attained at the multilateral level has been little. The possibility of entering into PTAs for countries at asymmetric levels of development was considered an onerous task due to the lack of opportunities for mutual gains. Uruguay Round[5] was the first WTO Round to pay the requisite attention to the issues of services and investment at a multilateral level through TRIMS, GATS and TRIPS, however, quite limited in scope. Due to limited success at multilateral forums, and the scope of the negotiations turning out to be primitive in nature, the countries have resorted to BITs (Bilateral Investment Treaties), IIAs (International Investment Agreements) and investment provisions in RTAs. The cumulative number of IIAs stood at more than 3000 in 2014, with the highest spurt in IIAs and BITs signed observed in the 1990s, which coincided with the rise in number of PTAs in general[6] .This can in part be attributed to the change in the attitude of developing countries which were earlier skeptic

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[4] CUFTA (Canada-U. S Free Trade Agreement) signed between Canada and U.S in 1989, was expanded to include Mexico, to form NAFTA (North America Free Trade Agreement) that came into force in 1995.

[5] Uruguay Round (1986-94) was the 8th WTO round held in Punta del Este, Uruguay with 123 nations participating.

[6] UNCTAD, IIA Database.

towards liberalization with dominant States and protectionist regimes. Also, the increasingly significant role played by investment flows and services trade during the 1990s, with rising globalization, motivated such negotiations. These 'deeper' PTAs are more desirable for developing nations as they act as a commitment device for them to lock-in domestic reforms and streamline their regulations and institutions to global standards. The developing countries look out for 'deeper' provisions in a PTA rather than the traditional benefits of lower tariffs since low tariff rates and access to developed markets are usually already available to them under non-reciprocal benefits[7]. A North-South PTA, yields accountability, enforceability, credibility, system and gradualism to the liberalization process of developing nations and ameliorates the costs associated with the reformative measures.

Another phenomenon that has been gaining dominance in the world economy is the widespread array of Global Value Chains (GVCs) and International Production Networks(IPNs) encapsulating countries at various levels of development. Beginning from sectors like apparel and commodities, value chains have now spread over diverse sectors like electronics, pharmaceuticals and even services such as health, tourism etc. Firms have fragmented their production process across geographies in order to exploit the comparative advantage of different locations where countries specialize in different stages of production. Such fragmentation has been made possible by remarkable advancements in production technology, communication, transportation and unilateral liberalization undertaken by countries. This fragmentation of production process dates back to 1970s when MNCs based out of Japan and United States began to relocate their production activities in East Asia and Mexico respectively to exploit their low-cost advantage. Feenstra (1998) referred to this increased outsourcing of production process (domestically/abroad) as a representation of 'breakdown of vertically-integrated mode of production'- the so called 'Fordist' production. With the increased integration of the world economy including technological convergence and spread of the MNCs across global locations, minute variations in costs could lead the comparative advantage to switch from one nation to another. Baldwin (2006) defined this process of globalization as to be comprised of two great

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[7]The Enabling Cause provides a special, favorable and differential status to developing countries, and was adopted in 1979, under GATT. It forms the legal ground for GSP (Generalized System of Preferences) under which, developing country goods are given a non-reciprocal preferential tariff treatment by developed nations. Also, GSTP (Generalized System of Trade Preferences) falls under the realm of Enabling Cause and allows developing countries to provide concessional tariff rates to each other.

'unbundlings'.[8] Bhagwati & Dehejia (1998) referred to this volatility in comparative advantage due to fragmentation of production as 'kaleidoscopic comparative advantage'. Krugman (1995) identified the breaking up of a production process into several stages carried out at different locations to add some value at every stage as a 'new aspect of modern world trade' and referred to it as 'slicing up of the value chain'. GVCs & IPNs capacitate nations in specializing in 'tasks' and hence help augment their efficiency, wages and income. They have had fundamental impacts on economic and political dynamics of the global economy by providing opportunities to both developed and developing countries to flourish, leading to an increased trade in investment, technology, services (also infrastructure services for production across borders) and intangible knowledge apart from the traditional merchandise trade.

Against this backdrop of rising GVCs and IPNs, 'deeper integration' assumes importance. Over the years, the role of traditional protectionist trade barriers like tariffs has been on a downfall[9], while the more unpredictable issues related to investment, laws, standards, movement of capital have assumed greater importance. Harmonization of domestic and 'behind-the-border' policies, provides a congenial environment for cross-border production and business operations (Lawrence, 1996). In this context, PTAs can play a critical role in standardizing rules and regulations across member nations as it is easier to address complex and non-transparent barriers and regulatory measures, in such preferential arrangements than through multilateral negotiations.

