Preferential trade agreements and the structure of international trade

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Abstract

In this paper we examine the impact of membership in Preferential Trade Agreements (PTAs) on trade between PTA members. Rather than considering the impact of PTA membership on the volume of trade we consider the impact of membership on the structure of trade. For a large sample of countries over the period 1962-2000 we find that membership in a PTA is associated with an increase in the extent of intra-industry trade. Our results indicate that this is especially the case for PTAs formed between richer countries, with the effects of PTAs between poorer countries found to be smaller.

Keywords: Preferential Trade Agreements, Intra-Industry Trade, Gravity Equation

JEL Classification: F10, F15

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1. Introduction

In the last two decades there has been a proliferation in the number of Preferential Trade Agreements (PTAs).[1] According to Urata and Okabe (2009) the number of PTAs reported to the WTO was 25 in 1990, 91 in 2000 and 194 in 2007. For a long time most PTAs were regional in focus with members being geographically close to each other, as for example the European Union (EU) and the North America Free Trade Agreement (NAFTA). More recently however countries or regional blocs have signed PTAs with geographically distant partners and partners at differing levels of economic development.[2] Moreover, regional groupings have also become more diverse in terms of the development levels of their members, as for example the Association of Southeast Asian Nations (ASEAN).

As discussed in the literature (see for example Viner, 1950) there is a trade-off involved when discussing the benefits of PTA membership. On the one hand, there is a *trade creation* effect that comes from the elimination in distortions between the relative prices of domestic goods and those of other members. On the other hand, there exists the potential for a *trade distortion* effect due to the introduction of distortions between the relative prices of member and non-member goods. By now a large number of empirical papers have addressed the issue of whether membership in a PTA creates trade between members (see Section 2 below). A related issue that has been addressed is whether trade diversion is also an outcome of the presence of a PTA; that is, is trade between a member and a non-member reduced as a result of the presence of the PTA? These issues have usually been addressed using the gravity equation, with the results being mixed depending upon the sample, the time period, the specification of the gravity equation and the particular PTAs considered.

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[1] In what follows we take Preferential Trade Agreements (PTAs) to mean any preferential access for members of such an agreement.

[2] For example, the US has signed agreements with Israel (1985), Jordan (2002), Australia (2004), Morocco (2005) and Peru (2009), while the EU has signed agreements with Turkey (1996), the Faroe Islands (1997), the Palestinian Authority (1997), Tunisia (1999), South Africa (2000), Morocco (2000), Israel (2000), Mexico (2000), Chile (2004), Algeria (2006) and Cote d'Ivoire (2008).

To date the vast majority of papers considering PTAs have concentrated on the issue of whether trade creation and/or trade diversion effects of PTAs are present, usually using data on total bilateral trade or total exports as the variable of interest and dummies for the presence (or absence) of a PTA between two countries. There are very few papers that consider *how* PTAs affect trade however, recent exceptions being Urata and Okabe (2009) who examine the impact of PTAs on industry-level trade and Egger et al. (2008) who consider the effect on the structure of trade.

In this paper, rather than examine whether PTA membership affects the level of trade between members (as well as between members and non-members) we examine whether membership in PTAs is associated with a change in the structure of trade between members. As discussed by Egger et al. (2008) this issue has been largely ignored to date in the empirical literature. Yet the issue of whether joining a PTA stimulates gains due to specialisation, i.e. inter-industry trade, or to gains from scale economies and product differentiation, i.e. intra-industry trade, would seem to be an important one when considering the benefits of PTAs and the question of which countries should form a PTA. In particular, if most of the growth in trade due to the presence of a PTA is attributable to intra-industry trade, then we may expect that the resource reallocation effects in the short to medium run would be lower than if inter-industry trade was most affected, since the change would require little inter-industry factor movements. In this paper, we examine whether membership in PTAs has a significant impact upon the popular Grubel–Lloyd index of intra-industry trade (IIT) in a gravity framework. To examine this issue we use data from Feenstra et al. (2005) on up to 168 countries over the period 1962-2000[3]. Our paper differs from that of Egger et al. (2008) in a number of ways. Firstly, while Egger et al. (2008) focus on a sample of largely

[3] This number includes countries no longer in existence (e.g. Czechoslovakia, ex-Yugolslavia) along with the countries that replaced them (e.g. Czech Republic, Slovakia).

