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Kazunobu HAYAKAWA and Nobuaki YAMASHITA

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Abstract

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Keywords: Preferential trade agreements, regional trade agreements expansion strategy of multinational enterprise, gravity equation
JEL classification: F15, F53

* Kazunobu Hayakawa, Economic Integration Studies Group, Inter-Disciplinary Studies Center, Institute of Developing Economies, 3-2-2 Wakaba, Mihama-ku, Chiba-shi, Chiba 261-8545 Japan. Phone: 81-43-299-9754; Fax: 81-43-299-9763. E-mail: kazunobu_hayakawa@ide.go.jp

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INSTITUTE OF DEVELOPING ECONOMIES (IDE), JETRO
3-2-2, WAKABA, MIHAMA-KU, CHIBA-SHI
CHIBA 261-8545, JAPAN

The Role of Preferential Trade Agreements (PTAs) in Facilitating Global Production Networks[§]

Kazunobu HAYAKAWA
Inter-disciplinary Studies Centre, Institute of Developing Economies, Japan

Nobuaki YAMASHITA
School of Economics and Finance, La Trobe University, Australia

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The Role of Preferential Trade Agreements (PTAs) in Facilitating Global Production Networks

1. Introduction

The proliferation of 'Preferential Trade Agreements' (PTAs) and Regional Trade Agreements (RTAs) in the global trading environment has significantly shaped the day-to-day conduct of international business transactions since the GATT formally formed five decades ago (Sally 2008).[1] Such trade agreements have rapidly spread widely throughout the world since the early 1990s, with the total number of PTAs in force reaching nearly 300 in 2009, up from around 50 in 1990. In addition, there has been a noticeably increasing number of PTA partners for each country; the average number of PTA partners for a given country has increased from 1.8 to 9.9 between 1991 and 2005 (Figure 2). PTAs in Europe and North America now cover almost 40% of world trade, and East Asia – the centre for global trade dynamics – has also found enthusiasm for bilateral PTA deals in recent years (Augier et al. 2005).

An important parallel development in world trade is the ever-growing importance of the extensive form of global and regional production networks mainly driven by widespread operations of multinational enterprises (MNEs). Global production networks refer to the key growing facet of international business where MNEs vertically separate two or more stages of production process across two or more countries, involving extensive outsourcing and the use of cross-border supply chains (Jones and Kierkowski 2001). For example, *Quanta Computer*, the largest laptop original design manufacturer (ODM)[2] originating in Taiwan, collects parts and components from around the globe – such as Intel microprocessors and Microsoft operating systems from the US, graphic tips designed by ATI technologies from Ontario in Canada, hard disc drives from Japan, and liquid crystal display (LCD) screens and memory chips produced from companies in Taiwan and South Korea – and then assembles them at Quanta Shanghai Manufacturing City using 40,000 workers in China.[3, 4] As a consequence,

[1] PTAs in this paper include free trade agreements, common markets, customs unions, and single economic unions.
[2] ODM or contract manufacturer refers to a company which designs and manufactures a product which is eventually branded by another firm.
[3] Dean, Jason and Pui-Wing Tam (2005), 'The Laptop Trail', *The Wall Street Journal*, June 9.
[4] In 2006, Quanta Computer was listed as one of the Global Fortune 500 Enterprises in Fortune Magazine.

an increase in trade has occurred in the different stages of production – parts and components and final assembled goods – that comprise global production networks (Yeats 2001, Athukorala and Yamashita 2006, Yamashita 2010).

Despite these two important developments in the global economy, there has been a dearth of studies assessing the role of expanding PTAs in facilitating the integration of countries into global and regional production networks. To fill this gap, we systematically examine PTAs' effects on trade flows separated at the vertical production chains into parts and components (PCs), and finally assembled goods, in the gravity model framework. We consider a total of 268 PTAs including those in force as well as those phased out during the period of 1979-2008, in contrast to the majority of available papers which only include a handful of all existing PTAs in force.[5] By so doing, we are able to assess the 'spaghetti bowl effects', the increased transaction costs due to complexity in rules of origins (RoOs) and inconsistencies created by the overlapping trade agreements.[6] There has been increasing evidence to suggest that FTAs are used less for market access than anticipated because the costs of complying with RoOs are higher than the benefits of preferential trade especially with lower MFN rates (Takahashi and Urata 2008, Hayakawa et al. 2009). In addition, PTAs may not have any actual impacts on trade in parts and components since they are essentially duty free owing to the 'tariff escalation' which makes MFN tariff rates almost negligible or significantly lower for parts and components than for final goods in most countries.[7] This suggests that the previous studies estimating PTAs' effects on total trade flows may have been biased upward due to the aggregation of the data and heterogeneous effects of PTAs.

This paper finds that PTAs actually have heterogeneous effects on trade in production networks in contrast to the commonly found positive effects on total trade flows. In particular,

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See http://www.quantatw.com/Quanta/english/Default.aspx

[5] The only exception is Medvedev (2010) who covered 209 PTAs, including those notified and non-notified to the WTO, for the year 2004. However, his focus is on estimating PTA effects on total trade rather than production network trade.

[6] These costs include different schedules for phasing out tariffs, different rules of origins (RoOs), exclusions, conflicting standards, and differences in rules, other regulations and policies. Indeed, these costs may exert adverse effects on production network trade by causing involvement of a larger number of imported parts and components from a wide array of countries. The related costs for satisfying RoOs arise from exporting firms' need to prepare all documentations to obtain the certificates of origins (CoOs) which certify that export goods are locally produced. For this purpose, downstream firms need to request each part and component supplier to issue invoices or contract documents. This creates higher documentation costs for the export of parts and components under the RTA schemes.

[7] Except for Thailand and China in the case of the automotive industry.

PTAs have no role in facilitating trade in parts and components when PTAs are formed. This is consistent with the concerns expressed for overlapping PTAs. At the same time, it is also found that PTAs have increased the level of trade in parts and components 6 and 9 years after their formation. Perhaps PTAs improve the general trading environment among countries in the long run. PTAs play an important role by increasing the level of trade in finally assembled goods by 13% to 17% both in the short and long run.