The paper is organized in the following manner. Section 2 discusses the literature that aims to study the impact of PTAs on trade flows, depending upon the different types of PTAs and their underlying provisions rather than restricting the cases to the dichotomy of presence or absence of a PTA between nations. Section 3 describes the data sources and variables used to construct a new dataset as well as the methodology to measure the 'depth' of agreements. It further describes

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[8] The first unbundling took place due to the fall in transport costs etc., thus promoting trade flows between nations since it curtailed the requirement of goods being produced near consumers. The second unbundling, according to him, was facilitated by improvements in ICT, hence rendering the need of the different stages of production process to be located in proximity of each other, obsolete

[9] For the developed countries, the Tariff Trade Restrictiveness Index (TTRI), which is a measure of 'average level of restrictions on imports' was approximately 1.5 per cent. Developing countries had a higher TTRI, with South Asia and Sub-Saharan Africa having a TTRI in excess of 8 per cent. (Key Statistics and Trends in Trade Policy 2016, UNCTAD)

the use of an augmented gravity equation to study the impact of a PTA and its depth on value added trade for total goods and services. The analysis is also done at a disaggregated level for selected sectors, namely, textiles and automotives, to assess how industry-specific characteristics may shape the impact of a deeper PTA on trade flows. Section 4 presents the results along with drawing insights, while section 5 concludes the study.

2. Literature Review

The impact of preferential trade agreements (PTAs) in enhancement or reduction of the trade flows and welfare of partner and non-partner countries has been a contentious and inconclusive topic amongst economists. Their views regarding the theoretical considerations and implications of such preferential arrangements have been diverse, subjected to multiple lines of debate and have also evolved over time. This contest dates back to the pioneer work of Viner (1950), who rejected the widely held convention of PTAs necessarily enhancing the welfare as they brought about certain intensity of liberalization.

Literature on the impact of PTAs on trade flows between countries is quite extensive.[10] In spite of significant efforts devoted to study the impact of PTAs on trade, investment, employment etc., little has been achieved in accounting for the differences across PTAs. Although the primary task of the PTAs is to facilitate prevalence of low tariffs and high economic integration amongst its members, they significantly differ in their types and attributes. Moreover, the 'deeper' trade agreements are viewed as institutional arrangements to coordinate economic policies as well as domestic regulations across the member states. Most of these studies, treat the presence or absence of PTAs between member states as a- binary variable, thus 'black-boxing' (Kim, 2010) the PTAs, not focusing upon the nature of a PTA. There is a dearth of studies that focus on the impact of the relationship between depth and breadth of PTAs as captured by the disciplines and provisions in a PTA on the trade flows between members and non-members. Further, most of the earlier studies, study the impact of a PTA on gross trade flows, and hence do not, capture the extent of participation of countries in GVCs & IPNs. This paper attempts to address the aforementioned gaps in the existing literature by assessing the implications of the evolving

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[10] See Tinbergen (1962), Aitken (1973), Trefler(1993), Frankel (1997), Klausing(2001), Hertel(2001), Zarzoso (2003), Baeir and Bergstrand (2007) etc.
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nature of these arrangements for value added trade and participation in GVCs and for trade prospects in specific sectors. Few studies, however, attempted, to incorporate these variations across PTAs in their studies, to some extent.

Magee (2008) used a Simultaneous Equations Model to show that RTA dummy variable accounts for more than the signing of a PTA between members and signifies the trade effects due to historical and political relations of members. This was in tandem with Krugman's(1991) 'natural trading partner' hypothesis .[11]Magee's work is one of the few works in literature which tried to study the differential trade impact depending upon the type of trade agreement- CU , FTA or a PTA. Hicks and Kim (2012) went ahead to examine their hypothesis that whether stronger institutional commitments lead to greater trade flows between the signatories of a PTA. The results showed that high quality RTAs were more effective in increasing trade and the binary treatment usually overestimated the effect of RTAs at low levels of commitments.

Smith (2000) aimed to differentiate the regional trade pacts according to the difference in their governance structures. RTAs differ according to their size, level of economic development of members, scope and depth, compliance as well as durability. Smith asserted that higher levels of legalism promoted compliance on the part of member countries as a higher cost of opportunism is faced by them thereafter. High levels of legalism were generally witnessed in cases where proposed levels of integration were high.

Orefice and Rocha (2014), is a seminal study towards studying the impact of a deeper PTA on production network trade as well as the opposite direction of causality. This study constructed an index for PTA depth using five PTA provisions namely- TRIPS, STE, Competition, IPR and Movement of Capital and COMTRADE data on imports in parts and components based on Broad Economic Categories, for 200 countries and 66 trade agreements to study this impact. Their findings suggested that a deep trade agreement causes the production network trade to increase by 12 per cent on an average.

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[11] This seemed to be in line with the 'natural trade partner' hypothesis that the countries that are geographically proximate, and are already major trade partner, when enter into PTAs would lead to less 'trade diversion' and an increase in welfare relative to geographically distant countries and hence are 'natural trade partners' and thus should be preferred for signing PTAs (Krugman,1991; Wonnacott and Lutz, 1989). The literature, however, stands divided on the holding true of this hypothesis. For instance, Krishna (2003) did not find any support to this hypothesis for U.S. data.