developed countries and a limited number of PTA episodes the current paper employs data on a large sample of both developed and developing countries and a longer period of time, thus capturing a larger number of PTAs. It is usually thought that while IIT is particularly important for trade between developed countries, it is less relevant for North-South and South-South trade. By including both developed and developing countries in the sample we are able to examine whether the results found for developed countries by Egger et al. (2008) also hold in a broader sample. Secondly, while Egger et al. (2008) make use of matching techniques we employ the familiar gravity equation, taking account of the comments of Baldwin and Taglioni (2006) when specifying the gravity equation to deal with possible endogeneity. We employ the gravity model since the vast majority of the existing literature uses the gravity model, thus making our results comparable. Thirdly, the approach adopted by Egger et al. (2008) only allows one to consider the contemporaneous effects of PTAs on IIT. Given that it may take some time for the effects of PTA membership to filter through to trade structure it may be more appropriate to use the gravity model that can account for the longer-term effects of PTAs on trade structure. Fourthly, an important difference between our paper and the Egger et al. (2008) paper is that we search for a non-linear relationship between PTA presence and IIT, testing for non-linearities based on trade partner's relative levels of development. Such non-linearities are suggested by the theoretical literature (see for example, Bergstrand, 1990) and allow us to examine whether there are differences in the impact of PTA membership on IIT for partners at different levels of development. Our results indicate that membership in a PTA is associated with an increase in the extent of IIT. In addition, we find that the effect of PTA membership on IIT is larger when a PTA is formed between two developed countries.

The remainder of the paper is set out as follows. Section 2 reviews the existing evidence on the impact of PTAs, while Section 3 discusses our main hypotheses, our empirical approach and the data used. Section 4 discusses our main results and Section 5 reports some robustness results. Section 6 concludes.

2. Existing Evidence on the Impact of PTAs

The gravity equation has been developed as the standard tool to estimate the effects of PTAs on trade between members (early studies include Tinbergen, 1962 and Aitken, 1973). A dummy variable taking the value one if two countries are both members of a PTA is included in the gravity equation and used as an indicator of the effect of PTA membership on trade flows between member countries (i.e. trade creation effects). A number of extensions to this standard methodology have been considered. One such extension has been to consider specific PTAs rather than bundling them all into one dummy variable by constructing PTA dummies for each of a number of specific PTAs. This allows one to examine the impact on trade flows of specific PTAs.

Using such an approach has lead to mixed results. Aitken (1973), Abrams (1980) and Brada and Mendez (1983) for example found membership in the European Community to have a positive and significant effect on trade flows among members, while Bergstrand (1985) and Frankel et al. (1995) found insignificant effects. Frankel (1997) finds a positive impact from the Southern Common Market (MERCOSUR) membership, insignificant effects from membership in the Andean pact, and occasionally negative effects from membership in the European Community. In a recent paper, Medvedev (2010) argues that using data on total trade – as is commonly done in the literature – is a poor proxy for preferential trade, and that when using a measure of preferential trade the estimated effect of PTAs is found to rise. He shows further that the trade creating effects of PTAs are largest for South-South agreements and smallest (and insignificant) for North-North agreements.

A number of studies have also attempted to examine the potential trade diversion effects of PTAs by including binary variables that take the value one if only one member of a country pair belongs to a PTA. Frankel et al. (1996) for example, estimate a gravity model of trade among 63 countries in the period 1965-1992 with a dummy variable for different PTAs included. Trade creation effects are found in the cases of the European Community, MERCOSUR, the Andean Pact, ASEAN and Australia New Zealand Closer Economic Agreement (ANZCERTA). Introducing dummy variables to represent trade between PTA members and non-members they find mixed results. Trade diversion effects are found in the case of European Free Trade Area (EFTA), NAFTA and ANZCERTA, but in other cases (ASEAN, MERCOSUR, Andean Pact, European Community) the coefficient on the dummy is positive, suggesting that the trade bloc lowered its external barriers at the same time as it liberalised internally, a phenomenon often termed *open bloc trade creation*.