2. The Impact of PTAs on Production Network Trade

This section briefly discusses development of PTA formation and some theoretical background to guide the ensuing empirical analysis. We draw information for PTA formation from the WTO Regional Trade Agreements Information System (RTA-IS).[8] The RTA-IS database is a single, consistent, publicly-available source of information containing all trade agreements notified to the WTO to date with a list of partner countries, WTO legal cover, date of entry into force and status.[9] In addition, we also record those PTAs which ceased after their date of entry into force. For instance, the FTA between the Republic of Albania and Romania was in force in 2004, but it was terminated since Romania was admitted to the European Union in 2007. Lastly, since our focus is on PTAs on trade in merchandise goods, our PTAs do not include those agreements with only coverage of service trade under the GATS Article V.

The number of PTAs has significantly increased since the early 1990s (Figure 1).[10] This has been driven by the bilateral agreements signed by the European Union (EU) with Central and Eastern European countries, propelled by the accession of ten new members to the EU, although the agreements were terminated in 2004 (Vicard 2009). Figure 2 depicts average PTA member countries and the average number of PTA-participating countries for the period 1980-2007. There are two noteworthy trends. Firstly, the average number of PTA countries increased up to 1990 and then decreased to around 10 countries. This large drop in the average number was mainly driven by the phase-out of the Third Convention of Lome. From 1991 onwards, the average number of PTA member countries has been quite stable with

[8] http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx

[9] Notification to the WTO is voluntary, not compulsory. Hence, the database excludes the un-notified PTAs. However, since the mid-1990s, it appears that more countries have started reporting to the WTO.

[10] This paper does not make a distinction among PTAs, FTAs (free trade agreements), CUs (customs unions), and CMs (common markets). This is because the first two (PTAs and FTAs) are the dominant forms for existing trade agreements and those classified as FTAs in the WTO are essentially preferential agreements (Sally 2008).

a secular upward trend. This implies an increasing trend toward bilateral PTA agreements, rather than the signing of large-scale multilateral PTA agreements. Secondly, the average number of PTAs increased steadily from 1991, from 3 PTAs to 8.8 PTAs on average in 2007. This is consistent with the emergence of a spaghetti bowl – a wide spread of overlapping trade agreements – which has been at the centre of trade policy discussion in recent years (Sally 2008).

The net effects of PTAs on production network trade depend on the following factors. Firstly, trade in final assembled goods consisting of a larger number of imported parts and components may not be facilitated by the presence of complex RoOs in overlapping PTAs. Under a PTA, countries can maintain their own external tariffs while offering preferential (mostly zero) tariffs to the member countries.[11] In this setting, RoOs are put in place to prevent imports of any products into PTA countries through a country with the lowest tariff on the item in question and being re-exported to other countries (the final destinations). If RoOs impose stringent criteria for identifying the 'true' origins of parts and components used in products and cumbersome administrative compliance procedures, PTAs would not be used at all (Krishna 2006, Demidova and Krishna 2008).[12] The utilisation rates of PTAs can thus be influenced by the level of most-favoured-nation (MFN) rates as well as the extent of imported parts and components contained in final goods (Menon 2009).[13]

Secondly, PTAs may not have any actual impacts on trade in parts and components, since they are usually duty free owing to the 'tariff escalation', which makes MFN tariff rates almost negligible or significantly lower for parts and components than for final goods in most countries.[14] In other words, margins of preference are practically worthless for this product category. All in all, the creation of PTAs may not exert the expected trade enhancement effects despite significant resources invested in preparations, negotiations and maintenance. This may be manifested clearly when trade flows are distinguished as trade in parts and

[11] More precisely, under PTAs except for the customs unions where member countries also offer uniform external tariff rates.
[12] There are four types of criteria to determine the origins of goods: (i) the value-added content criterion, (ii) change in tariff classification criterion, (iii) the optional criterion allowing a choice of either (i) or (ii), and (iv) the dual criterion requiring satisfaction of both (i) and (ii) (Cador et al. 2006).
[13] In fact, evidence suggests lower utilisation of the PTA scheme for market access (Hayakawa et al. 2009; Takahashi and Urata 2010,). For example, only 3.6% of exporting firms are reported to use the Japan-Singapore agreement and 5.5% for the Japan-Malaysia agreement.
[14] Except developing countries like Thailand and China where a policy is in place to protect the domestic upstream industries.

components and as final products. The section below systematically examines this hypothesis in the gravity model framework.

3. Gravity Equation and Estimation Issues

To explore the impacts of PTAs on MNE network trade, we estimate the gravity equation separately for trade in final goods and for parts and components (PCs). In the empirical research of international economics, the gravity equation of bilateral trade flows has been the workhorse tool since its first application in Tinbergen (1962). One of the desirable features of the gravity equation is that it fits the data very well, typically explaining the variation of the bilateral trade flows in a range of 65% to 95% in terms of R squares. This high explanatory power has led many applied researchers to apply the gravity equation. The evaluation of PTAs' effects on trade flows using the gravity equation has been one of the most successful applications of the gravity equation (e.g., Frankel 1997, Soloaga and Winters 2001, Baier and Bergstrand 2007, Fratianni and Oh 2009).

The fundamental formulation of the gravity equation is that the bilateral trade flows are positively related to the size of markets (measured by GDP) and negatively related to the geographical distance between two countries. This loosely corresponds to the fact that the force of gravity between two entities increases with the products of their mass and decreases with distance (Deardorff 1998). Since the simple application of the gravity equation, there has been some development in gravity equation techniques.