Shingal (2014) attempted to get over the dichotomy of trade agreements for the case of PTAs in services. He looked at the differences in the provisions of these agreements and how their composition affects trade in services using the DESTA dataset and data from OECD's Bilateral Trade in Services Database. It was observed that the magnitude of effect on trade flows was reduced, when the heterogeneity of the agreements was taken into account.

3. Data & Methodology

The intricate network of GVCs and IPNs has brought about complexity in the trade system rendering measures like gross trade flows insufficient to capture the true value added contributed by each economy integrated into the value chain. With reliance on the gross trade flows of trade, the intermediate inputs crossing the border multiple times for getting processed further end up being counted more than once and hence value-added content of exports from an economy is overstated. The exports are usually dependent on intermediate inputs which are more often than not imported, and the value added is ideally accrued to foreign countries. The gross trade flows lead to a flawed reasoning of linking them with national material prosperity indicators, as this would only be true for fairly closed economies which are rare in today's globalized world. These statistics are hence losing their relevance to capture the integration of economic activities across geographies entrenched in production networks. The world has recently been dominated by trade in intermediate inputs accounting for approximately two thirds of the world trade (Johnson, Noguera,2012). The traditional trade statistics are hence, unable to capture the interconnectedness and interdependence between the nations in world trade. Also, they are unable to segregate the sectoral contribution to the total value added of exports and hence do not track the significance of different sectors that can help take appropriate policy measures.

The novelty of our work lies in constructing an intensive database for carrying out our study, using two existent databases. TiVA Database is an OECD-WTO initiative consisting of several trade indicators derived from OECD's inter-country input-output (ICIO) database. This ICIO database for countries has been created from several national and international sources of data, subject to constraints based on official National Accounts (SNA93) by economic activity. These sources include - National Supply & Use tables (SUTs), national & harmonized input-output tables, STAN Bilateral trade in goods by industry and end-use category (BTDIxE) and bilateral trade in services. The trade indicators analyzed in this study include - *gross exports of final*

products, gross exports of intermediate products and domestic value-added content of exports (in US dollars, thousands)[12]. The years taken into account for carrying out the empirical study are 2000, 2005, 2006, 2007, 2008, 2009, 2010 & 2011.

For our analysis regarding the depth of PTAs, and their impact on trade flows, we use the dataset created by WTO for the World Trade Report 2011 coding the PTAs notified to the WTO, signed during the time period 1958-2011[13]. This dataset codes these 101 trade agreements on 52 trade provisions classified as WTO+ (14 provisions) and WTO-X (38 provisions)[14]. For each of 101 trade agreements, this dataset assigns a value of 1 or 0 to each of the 52 provisions, depending upon whether the provision is present or not in the agreement's text. We take into consideration only those 56 PTAs from this dataset, that have been signed amongst the 61 countries present in the TiVA database. These countries represent 90.5 per cent of the world trade (as in 2015) in goods (90 per cent of total exports and 91 per cent of total imports) and 91 per cent of the world trade in services (93 per cent of total services exports and 89 per cent of total services imports). Depending upon the frequency of occurrence of a particular provision in this dataset and their likelihood/potential to impact the trade flows between countries, we zeroed out on 31 provisions to carry forward our analysis. The number of PTAs incorporating provisions that transcend the regular tariff reduction have been on a rise over time. Provisions pertaining to Non-Tariff Barriers and facilitation of trade like competition, IPR and movement of capital are contained in more than 50 per cent of these PTAs. Provisions related to illegal immigration, taxation etc. on the other hand have the lowest frequency of occurrence. The dataset codes the provisions of these PTAs based on their presence/ absence in the agreement text at the time they were signed. Since our analysis spans the time period from 2000-2011, we updated the dataset for the evolution of agreements over time. Over the time, the composition of many of the agreements

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[12] By OECD definition Domestic value added embodied in exports by industry i in country c covers value added generated anywhere in the domestic economy and can be further decomposed into three components: Direct domestic value added, Indirect domestic value added and Re-imports.

[13] We use the 2011 version of this dataset coded by WTO which coded only 101 agreements. We replicated the coding scheme for 32 PTAs by going through their texts as these PTAs were not a part of the earlier version of WTO dataset. WTO has come up with the revised edition of this dataset in 2017, coding all 282 PTAs notified to them and it conforms with our coding. We aim to use this newer version in our future work.

[14] The provisions that fall under the current mandate of WTO and are already subject to some form of WTO commitment are categorized as WTO+ provisions. The obligations which fall outside the current WTO mandate, have been termed as WTO-X provisions.

underwent changes involving signing protocols regarding 'newer' measures and some measures coming into effect a few years after the agreement was signed. Further, we make additions to this existing dataset by replicating a similar coding scheme for 32 PTAs signed during 1958-2011, between the 61 countries we are taking into consideration. These PTAs are the ones which have been notified to the WTO, but do not make an appearance in the WTO 2011 dataset. We went through the texts of these agreements, often running into hundreds of pages and coded the 31 provisions of interest as 1 or 0 depending upon their being mentioned or not mentioned in the PTA text, respectively. Thus, in total, we take into consideration 87 PTAs for carrying out our analysis for this study.