A further extension of the literature has been to deal with the potential endogeneity of the PTA variable: membership in PTAs is likely to be endogenous as countries self-select into PTAs for reasons related to the level of trade for example. Baier et al. (2008) have noted that the issue of endogeneity has received very little attention in the literature with few studies (exceptions being Baier and Bergstrand, 2002, and Magee, 2003) using instrumental variables or Heckman control functions to address this issue (often with mixed results). They go on to argue that panel regression may be a better solution to address this issue, either through the use of first differences (Bayoumi and Eichengreen, 1997) or country-pair fixed effects (Cheng and Wall, 2002).[4] Baier et al. (2008) use a fixed effects panel model to examine the impact of the EU, EFTA, European Economic Area (EEA) and all other PTAs using data on 96 countries within the period 1960-2000. When using bilateral fixed effects (with and without time effects) to

[4] Baier and Bergstrand (2009a) adopt both approaches.

account for endogeneity the coefficient estimates are all plausible and statistically significant. For each of the European agreements, trade is found to increase by at least 75%. Overall, the estimates are much larger than existing estimates. They go on to include time-country fixed effects to account for the time-varying multilateral price terms of Anderson and van Wincoop (2003).[5] This tends to lower the estimated effects of the European trade agreements, but with the exception of EFTA, the effects are still substantial.

Baier and Bergstrand (2004) find evidence that country-pairs that have PTAs tend to share similar characteristics. In particular they find that two countries are more likely to have a PTA the larger and more similar their GDPs are, the closer they are to each other but the more remote the pair are from the rest of the world, and the wider (narrower) the difference in their relative factor endowments with respect to each other (rest of the world). Using this information Baier and Bergstrand (2002) use an instrumental variables estimator to examine the impact of PTAs on trade for the year 2000, but find that the exogeneity of the instruments has to be rejected. A Heckman control function approach also does not solve the problem of endogeneity, with the results found to be very unstable.

An alternative method for dealing with one aspect of endogeneity – selection bias – is to use matching econometrics. This is the approach adopted by Baier and Bergstrand (2009b) who match country pairs with PTAs to virtually identical country pairs without PTAs, based on a set of common economic characteristics. The average effect of the treated (i.e. country pairs with PTAs) and the untreated are then compared. They again find coefficients that tend to be larger than those in the literature that don't account for endogeneity, with the average long-run effect of a PTA being to increase trade by 100%.

[5] Anderson and van Wincoop (2003) note that theory indicates that trade between two countries is decreasing in their bilateral trade costs *relative* to the average of the costs of the two regions to trade with all their partners, rather than to absolute trade barriers. This they refer to as multilateral resistance.

All of the above papers consider the effect of PTA membership on trade volumes. A small number of papers however also consider the issue addressed in this paper, namely the effects of PTA membership on the structure of trade. Egger et al. (2008) examine the presence of new PTAs on the popular Grubel–Lloyd index[6] of IIT. Egger et al. (2008) were also concerned about an endogeneity problem when considering the structure of trade and so employ matching and difference-in-difference analysis on a sample of mainly OECD countries. Endogeneity is likely to be an issue since a number of the determinants of PTAs found by Baier and Bergstrand (2004), most notably that country-pairs with larger and more similar real GDPs have a higher probability of forming a PTA, are also related to the level of IIT. Egger et al. (2008) find a positive effect on intra-industry trade shares of new PTA membership, with new membership in a PTA found to increase intra-industry trade by around 4%. From the results they conclude that the often found positive effect of PTA membership on the volume of trade can be mainly attributed to the growth in IIT. Ekanayake (2001) employs a gravity-type equation to examine the determinants of IIT between Mexico and its major trading partners and finds that participation in PTAs has a positive impact on IIT. Kim and Lee (2003) examine the impact of MERCOSUR on the levels of IIT amongst its members.[7] They construct the Grubel–Lloyd indicator of IIT over the 1990s and find that the levels of IIT increased dramatically following the establishment of MERCOSUR. While this was true for trade with all partners the effect was more pronounced for trade with partners that were also members of MERCOSUR. Rodas-Martin (1998) calculated measures of both IIT and revealed comparative advantage among Central American countries in 1994 and found that there were generally low levels of IIT and the presence of many products with high levels of revealed comparative advantage.

[6] They also consider an adjustment to this index that accounts for trade imbalances.