In the simplest form, the gravity equation has logs of importer's and exporter's GDPs and a log of distance (*Dist*) between trading partners:

$$\ln X_{ijt} = \beta_0 + \beta_1 \ln \mathrm{GDP}_{it} + \beta_2 \ln \mathrm{GDP}_{jt} + \beta_3 \ln \mathrm{Dist}_{ij} + \varepsilon_{ij} \qquad (1)$$

where X_{ij} represents bilateral goods exports from exporter i to importer j. In the actual data, we use j's import record of i's exports because it is generally believed that import records are better recorded for tax collection purposes. Subscript t denotes years. The symbol *ln* before a variable denotes the natural logarithm. Equation (1) is usually extended to include the following explanatory variables. Most importantly, *PTA* is a dummy variable, taking unity if countries are members of the same PTA and zero otherwise. Note that the PTA dummy has a

time dimension because it covers a trade agreement that ceased after 1988, which the initial year for the sample period. *Cont* is a dummy variable, taking unity if two countries share the national border and zero otherwise. *Lang* is a dummy variable taking unity if a language is spoken by at least 9% of the population in both countries and zero otherwise. *Col* is a dummy variable taking unity when countries had colonial experience, zero otherwise. *Vol* is bilateral exchange rate volatility between countries *i* and *j*. The volatility of nominal exchange rates creates risks and uncertainly in international trade transactions. Hence, volatile exchange rates may reduce the level of trade between pair countries. We use a widely-used indicator, the real exchange rate volatility, which is constructed as the standard deviation of the first-difference of the monthly natural logarithm of bilateral real exchange rates in the preceding five-year period (Rose 2000).[15]

Despite its long history of successful empirical application, until recently the key shortcoming of the gravity equation was the absence of solid theoretical underpinning. Anderson (1979) and Bergstrand (1985, 1989) initially addressed this limitation, and their works were followed by the Ricardian trade model (Eaton and Kortum 2002), the Heckscher–Ohlin (Deardorff 1998), and the monopolistic competition models (Helpman and Krugman 1985, Anderson and van Wincoop 2003). These development derives the following log-linear theoretically-consistent gravity equation under the assumption that trade costs are a function of geographical distance, linguistic commonality, border contingency, and PTA (see algebraic derivation in Anderson and van Wincoop 2003, Baier and Bergstrand 2007).

$$\ln X_{ij} = \beta_0 + \beta_1 \ln \mathrm{GDP}_i + \beta_2 \ln \mathrm{GDP}_j + \beta_3 \ln \mathrm{Dist}_{ij} + \beta_4 \mathrm{Cont}_{ij} + \beta_5 \mathrm{Lang}_{ij} + \beta_6 \mathrm{Col}_{ij} + \beta_7 \mathrm{PTA}_{ij} + \beta_8 \mathrm{Vol}_{ij} + \beta_9 \ln \Pi_i + \beta_{10} \ln P_j + \varepsilon_{ij}. \quad (2)$$

As shown, this theoretically-consistent gravity equation includes multilateral resistance terms, $\ln \Pi_i$ and $\ln P_j$, accounting for cross-country price variations. Currently, there are three techniques available to capture these terms: (i) collection of multi-country price indices, (ii) use of custom programming to simultaneously obtain values for transportation costs and estimate the structural equation using non-linear least squares, and (iii) estimation of the equation using importer and exporter dummies in place of respective price indices. We follow the last method because most countries do not report price indices,

[15] The nominal exchange rates are drawn from line *rf* of International Financial Statistics (IFS) and are deflated by the monthly consumer price index.

and the estimation is relatively easier with a panel data structure. The benchmark estimation equation now takes the following form:

$$\ln X_{ijt} = \beta_0 + \beta_3 \ln \text{Dist}_{ij} + \beta_4 \text{Cont}_{ij} + \beta_5 \text{Lang}_{ij} + \beta_6 \text{Col}_{ij} + \beta_7 \text{PTA}_{ijt} + \beta_8 \text{Vol}_{ijt} + \theta_{it} + \delta_{jt} + \varepsilon_{ij}. \quad (3)$$

Subscript t denotes time (year). The inclusion of importer-year (θ) and exporter-year (δ) dummy variables automatically drops importer and exporter GDPs. We estimate equation (3) with trade in final goods as the dependent variable and parts and components (PCs) for the other.

We also face the potential endogeneity issue of a PTA dummy. If the decision to enter into a PTA is determined by the same set of factors influencing bilateral trade between *i* and *j*, the estimation of equation (3) by OLS estimates will be inconstant and biased (Baier and Bergstrand 2004). To avoid this, we employ bilateral fixed (exporter-importer-year) effects to take advantage of the panel structure of data following Baier and Bergstrand (2007). Bilateral fixed effects isolate the PTA impacts on bilateral trade flows from any time-invariant country-pair-specific elements, some of which are related to the decision on the formation of PTA and the bilateral international trade. The choice to include bilateral fixed effects is also supported by the absence of a reliable instrument variable (IV) approach for the endogeneity problem. Baier and Bergstrand (2007) attempt a wide array of economic and political potential instrument variables. However, they concluded that finding a suitable IV which determines the likelihood of entering PTAs and at the same time is directly unrelated to bilateral trade flows is almost an impossible task.

Based on the discussion, we also estimate the following (preferred) equation which accounts for both multilateral resistance and the PTA endogeneity issue:

$$\ln X_{ijt} = \beta_0 + \beta_7 \text{PTA}_{ijt} + \beta_8 \text{Vol}_{ijt} + \theta_{it} + \delta_{jt} + u_{ij} + \varepsilon_{ijt}. \quad (4)$$

In other words, it includes exporter-year, importer-year and the pair-year dummies. Inclusion of the pair-dummy removes other time-invariant pair variables such as distance.

We also consider the lagged PTA effects. While the PTA dummy is constructed based on the 'date of entry into force' of the agreement, the actual implementation of a PTA involves a 'phase-in' period, typically over 10 years. For instance, NAFTA had 10-year

phase-in period before its full implementation. In addition, the terms of trade created by the formation of PTAs tend to have lagged effects on trade volume (Baier and Bergstrand 2007). Thus, the entire effects of PTAs on trade flows and how MNEs react to PTAs cannot be fully captured in the concurrent year only. We include lagged PTA dummies in three-year intervals (i.e., t-3, t-6, and t-9). Baier and Bergstand (2007) found that PTAs can have a prolonged effect for as long as 10 years.