The correlation coefficient between the total trade in value added and the average depth of PTAs signed was significantly high and positive (0.89) for the years under study - 1995, 2000, 2005, 2006, 2007, 2008, 2009, 2010 and 2011, as seen in Figure 2.

Figure 2 : Correlation between Trade in Value Added and Average Depth of PTAs (1995, 2000, 2005, 2006, 2007, 2008, 2009, 2010 and 2011)
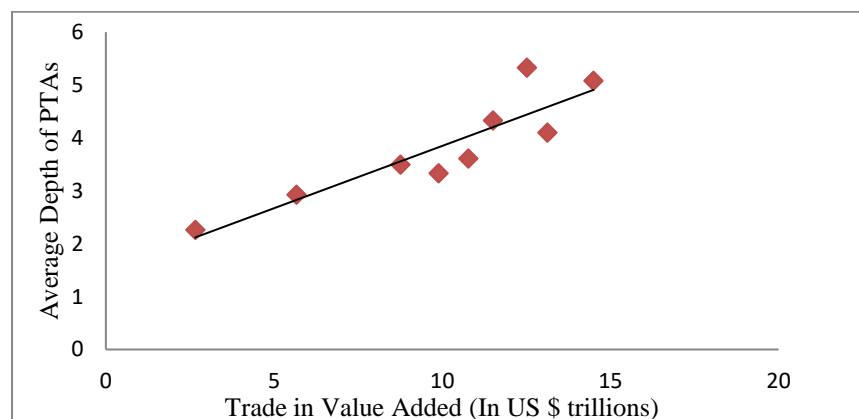
Source : Author's construction based on DESTA dataset and OECD TiVA Dataset

Our final panel data set was constructed using the two databases described earlier. For carrying out a gravity analysis, we deal with data at country-pair (dyad) levels. With the 61 countries under study, we created 3660 possible dyads, for eight years (2000, 2005, 2006, 2007, 2008, 2009, 2010 & 2011), giving us a sum total of 29280 observations. The next step involved extracting pair-wise trade data from the TiVA database, for exports of final goods and services, exports of intermediate goods and services and domestic value-added content of gross exports for all eight years, at country-pair level. Further, depending upon the presence/ absence of a PTA

between a particular country pair (from the list of our 87 PTAs under consideration), we assigned a value of 1 or 0 to the PTA dummy in our dataset, for all eight years. The 31 provisions of WTO, zeroed upon earlier, were also assigned values depending upon which particular PTA a country pair is a member of. All these provisions assumed a value of zero for the country pair consisting of nations which haven't entered into a trade agreement amongst themselves. Year wise updates on all 31 provisions were made for all country-pairs, conditional upon the year of entering into a PTA as well as years when major provisions were adopted by certain trade agreements (hence, for corresponding country pairs). In the cases, where a particular country-pair was a member of more than one PTA, the 0 or 1 value for a particular PTA provision was decided after looking at the coding scheme of all the PTAs the pair is a member of. If the provision was coded 1 for at least one of the PTAs, the final coding of that particular provision was 1 since it's assumed that a country-pair can use the provisions of either of the PTAs for exporting to/importing from a specific partner with which it has more than one PTA.

The literature on the impact of trade liberalization on trade flows using the gravity equation has been criticized on the front of treating the presence/absence of a PTA as exogenous. However, in the case where the entering into PTAs is endogenous[15], using a regular OLS for estimation (without any fixed effects) of an equation, renders the estimates of these studies suffering from endogeneity bias, inconsistency and hence over or under-estimation. Baier and Bergstrand (2004) came up with a theoretical and empirical model aimed at exploring the economic determinants of a PTA. They provided evidence that a country pair with larger and more similar GDPs and which has more geographically proximate countries, is more likely to have a PTA signed between the two countries. However, this list of factors determining the probability of signing a PTA coincides with the list of factors that promote large trade flows. Therefore, Baier & Bergstrand(2007) concluded that as far as observable economic aspects are concerned, the countries have 'chosen well' into PTAs, as the country pairs having an agreement , have economic features that are associated with large trade flows too.

The other source of endogeneity issue lies in the problem of simultaneity bias. With the explanatory variables (R.H.S Variables) like GDP, distance etc. held constant, a country-pair that has trade levels exceeding their 'natural' level that the gravity framework predicts, might face

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[15] Endogeneity is said to occur in a multiple regression model if some of the explanatory variables are correlated with the error term . In this case we specifically deal with the PTA dummy being correlated with the error term.

pressure to form a PTA, to prevent possible trade diversion, causing a positive simultaneity bias in the estimate of PTA coefficient.