The other estimation issue is zero-valued trade flows. As suggested by many (e.g., Melitz 2003), trade flows can be systematically zero rather than pure misreporting. The recent firm heterogeneity literature in international economics discovers that firms systematically make export market participation decisions, generating observed zero value trade. Melitz (2003) and Helpman et al. (2008) suggest that only highly productive firms can afford to bear the fixed costs of exporting. The quick ad hoc way of checking the robustness of the results is to estimate trade flows by adding one before taking logarithms transformations and compare the results from estimating without taking account of zero.[16]

4. Data

The data on bilateral trade at the 5-digit commodity level are drawn from the UN Comtrade database. We use an annual data series for the period of 1988-2008. The initial year is set to 1988 because this is the first year when UN data in SITC Revision 3 is available. The end year is 2008, the year for which the latest data is available. This time span also covers the period when PTAs increased dramatically (Figure 1). The data cover 142 countries. Trade data distinguished into parts and components and final assembled goods is based on a commodity list with 5-digit categorization in the sector of machinery and transport equipment sector (SITC 7) (see the Appendix for more details). A prime focus on parts and components of machinery and transport equipment products is justified because the available case studies

[16] Recently, two approaches were developed to systematically deal with the zero trade issues. The first approach proposed in Silva and Tenreyro (2006) is to use the pseudo poisson maximum likelihood (PPML), which is more attractive than the least square estimators when the conditional expectation of the logged error term in the log-form estimation equation is non-zero. The second approach takes into account firm heterogeneity and self-selection mechanism into export markets by the extended technique of the Heckman two-step estimation (Helpman et al. 2008). The downside of PPML is that zero valued trade is treated as in the normal trade values. The extended Heckman procedure requires the data on fixed costs for exporting, which are not available to this study. Alternatively, the censored regression by the tobit model can be done to control for the truncation of sample by zero trade. However, it has mostly been found that truncation regression does not appreciatively change results.

suggest global production networks are more prevalent in this sector (e.g., Brown and Linden 2005). Hence, we can reasonably capture MNE strategies in production network trade by focusing on the machinery and transport equipment sector.

Our empirical analysis using the gravity model covers all of the 267 PTAs which are listed in Appendix 1. In the gravity literature, a set of PTA dummies is customarily constructed in order to capture trade creation and trade diversion effects in addition to the 1-0 PTA member country dummy variable (Soloaga and Winters 2001, Carrere 2006, Fratianni and Oh 2009). While a generic PTA dummy is 1 when both the import and export countries belong to the same PTA and zero otherwise, the other PTA dummy is 1 when the import country belongs to any PTA and the export country does not, otherwise it is 0. In this way, trade creation means positive trade effects of PTAs for intra-PTA members while trade to non-PTA members stays constant, whereas trade diversion represents the opposite case.[17] In the current framework whereby countries are allowed to have more than one PTA, multiple PTA dummies per agreement have no usefulness. Using an example from the US-NAFTA trade, this problem can be explained as follows. The first dummy by definition means 1 for US trade with Canada and Mexico, and zero otherwise. The second dummy is 1 when the US imports from countries other than NAFTA members. Now, introduction of a dummy variable for the US-Chile PTA in the same manner makes US imports from Chile and US imports from extra-NAFTA members indistinguishable (Medvedev 2010). Furthermore, our data set covers PTAs since 1988, hence, each of the sample countries has at least one FTA. In fact, a second PTA dummy essentially accounts for 93% of all sample countries. This means that the second PTA dummy will, if introduced, be completely absorbed in the intercept of regressions. Hence, we only use a single PTA dummy in our analysis. Lastly, Distance, Contingency, Language, and Colony are drawn from the CEPII database.[18]

5. Results

Table 1 reports results for estimating PTAs' effects on trade flows with and without the pair dummies, and Table 2 shows the time lagged effect of PTAs with the pair dummies. Separate gravity regressions are presented for two different dependent variables - trade in parts and components (PCs) and final goods (Final). Exporter-year, importer-year and the pair

[17] Soloaga and Winters (2001) also include a third dummy variable in the gravity model.
[18] http://www.cepii.fr/anglaisgraph/bdd/bdd.htm

dummies are included in the estimations but the coefficients are not reported for brevity. The conventional gravity variables such as distance and contingency variables show the expected sign (regressions (1) and (2) in Table 1). From regression (5) onwards in Table 1, the same estimations are repeated by adding one in the dependent variable before taking logarithm. It turns out that the estimate coefficient for the PTA dummies does not change much by taking into account zero trade flows. Hence, discussions below focus on the results that exclude zero trade flows.

Results in regressions (1) and (2) in Table 1 show that PTAs facilitate trade flows connecting the production network. Regressions (1) and (2) suggest that PTAs would increase the level of trade flows among member countries by 42% to 62% for both trade in parts and component and final goods.[19] This finding is consistent with the general positive findings of PTA effects on bilateral total trade flows (Baier and Bergstrand 2007). However, the results may be driven by the endogenity problem of the PTA dummy. It appears that the economic significance of the estimated coefficients on the PTA dummy is too large. Regressions (3) and (4) take this into account by including the bilateral pair-dummy. It turns out that the PTA dummy no longer supports the above positive finding. In particular, regression (3) indicates that the sign of the PTA dummy is negative for trade in parts and components, although not statistically significant. However, in regression (4) the PTA dummy is still found to be positive and statistically significant at the 1% level. It also indicates that PTAs would increase the level of trade in final goods by 13%, which is lower than that obtained in regression (2).

The results have two implications. Firstly, PTAs have heterogeneous effects on trade in production networks, supporting our approach of separating trade into parts and components and final goods. Secondly and more importantly, PTAs may play no role in facilitating trade in parts and components, as compared to trade in final goods in a concurrent year. As discussed in section 2, this may suggest that MNEs with production networks may not find it attractive to use PTAs due to the complexities and other transaction costs, or because of already low MFN rates for this product category. On the other hand, PTAs play an important role in facilitating trade in final goods.

[19] This is computed by the following formula: (exponential (the estimated coefficient)-1)*100.

The results in Table 2 show the lagged effects of PTAs. The top panel (Table 2a) shows the results for trade in parts and components in the dependent variable, and the bottom panel (Table 2b) is for trade in final goods. Interestingly, the PTA dummy on the level of trade in parts and components turns to from negative to positive and statistically significant at the 5% level after 6 years of PTA formation (regressions (2), (5) and (7) in Table 2a). It also suggests that PTAs would increase the level of trade in parts and components by 6%. Even after 9 years, PTA dummies are still found positive and statistically significant at the 5% level in regression (3).

Table 2b reinforces the finding of Table 1. In most of the regressions, PTA dummies turn out to be positive and statistically significant at the 1% level by increasing the level of trade in final goods by 14% to 17%. Interestingly, such positive effects are pervasive up to 6 years later but unseen after 9 years. As found in Table 1, the contemporaneous PTA effects on trade flows are clearly positive with strong statistical significance.

All in all, the results in Tables 1 and 2 indicate that PTAs facilitate trade in production networks and such positive effects emerge in the long run. These prolonged effects of PTAs on trade flows connecting production networks are quite similar to the finding of a well-cited paper by Baier and Bergstrand (2007) concerning total trade flows. At the same time, it was found that PTA effects on trade in parts and components are unseen in the short run. Perhaps, when PTAs are formed, MNEs with extensive production networks opt not to use PTAs because of high transaction costs or low-MFN rates available to this product category; however, the positive effects of PTAs emerge after 6 years. This may be associated with improvements in the general trading environment due to well-established PTAs among member countries. It also appears that final goods producers in production networks benefit from new PTAs and positive effects are quite perversive for trade in final goods.

6. Conclusion

The proliferation of overlapping PTAs gives a rise to the additional international business transaction costs such as dealing with different schedules for phasing out tariffs, different rules of origins (RoOs), and different administrative rules in other regulations across different agreements. A growing concern is that PTAs may become major obstacles to an expansion of global production network trade, driven by widespread operations of MNEs. In this context,

this paper examines the role of PTAs in international trade connecting production networks (separately for trade in parts and components and final goods) using the gravity model approach, while taking into account the endogenous nature of PTAs for the period 1988-2008 with over 250 trade agreements in total.

This paper found that PTAs play an important role in increasing the level of trade in final goods both in the short and long run, while the positive PTA effects on trade flows in parts and components (PCs) only emerge in the long run. This suggests that the impacts of PTAs on trade flows are quite heterogeneous, supporting our approach. The sign of a PTA dummy in the concurrent year suggests that PTAs may not have any impact on the level of trade in parts and components. This finding partly also reflects concerns expressed for overlapping PTAs, especially in a context where production of goods is fragmented with different parts of the value chain located in different countries and linked across borders through trade in parts and components. In other words, MNEs do not find it beneficial to conduct international trade transactions using newly formed PTAs. This may be because trade in parts and components is already subject to low MFN rates. However, we found that PTAs have a positive impact by raising the level of trade in parts and components in the long run (even after 9 years). Perhaps PTAs improve the general trading environment by making it more conducive to all sorts of international trade. Hence, this paper did not find strong evidence supporting the spaghetti bowl effects of overlapping PTAs which are thought to be developing into major obstacles to international business transactions in a context of emerging global production networks. Instead, we find that positive PTAs are likely to emerge by increasing the level of trade flows 6 and 9 years after the implementation of PTAs among member countries.

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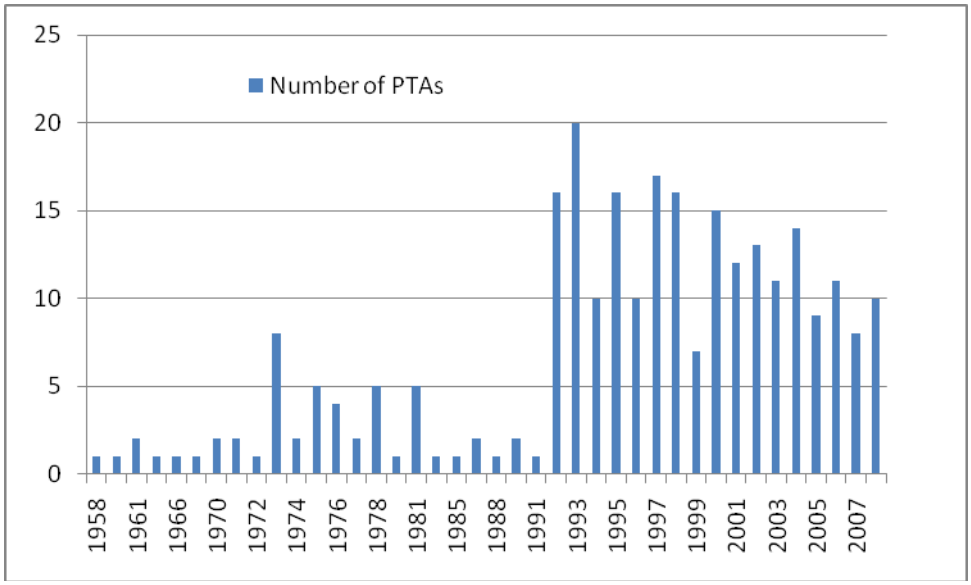
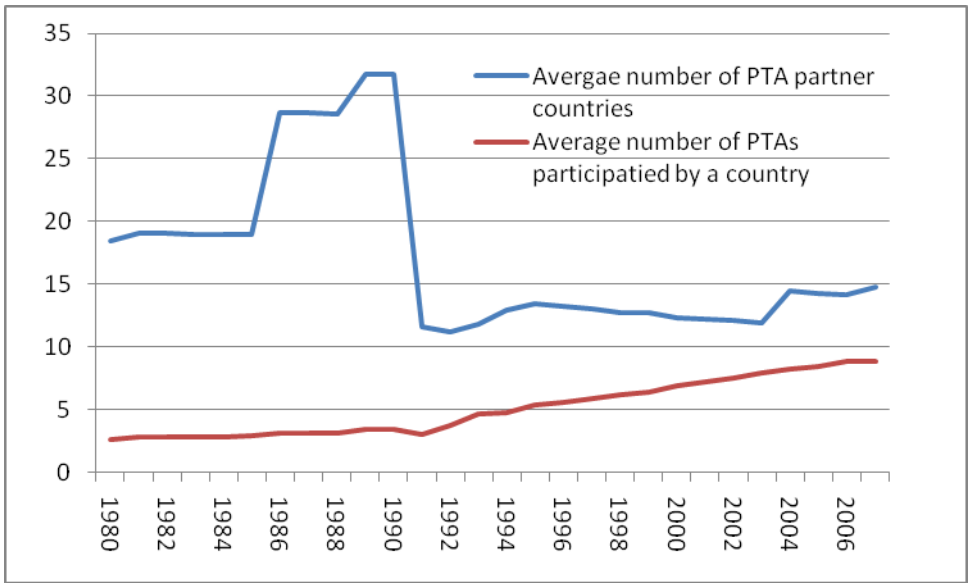
Figure 1: Number of PTAs Notified to the WTO, 1958-2008



Notes: The PTA data is based on the WTO Regional Trade Agreements Information System (RTA-IS). The figures represent the number of PTAs that entered into force in the given year; the figures are not net counts of PTAs.