The following augmented gravity equation with three-way fixed effects is hence estimated to study the impact of a PTA on trade flows:

$$\ln(exports)_{ijt} = \alpha + \varphi_{ij} + \varphi_{it} + \varphi_{jt} + \beta.PTA_{ijt} + \varepsilon_{ijt}$$

The subscripts i, j and t stand for exporter-country, importer-country and time period respectively. The dependent variable here is log of bilateral exports from country i to j at time t. We use the above specification for estimating the impact of PTA_{ijt} on bilateral exports of final goods and services, intermediate goods and services and domestic value-added content of gross exports. The variable PTA_{ijt} takes the value of zero for country pairs which haven't entered into a trade agreement ever. For the country-pairs, which have implemented a trade agreement over 1958-2011, the variable PTA_{ijt} takes a value zero for the years preceding the signing of the PTA and a value of 1 for the year of entering into an agreement and the years post that. The issues of endogeneity and simultaneity are controlled for using three types of fixed effects in our specification : country pair fixed effects (captured by φ_{ij}), exporter-year fixed effects (captured by φ_{it}) and importer-year fixed effects (captured by φ_{jt}). The country pair fixed effects are included to capture features specific for a particular dyad/pair of countries such as geographical distance between them, common language, common border etc. The exporter-year and importer-year fixed effects, on the other hand, capture the importer and exporter characteristics that vary over time such as GDP, population and multilateral trade resistance.

Apart from studying the impact of the existence of a PTA on different types of trade flows, the main objective of this study lies in analyzing the impact of a 'deeper' trade agreement on trade flows. We therefore construct two indices in order to capture how 'deep' a trade agreement is, to estimate the following equation, where $PTAdepth_{ijt}$ is indicative of these indices:

$$\ln(exports)_{ijt} = \alpha + \varphi_{ij} + \varphi_{it} + \varphi_{jt} + \beta.PTAdepth_{ijt} + \varepsilon_{ijt}$$

The first index is constructed by summing up the number of provisions (both WTO+ & WTO-X) present in a particular agreement. This index hence ranges from 0 to 31 for different country-

pairs.[16] It is the simplest of the indices as it assumes that the greater the number of provisions, the 'deeper' the agreement. This index however suffers from the shortcoming of assuming that each one of the 31 provisions under consideration, contributes equally to the volume of trade flows between the member countries and hence assigning equal weight to each of them. This is however, a faulty assumption since some of these provisions have a higher bearing on trade flows than others. Provisions like Investment, Competition Policy and Movement of Capital are of higher relevance as they provide the foreign firms with a level playing field as well as opportunities to fragment production based on cost-advantage. Also, the provisions pertaining to Intellectual Property Rights and labour issues are meant to bring about a harmonization in standards and regulations across members, thus creating an environment which is congenial to function in. On the other hand, provisions like cultural cooperation and energy, although important, do not impact trade flows directly.

To deal with this drawback, we use Principal Component Analysis (PCA) for creation of a new index. Principal Component Analysis carries out orthogonal transformation in order to convert possibly correlated variables into a number of 'principal components', which are uncorrelated to each other. A principal component is defined as a linear combination of observed variables assigned optimal weights. The first principal component extracted through PCA explains the maximal variation in the observed variables. Each new component explains smaller and smaller variance, progressively, under the constraint of orthogonality with other principal components. PCA is used to obtain factor loadings of all 31 provisions, which are then used as weights to construct an index for each dyad at each time period, measuring the 'depth' of the PTA signed between them.

4. Results

Table 1 shows the results of OLS estimation of the gravity equation specifications discussed above, for total final goods and services. Column (1) and (2) show the result of impact of existence of a PTA between two countries on trade in final goods and services and on trade in intermediate goods and services. Trade in intermediate goods and services is often used as a proxy for measuring the extent of value chain/production network trade.

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[16] 0 for the dyads which have never signed a PTA or the pre-PTA years for some country-pairs.

Table 1: Effect of Depth of PTA on trade in final and intermediate goods and services: OLS Estimation (Total goods and services)

Dependent Variable (ln)	Trade in final goods & services (Total)	Trade in intermediate goods & services (Total)	Trade in final goods & services (Total)	Trade in intermediate goods & services (Total)	Trade in final goods & services (Total)	Trade in intermediate goods & services (Total)
	(1)	(2)	(3)	(4)	(5)	(6)
PTA_{ijt}	0.152***	0.164***				
	(0.021)	(0.027)				
Number of Provisions			0.007***	0.008***		
			(0.001)	(0.002)		
$lnPTAdepth_{ijt}$					0.255***	0.289***
					(0.043)	(0.048)
Country-pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29130	29090	29130	29090	29130	29090
R-squared	0.972	0.959	0.972	0.959	0.972	0.959

i) Robust standard errors in parenthesis ii) $p< 0.05*$, $p<0.01**$, $p < 0.001***$

The subsequent columns show the results of 'depth' of a PTA on trade in final goods and services. The average impact of a PTA on trade in final goods and services (gross) is 16.4 per cent ($e^{0.152}-1$). The average impact on trade in intermediate goods and services, on the other hand, is 17.8 per cent ($e^{0.164}-1$). The subsequent columns show the results of deeper PTAs on trade in final and intermediate goods and services (total). In particular, columns (3) and (4) use the number of provisions in the PTA text as an index of PTA depth and column (5) and (6) use the log of index constructed using PCA determined weights to account for depth of a PTA. Having an additional provision in the PTA text increases the trade in final goods and services by 0.7 per cent and the trade in intermediate goods and services by 0.8 per cent. Further, columns (5) and (6) show that a 1 per cent increase in the depth of an agreement causes the trade in final goods and services to rise by 25.5 per cent. The increase in intermediate goods and services associated with a 1 per cent change in PTA depth is 28.9 per cent.

We notice, that the impact of a 'deeper' agreement is more on production network trade (proxied by trade in intermediate goods and services) as compared to trade in final goods and services. This result is quite intuitive since the presence of 'deeper'/'newer' provisions are more important than others, since they facilitate fragmentation of production by helping in harmonization of the

'behind-the-border' measures and creating an environment conducive for cross border production. These 'deeper' disciplines, traverse well beyond the traditional PTAs that focus only on lowering tariffs. We move forward to analyze the impact of PTAs on trade flows, at disaggregated level, for two different sectors namely- textiles and automotives, to assess how industry-specific characteristics may shape the impact of a deeper PTA.

Table 2: Effect of Depth of PTA on trade in final and intermediate goods and services : OLS Estimation (Textiles)

Dependent Variable (ln)	Trade in final goods & services (Textiles)	Trade in intermediate goods & services (Textiles)	Trade in final goods & services (Textiles)	Trade in intermediate goods & services (Textiles)	Trade in final goods & services (Textiles)	Trade in intermediate goods & services (Textiles)
	(1)	(2)	(3)	(4)	(5)	(6)
PTA_{ijt}	0.050	0.072				
	(0.045)	(0.048)				
Number of Provisions			0.001	0.002		
			(0.001)	(0.002)		
$lnPTAdepth_{ijt}$					0.065	0.083
					(0.059)	(0.068)
Country-pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	27416	26288	27416	26288	27416	26288
R-squared	0.946	0.954	0.946	0.954	0.946	0.954

i)Robust standard errors in parenthesis   ii) $p < 0.05^*$, $p<0.01^{**}$, $p < 0.001^{***}$

Table 2 shows that the impact of a PTA/PTA depth on trade flows for textiles sector is insignificant for both final goods as well as intermediate goods. For a sector like textiles which is highly homogenized, intra-industry trade is limited. Also, with limited innovation involved, the need to have a harmonized system of rules across nations like IPRs is not a highly important need.

For the automotive sector, Table 3 shows that the effect of having a PTA on trade in final goods is 26.3 per cent ($e^{0.234}$-1) whereas that on intermediate goods is 31.3 per cent ($e^{0.273}$-1). The columns that follow depict that the rise in the number of provisions by 1 raises the trade in final goods in this sector by 0.8 per cent and the trade in intermediate goods rises by 1 per cent.

Table 3: Effect of Depth of PTA on trade flows: OLS Estimation (For Automotives)

Dependent Variable (ln)	Trade in final goods & services (Automotives)	Trade in intermediate goods & services (Automotives)	Trade in final goods & services (Automotives)	Trade in intermediate goods & services (Automotives)	Trade in final goods & services (Automotives)	Trade in intermediate goods & services (Automotives)
	(1)	(2)	(3)	(4)	(5)	(6)
PTA_{ijt}	0.234**	0.273***				
	(0.059)	(0.066)				
Number of Provisions			0.008**	0.010***		
			(0.003)	(0.003)		
$lnPTAdepth_{ijt}$					0.371***	0.442***
					(0.079)	(0.096)
Country-pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24182	23529	24182	23529	24182	23529
R-squared	0.926	0.931	0.926	0.931	0.926	0.931

i) Robust standard errors in parenthesis ii) $p < 0.05$*, $p<0.01$**, $p < 0.001$***

The impact of a 1 per cent rise in depth of the PTA on trade in final goods is an increase of 37 per cent, whilst the number is as high as 44 per cent for intermediate goods. Even for the case of automotive sector, the significance of PTA depth is higher for increased trade flows rather than the presence/absence of a PTA. The higher rise in trade in intermediate goods (auto parts and components) arising from a deeper PTA is in tandem with the trends observed for goods and services (gross).