Figure 2: The Process of PTA Formation during 1980-2007



Note: This is based on the WTO Regional Trade Agreements Information System (RTA-IS).

Table 1: PTA Effects on Trade in Parts and Components (PCs) and Final Goods

	log(*X*)				Log(*X*+1)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	PCs	Final	PCs	Finished	PCs	Final	PCs	Final
PTA	**0.353*** **	**0.486*** **	**-0.042**	**0.127*** **	**0.877*** **	**1.030*** **	**-0.079**	**0.120** **
	[0.017]	**[0.018]**	**[0.029]**	**[0.031]**	**[0.026]**	**[0.028]**	**[0.049]**	**[0.052]**
Distance (Dist)	-1.378***	-1.472***			-1.919***	-2.196***		
	[0.010]	[0.011]			[0.015]	[0.016]		
Language (Lang)	0.682***	0.674***			1.075***	1.243***		
	[0.020]	[0.021]			[0.027]	[0.029]		
Contingency (Cont)	0.317***	0.334***			0.500***	0.603***		
	[0.041]	[0.041]			[0.076]	[0.087]		
Colony (Col)	0.927***	0.766***			1.563***	1.630***		
	[0.033]	[0.032]			[0.055]	[0.062]		
Volatility (Vol)	-0.053	-0.454***	0.031	0.062	1.989***	1.865***	0.098	0.145
	[0.098]	[0.099]	[0.122]	[0.133]	[0.199]	[0.220]	[0.246]	[0.256]
Exporter * Year	YES	YES	YES	YES	YES	YES	YES	YES
Importer * Year	YES	YES	YES	YES	YES	YES	YES	YES
Pair	NO	NO	YES	YES	NO	NO	YES	YES
Obs.	109,463	109,463	109,463	109,463	215,468	215,468	215,468	215,468
R-squared	0.78	0.77	0.28	0.27	0.77	0.76	0.15	0.16

Notes: Standard errors are in parentheses. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. 'Parts' denotes trade in parts and components as the dependent variable, and 'final' denotes trade in final assembled goods.

Table 2: Lagged PTA Effects on Trade in Parts and Components and Final Goods

(a)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bilateral trade in parts and components (PCs)								
PTA(t)				-0.051*	-0.043	-0.037	-0.042	-0.04
				[0.030]	[0.029]	[0.029]	[0.031]	[0.031]
PTA(t-3)	0.009			0.025			-0.001	0.001
	[0.028]			[0.029]			[0.032]	[0.032]
PTA(t-6)		0.057**			0.057**		0.058**	0.045
		[0.024]			[0.024]		[0.026]	[0.029]
PTA(t-9)			0.044**			0.041*		0.023
			[0.022]			[0.022]		[0.024]
Total Effects		0.057	0.044	-0.051	0.057	0.041	0.058	
Obs.	109,463	109,463	109,463	109,463	109,463	109,463	109,463	109,463
R-squared	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28

(b)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bilateral trade in final goods								
PTA(t)				0.084**	0.126***	0.130***	0.091***	0.091***
				[0.033]	[0.031]	[0.032]	[0.034]	[0.034]
PTA(t-3)	0.153***			0.127***			0.104***	0.104***
	[0.030]			[0.032]			[0.035]	[0.035]
PTA(t-6)		0.082***			0.082***		0.050*	0.052
		[0.027]			[0.027]		[0.029]	[0.032]
PTA(t-9)			0.015			0.024		-0.005
			[0.024]			[0.024]		[0.026]
Total Effects	0.153	0.082		0.211	0.208	0.13	0.195	0.195
Obs.	109,463	109,463	109,463	109,463	109,463	109,463	109,463	109,463
R-squared	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27

Notes: Standard errors are in parentheses. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In all regressions, exporter*year, importer*year and pair dummies are included. PTA (t-1) refers to the lagged effect for three years and PTA (t-2) for six years. Bilateral exchange rates' volatility has been included in all regressions, but the estimated coefficients are not presented since they are not statistically significant. Total effects are the sum of the statistically significant PTA coefficient estimates.

Appendix 1: A list of Preferential Trade Agreements (PTAs)

Name of Agreement	Year of Entry into Force	Year Phased Out
Albania – Bulgaria	2003	2007
Albania - Former Yugoslav Republic of Macedonia	2002	2007
Albania - Moldova	2004	2007
Albania - Romania	2004	2007
Andean Community (CAN)	1988	1996
Armenia – Kazakhstan	2001	
Armenia – Moldova	1995	
Armenia - Russian Federation	1993	
ASEAN - Japan	2008	
ASEAN Free Trade Area (AFTA)	1992	
Asia Pacific Trade Agreement (APTA) (previously, Bangkok Agreement)	1976	
Asia Pacific Trade Agreement (APTA) - Accession of China	2002	
Australia - New Zealand (ANZCERTA)	1983	
Australia - New Zealand Free Trade Agreement	1966	1983
Australia - Papua New Guinea (PATCRA)	1977	
Bulgaria - Estonia	2002	2004
Bulgaria - Former Yugoslav Republic of Macedonia	2000	2007
Bulgaria - Israel	2002	2007
Bulgaria - Latvia	2003	2004
Bulgaria - Lithuania	2002	2004
Bulgaria - Slovak Republic Free Trade Agreement	1996	1999
Bulgaria - Slovenia	1997	1999
Bulgaria - Turkey	1999	2007
Canada - Chile	1997	
Canada - Costa Rica	2002	
Canada - Israel	1997	
Canada - US Free Trade Agreement (CUSFTA)	1989	1994
(Caribbean Community and Common Market) (CARICOM)	1973	
Central American Common Market (CACM)	1961	
Central European Free Trade Agreement (CEFTA)	1993	2004
CEFTA - Accession of Bulgaria	1999	2007
CEFTA - Accession of Croatia	2003	
CEFTA - Accession of Romania	1997	2007
CEFTA - Accession of Slovenia	1996	2004
Central European Free Trade Agreement (CEFTA)2006	2007	
Chile - Costa Rica	2002	
Chile - El Salvador	2002	
Chile India	2007	
Chile Japan	2007	
Chile Mexico	1999	
Common Economic Zone	2004	
Common Market for Eastern and Southern Africa (COMESA)	1994	