The automotive industry is characterized by production networks which are global in nature and hosts a multitude of firms varying in terms of their geographic location, size and specialization, ranging from engaging in R&D to producing the simplest of parts and components to designing the most complex systems that go into the assembly of a vehicle. The vertical integration which characterized the automotive industry years ago has given way to a production network spread across regions and the input suppliers specializing and segregated into tiers. The automotive industry is one of the industries that has been experiencing wide scale global mergers and the production facilities being relocated across geographies (especially developing ones). The GVC pertaining to automotives is a long, complex and evolved one, having strong forward as well as backward linkages and involving high capital intensity as well as technological components. These linkages particular to this industry makes it a significant sector to stimulate growth,

innovation and employment in nations through a large-scale multiplier effect. The sector witnesses a need for wide scale product differentiation (and hence higher intra-industry trade) as countries differ in their levels of income and purchasing power and the automotive firms aim to capture different markets by differentiating their products in terms of their characteristics and features. Further, product differentiation arises since developed and developing nations differ in regulatory requirements related to emissions, safety measures etc. This sector has also been known for investments being subjected to local content requirements (sourcing a proportion of inputs from local suppliers instead of importing), which is often politically motivated to protect local suppliers and spur domestic employment although at the expense of efficiency. Therefore, commitments pertaining to 'newer' areas such as 'Investment' and 'TRIMS' which remove such restrictions are particularly important for the automotive sector. Further, since large scale investments which are long-term in nature, go into the relocation of plants for automotives, a congenial environment and supportive government policies also play a major role. The role of issues like IPR and their protection is quite heterogeneous across industries depending upon the knowledge and technological intensity of the products. With time, more technological components have been featuring in the automotive GVC, thus making the protection of intellectual property a desired feature for a destination for relocation of production. One can also observe that developing nations have been trying hard to enable an environment congenial for such relocations and to be a part of GVCs and IPNs through liberalization initiatives with regard to investment, IPR, R&D, etc., often through PTA provisions. The 'deeper' PTAs aid the countries in removal of tariff protections and in addressing issues like competition, local content requirement, etc. which are important for this sector. The PTAs are also being used as a tool to consolidate the IPR regime because of the exchange of tacit forms of knowledge across borders as well as to attain standards in managerial and technical capabilities. Therefore, 'deep' integration matters and caters much more to a sector like automotives.

We further carry out this analysis for total goods and services as well as at the disaggregated level for trade in value added (based on domestic value-added content measure from TiVA). The overall results are in sync with the previous results with the depth of agreement mattering more than the presence/absence of a PTA for both total goods and services as well as the automotive

sector. The impact of PTA depth is highest for the automotives sector, while it is insignificant for the textiles sector. [17]

These specifications have been estimated considering only non-zero trade flows. However, this method might lead to missing out on significant trends/information associated with non-trading countries. Thus, following Chen & Mattoo (2008), we further support this analysis by using a modified 2-stage Heckman model. The first stage involves estimating the country's decision to export ($\Pr (X_{ij} > 0)$) through a linear probability model since we have fixed effects in our model which might cause incidental parameter problem in case we use probit model. The exclusion variable we use is a dummy variable that will take the value of 1 if a particular country exported to a particular destination 5 years ago and 0 if not. In the case, when it is costly to enter particular market, existence of a market five years ago impacts the export decision but not the magnitude of trade. The results observed after taking into account the sample selection problem and Heckman correction, are in tandem with the OLS results discussed earlier.[18]

5. Conclusion

This paper aims to find the relationship between the existence of 'deep' PTAs between trading partners and the value-added trade flows. We endeavor to find how the 'depth' of PTAs as defined by their provisions and content impact the propagation of GVCs and IPNs. According to our results, the existence of a PTA increases the trade in final goods and intermediate goods by 16.2 per cent and 17.3 per cent respectively. Further, the impact of depth of the PTA based on the weighted index constructed using their content increases the trade in final goods by 25 per cent and trade in intermediate goods by 29 per cent. Also, our results suggest that 'deep' agreements affect those sectors more which have a higher level of intra-industry trade, product differentiation, complex and long value chains and require a greater degree of synchronization in rules and regulations across borders. The impact of a deeper agreement on trade in intermediate goods for automotive sector was 44 per cent while it was insignificant for the case of textiles sector.

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[17] Please refer to Table A3, A4 in the Appendix.
[18] Results available under request.

These results also suggest that there are reasons beyond pruning the tariff leading to an increase in the quantity as well as provisions under the ambit of PTAs. The increased trade in intermediate inputs, required for the globalized production needs harmonized rules across nations. Since cross-border production is not limited to trade in goods only but involves movement of people, capital, technology etc., regulations related to investment, IPR, competition conforming to global standards provide a congenial climate for firms to produce across borders. Also, these PTAs act as a commitment device to signal a safe and credible environment for firms to segregate their value chains across nations.

Further, these results equip us to provide some policy prescriptions about the greater role of non-tariff measures in the contemporary world with global production sharing. Symmetric rules and regulations across nations, should be aimed through 'deeper' PTAs as the 'at the border' measures have already been brought to a low through multilateral efforts and unilateral liberalization decisions.