Commonwealth of Independent States (CIS)	1994	
Costa Rica - Mexico	1995	
Croatia - Albania	2003	2007
Croatia - Former Yugoslav Republic of Macedonia	1997	2007
Czech Republic - Bulgaria Free Trade Agreement	1996	1999
Czech Republic - Estonia	1998	2004
Czech Republic - Israel	1997	2004
Czech Republic - Latvia	1997	2004
Czech Republic - Lithuania	1997	2004
Czech Republic - Romania Free Trade Agreement	1995	1997
Czech Republic - Slovak Republic Customs Union	1993	2004
Czech Republic - Slovenia	1994	1995
Czech Republic - Turkey	1998	2004
Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR)	2006	
East African Community (EAC)	2000	
European Community (EC) - Albania	2006	
EC – Algeria	1976	
EC - Austria Agreement of 1972	1972	1995
EC – Bulgaria	1993	2007
EC - Bulgaria Interim Agreement	1993	1995
EC - CARIFORUM States EPA	2008	
EC - Chile	2003	
EC - Croatia	2002	
EC - Cyprus Association Agreement	1973	2004
EC - Czech and Slovak Federal Republic Interim Agreement	1992	1995
EC - Czech Republic Europe Agreement	1995	2004
EC – Egypt	2004	
EC - Egypt Cooperation Agreement	1978	2004
EC - Estonia Agreement	1995	2004
EC - Finland Agreement	1974	1994
EC - Former Yugoslav Republic of Macedonia	2001	
EC - Greece Additional Protocol	1975	1981
EC - Greece Association Agreement	1962	1981
EC - Hungary Europe Agreement	1994	2004
EC - Hungary Interim Agreement of 1991	1992	1994
EC –Iceland	1973	
EC –Israel	2000	
EC - Israel Agreement of 1975	1975	2000
EC – Jordan	2002	
EC - Jordan Cooperation Agreement	1978	2002
EC - Latvia Agreement	1995	2004
EC – Lithuania	1995	2004
EC - Malta Association Agreement	1971	2004
EC - Mexico	2000	
EC – Morocco	2000	

EC - Morocco Cooperation Agreement	1978	2000
EC – Norway	1973	
EC - Overseas Countries and Territories (OCT)	1971	
EC - Poland Europe Agreement	1994	2004
EC - Poland Interim Agreement of 1991	1992	1994
EC - Portugal Interim Agreement	1976	1986
EC – Romania	1993	2007
EC - Romania Interim Agreement	1993	1995
EC - Slovak Republic Europe Agreement	1995	2004
EC - Slovenia Cooperation Agreement	1993	1997
EC - Slovenia Interim Agreement	1997	2004
EC - South Africa	2000	
EC - Spain Agreement of 1970	1970	1986
EC - Sweden Agreement	1973	1995
EC - Switzerland - Liechtenstein	1973	
EC - Syria	1977	
EC - Tunisia	1998	
EC - Tunisia Cooperation Agreement	1978	1998
EC - Turkey	1996	
EC - Turkey Association Agreement of 1973	1974	1996
EC Treaty	1958	
EC (9) Enlargement	1973	
EC (10) Enlargement	1981	
EC (12) Enlargement	1986	
EC (15) Enlargement	1995	
EC (25) Enlargement	2004	
EC (27) Enlargement	2007	
Economic and Monetary Community of Central Africa (CEMAC)	1999	
Economic Community of West African States (ECOWAS)	1993	
Economic Cooperation Organization (ECO)	1992	
European Free Trade Agreement (EFTA) Bulgaria	1993	2007
EFTA – Chile	2004	
EFTA – Croatia	2002	
EFTA - Czech Republic Agreement	1992	2004
EFTA – Czechoslovakia	1992	1993
EFTA – Egypt	2007	
EFTA - Estonia Free Trade Agreement	1996	2004
EFTA - Former Yugoslav Republic of Macedonia	2001	
EFTA - Hungary Agreement	1993	2004
EFTA – Israel	1993	
EFTA – Jordan	2002	
EFTA - Korea, Republic of	2006	
EFTA – Latvia	1996	2004
EFTA – Lithuania	1996	2004
EFTA – Mexico	2001	

EFTA – Morocco	1999	
EFTA - Poland Agreement	1993	2004
EFTA - Romania Free Trade Agreement	1993	2007
EFTA – SACU	2008	
EFTA – Singapore	2003	
EFTA - Slovak Republic Agreement	1992	2004
EFTA – Slovenia	1995	2004
EFTA - Spain Agreement	1980	1986
EFTA – Tunisia	2005	
EFTA – Turkey	1992	
EFTA (Stockholm Convention) (G)	1960	
EFTA accession of Iceland	1970	
Egypt – Turkey	2007	
El Salvador – Mexico	2001	
Estonia - Latvia – Lithuania	1994	2004
Estonia - Norway Free Trade Agreement	1992	1996
Estonia - Sweden Free Trade Agreement	1992	1995
Estonia - Switzerland Free Trade Agreement	1993	1996
Eurasian Economic Community (EAEC)	1997	
Finland – Bulgaria	1975	1993
Finland - Czechoslovakia Agreement	1975	1992
Finland - Estonia Protocol	1992	1995
Finland - Hungary Agreement	1975	1993
Finland - Latvia Protocol	1993	1995
Finland - Lithuania Protocol	1993	1995
Finland - Poland Agreement	1978	1993
Finland-European Free Trade Association (FINEFTA)	1961	1986
First Convention of Lom?	1976	1981
Georgia – Armenia	1998	
Georgia – Kazakhstan	1999	
Georgia - Russian Federation	1994	
Global System of Trade Preferences among Developing Countries (GSTP)	1989	
Guatemala – Mexico	2001	
Gulf Cooperation Council (GCC1)	1981	2003
Gulf Cooperation Council (GCC2)	2003	
Honduras - Mexico (G)	2001	
Hungary – Estonia	2001	2004
Hungary – Israel	1998	2004
Hungary – Latvia	2000	2004
Hungary – Lithuania	2000	2004
Hungary - Slovenia Free Trade Agreement	1995	1995
Hungary – Turkey	1998	2004
India – Singapore	2005	
India - Sri Lanka	2001	
Israel – Mexico	2000	

Japan – Indonesia	2008	
Japan – Malaysia	2006	
Japan – Mexico	2005	
Japan – Philippines	2008	
Japan – Singapore	2002	
Japan – Thailand	2007	
Jordan – Singapore	2005	
Korea, Republic of – Chile	2004	
Korea, Republic of – Singapore	2006	
Kyrgyz Republic – Armenia	1995	
Kyrgyz Republic – Kazakhstan	1995	
Kyrgyz Republic – Moldova	1996	
Kyrgyz Republic - Russian Federation	1993	
Latin American Integration Association (LAIA)	1981	
Latvia - Norway Free Trade Agreement	1992	1996
Latvia - Sweden Free Trade Agreement	1992	1995
Latvia - Switzerland Free Trade Agreement	1993	1996
Lithuania - Norway Free Trade Agreement	1992	1996
Lithuania - Sweden Free Trade Agreement	1992	1995
Lithuania - Switzerland Free-Trade Agreement	1993	1996
Melanesian Spearhead Group (MSG)	1994	
MERCOSUR	1991	
Mexico – Nicaragua	1998	
Moldova - Bulgaria	2004	2007
Moldova - Croatia	2004	2007
Moldova - Former Yugoslav Republic of Macedonia	2004	2007
New Zealand - Singapore	2001	
North American Free Trade Agreement (NAFTA)	1994	
Pacific Island Countries Trade Agreement (PICTA)	2003	
Pakistan – Malaysia	2008	
Pakistan - Sri Lanka	2005	
Panama – Chile	2008	
Panama - Costa Rica (Central America)	2008	
Panama - El Salvador (Central America)	2003	
Panama – Singapore	2006	
Pan-Arab Free Trade Area (PAFTA)	1998	
Poland – Israel	1998	2004
Poland – Latvia	1999	2004
Poland – Lithuania	1997	2004
Protocol on Trade Negotiations (PTN)	1973	
Romania - Former Yugoslav Republic of Macedonia	2004	2007
Romania – Israel	2001	2007
Romania – Moldova	1995	2007
Romania – Turkey	1998	2007
Second Convention of Lome	1981	1986
Singapore – Australia	2003	

Slovak Republic – Estonia	1998	2004
Slovak Republic – Israel	1997	2004
Slovak Republic – Latvia	1997	2004
Slovak Republic – Lithuania	1997	2004
Slovak Republic - Romania Free Trade Agreement	1995	1997
Slovak Republic - Slovenia Free Trade Agreement	1994	1995
Slovak Republic – Turkey	1998	2004
Slovenia – Croatia	1998	2004
Slovenia – Estonia	1997	2004
Slovenia - Former Yugoslav Republic of Macedonia	1996	2004
Slovenia – Israel	1998	2004
Slovenia – Latvia	1996	2004
Slovenia – Lithuania	1997	2004
South Asian Free Trade Agreement (SAFTA)	2006	
South Asian Preferential Trade Arrangement (SAPTA)	1995	
South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA)	1981	
Southern African Customs Union (SACU)	2004	
Southern African Development Community (SADC)	2000	
Thailand – Australia	2005	
Thailand - New Zealand	2005	
Third Convention of Lome	1986	1991
Trans-Pacific Strategic Economic Partnership	2006	
Tripartite Agreement	1968	1993
Turkey – Albania	2008	
Turkey – Croatia	2003	
Turkey – Estonia	1998	2004
Turkey - Former Yugoslav Republic of Macedonia	2000	
Turkey – Georgia	2008	
Turkey – Israel	1997	
Turkey – Latvia	2000	2004
Turkey – Lithuania	1998	2004
Turkey – Morocco	2006	
Turkey – Poland	2000	2004
Turkey – Slovenia	2000	2004
Turkey – Syria	2007	
Turkey – Tunisia	2005	
US – Australia	2005	
US – Bahrain	2006	
US – Chile	2004	
US – Israel	1985	
US – Jordan	2001	
US – Morocco	2006	
US – Singapore	2004	
West African Economic and Monetary Union (WAEMU)	2000	

Appendix 2: Trade Data Compilation Method

The trade data in this paper are tabulated using a list of parts and components prepared by building on previous studies by Yeats (2001) and Athukorala (2005). Identification of trade in parts and components takes a more systematic approach following the commodity classification system by the United Nation's Broad Economic Category (BEC) as detailed below, whereas the previous studies including Yeats (2001) and Athukorala (2005) simply identify a list of components by merely focusing on the production descriptions.

The first step is to refer to the classification system of the United Nations' Broad Economic Category (BEC) and select the relevant parts and components items. The BEC classification was originally constructed in order to categorize trade data into end-use categories that are meaningful within the framework of the System of National Accounts (SNA). The broad categories approximate the three basic classes of goods in the SNA: capital, intermediate and consumers goods. The BEC includes nineteen basic categories and further subdivisions. Each category of the BEC is defined in SITC system. (http://unstats.un.org/unsd/cr/family2.asp?Cl=10). Among seven major categories, industrial supplies (BEC 2), capital goods (BEC 4), and transport equipment category (BEC 5) include a sub-category for 'parts and accessories'. However, not all items classified as parts and accessories of BEC 2, 4, and 5 correspond to parts and components in a strict sense. Therefore, only the items under the BEC sub-category that also correspond to the Standard International Trade Classification's SITC 7 (machinery and transport equipment) and SITC8 (miscellaneous manufacturing) are identified as parts and components in this paper. Limiting items to SITC 7 and 8 prevents the inclusions of some components which are traded as 'products in their own right' under specific trade names (e.g., Michelin tyres). The final list prepared though this procedure contains a total of 264 items at the 5-digit level of SITC.