We aim to carry forward this stream of research by studying how the impact of deeper trade agreements on total trade and trade within particular sectors differs across major trade blocs, countries with varying levels of development (North-North, North-South, South-South) and across regions (Asia, East Asia, South East Asia and Europe). We expect to find interesting patterns depending upon sectoral and regional blocs, for instance, East Asia and South East Asia have developed intricate production networks for electronics and automotives.

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Appendix A

Table A1: List of provisions taken into consideration for the study:

WTO+ Areas	WTO-X Areas

PTA Industrial Goods	Competition Policy	SMEs
PTA Agricultural Goods	Environmental Laws	Social Matters
Customs Administration	IPR	Visa and Asylum
Export Taxes	Investment Measures	
SPS Measure	Labour Market Regulations	
State Trading Enterprises	Movement of Capital	
Technical Barriers to Trade	Agriculture	
Countervailing Measures	Cultural Cooperation	
Antidumping	Education & Training	
State Aid	Energy	
Public Procurement	Financial Assistance	
TRIMS Measures	Industrial Cooperation	
GATS	Regional Cooperation	
TRIPs	Research and Technology	

Table A2: List of Trade Agreements taken under consideration:

ASEAN free trade area	Japan-Viet Nam	Japan-Malaysia
ASEAN-Australia-New Zealand	Korea, Republic of-India	Japan-Mexico
ASEAN-India	Korea, Republic of-Singapore	Japan-Philippines
ASEAN-Korea	MERCOSUR	EFTA Vaduz (2001)
Australia-New Zealand	MERCOSUR-India	EFTA Stockholm (1960)

(ANZCERTA)		
Australia-Singapore	NAFTA	APTA
Australia-Thailand	SACU	Japan-Singapore
CAFTA-DR	Turkey-EFTA	Japan- Brunei
Canada-EFTA	US-Australia	Chile - India
Chile-Australia	US-Bahrain	
Chile-China	US-Chile	
Chile-Japan	US-Israel	
Chile-Korea	US-Singapore	
China-ASEAN	Canada Chile	
China-Hong Kong	Canada Colombia	
China-New Zealand	Canada Costa Rica	
China-Singapore	Canada Israel	
EC Enlargement (12)	Colombia Chile	
EC Enlargement (15)	Chile Costa Rica	
EC Enlargement (25)	Chile Mexico	
EC Enlargement (27)	EFTA Chile	
EC Treaty	EFTA Colombia	
EC-Chile	EFTA Mexico	
EC-Croatia	EFTA Singapore	
EC-Iceland	EFTA Tunisia	
EC-Israel	EU Korea	
EC-Mexico	Hong Kong New Zealand	
EC-Norway	Israel Mexico	
EC-South Africa	New Zealand- Singapore	
EC-Switzerland Liechtenstein	Thailand New Zealand	
EEA	Trans Pacific	
EFTA-Israel	Turkey Chile	
EFTA-Korea	Turkey Israel	
India-Japan	Colombia Mexico	
India-Malaysia	EFTA Israel	
India-Singapore	Turkey Tunisia	
Japan-ASEAN	LAIA	
Japan-Switzerland	Japan-ASEAN	
Japan-Thailand	Japan-Indonesia	

Table A3: Effect of Depth of PTA on trade in value added: OLS Estimation (a) Total Goods & Services (b) Textiles

Dependent Variable (ln)	Trade in value added (Total)	Trade in value added (Total)	Trade in value added (Total)

PTA_{ijt}	0.158*** (0.022)		
Number of Provisions		0.007*** (0.002)	
$lnPTAdepth_{ijt}$			0.312*** (0.055)
Country-pair fixed effects	Yes	Yes	Yes
Country-time fixed effects	Yes	Yes	Yes
Observations	29150	29150	29150
R-squared	0.945	0.945	0.945

(a)

Dependent Variable (ln)	Trade in value added (Textiles)	Trade in value added (Textiles)	Trade in value added (Textiles)
PTA_{ijt}	0.066 (0.039)		
Number of Provisions		0.001 (0.001)	
$lnPTAdepth_{ijt}$			0.078 (0.053)
Country-pair fixed effects	Yes	Yes	Yes
Country-time fixed effects	Yes	Yes	Yes
Observations	27408	27408	27408
R-squared	0.952	0.952	0.952

(b)

Table A4: Effect of Depth of PTA on trade in value added: OLS Estimation (Automotives)

Dependent Variable (ln)	Trade in value added (Automotives)	Trade in value added (Automotives)	Trade in value added (Automotives)
PTA_{ijt}	0.248*** (0.066)		
Number of Provisions		0.008** (0.003)	
$lnPTAdepth_{ijt}$			0.466*** (0.055)
Country-pair fixed effects	Yes	Yes	Yes
Country-time fixed effects	Yes	Yes	Yes
Observations	24726	24726	24726
R-squared	0.929	0.929	0.929

i) Robust standard errors in parenthesis

ii) p< 0.05*, p<0.01**, p < 0.001***