[7] Grubel and Lloyd (1975) also showed that the level of IIT increased after the formation of the Organisation for European Economic Cooperation (OEEC) and the European Economic Community (EEC).

Martincus and Estevadeordal (2009) consider a related issue, concentrating on the specialisation patterns of ten Latin American countries over the period 1985-1998, arguing that these countries are good examples to consider as they have engaged in both unilateral trade liberalisation programs and regional integration. The authors use sectoral value-added data to construct indicators of specialisation and construct most-favoured-nation (MFN) and preferential tariffs to identify a country's trade policy. Their results suggest that reducing MFN tariffs is associated with increasing production specialisation. In addition, they find that bilateral preferential trade liberalisation and differences in the degree of unilateral openness have resulted in increased dissimilarities in manufacturing production structures across countries. Such results would point to the opposite conclusion reached by Egger et al. (2008), with the increasing dissimilarity of countries suggesting greater inter-industry trade flows.

3. Method and Data

3.1. Model Specification

We follow the majority of the literature considering the relationship between PTAs and trade volumes by using the gravity model to examine the effects of PTAs on IIT. A number of other papers have used this model when considering the structure of trade. Ekanayake (2001) for example employs a gravity-type equation to examine the determinants of IIT between Mexico and its major trading partners. He finds that the gravity determinants tend to operate in the same way as for the value of trade, with distance having a negative impact upon IIT and a common border, common language and participation in PTAs having a positive impact. In his model he also includes other variables, such as differences in per capita income and economic size. Caetano and Galego (2007) also estimate a gravity-type model to explain IIT among CEECs and the EU, replacing physical distance with a measure of economic distance (from the EU-15 average).

As discussed by Baier and Bergstrand (2002), two common forms of the gravity equation have been estimated,

$$EXP_{ij} = \beta_0 + \beta_1 GDP_i + \beta_2 GDP_j + \beta_3 POP_i + \beta_4 POP_j + \beta_5 DIST_{ij} + \beta_6 LANG_{ij} + \beta_7 ADJ_{ij} + \beta_8 LOCK_{ij} + \beta_9 PTA_{ij} + \varepsilon_{ij} \quad (1)$$

or,

$$TRADE_{ij} = \beta_0 + \beta_1 (GDP_i \times GDP_j) + \beta_2 (POP_i \times POP_j) + \beta_3 DIST_{ij} + \beta_4 LANG_{ij} + \beta_5 ADJ_{ij} + \beta_6 LOCK_{ij} + \beta_7 PTA_{ij} + \varepsilon_{ij} \quad (2)$$

where EXP_{ij} is the value of merchandise imported by country *j* from exporter *i*, GDP_i (GDP_j) is the level of nominal gross domestic product of country *i(j)*, POP_i (POP_j) is the level of population in country *i(j)*, $DIST_{ij}$ is the distance between economic centres of countries *i* and *j*, $LANG_{ij}$ is a binary variable equal to one if countries *i* and *j* share a common language, ADJ_{ij} is a binary variable equal to one if countries *i* and *j* share a common border, $LOCK_{ij}$ is a variable accounting for whether none, one or both countries are landlocked, and PTA_{ij} is a binary variable equal to one if countries *i* and *j* have a preferential trade agreement. In the second specification the value of exports from *i* to *j* is replaced by the total level of trade (i.e. imports plus exports) between the country pair, $TRADE_{ij}$.[8] All variables with the exception of the dummy variables are usually included in log-form.

The starting point for our analysis therefore is the following equation;

$$TRADE_{ijt} = \beta_0 + \beta_1 (GDP_{it} \times GDP_{jt}) + \beta_2 (POP_{it} \times POP_{jt}) + \beta_3 DIST_{ij} + \beta_4 LANG_{ij} + \beta_5 ADJ_{ij} + \beta_6 LOCK_{ij} + \beta_7 PTA_{ijt} + \varepsilon_{ijt} \quad (3)$$

[8] In the former case one is able to examine the coefficients on the level of GDP and population for the exporter and importer separately, while in the latter one considers the product of countries i and j's the GDPs and populations. Considering these variables separately for countries i and j in this case makes little sense as the ordering of the data will determine whether a particular country is classified as the exporter or importer.

where *TRADE* now refers to either the logged level of total trade between country *i* and *j*, or the level of our indicator of the extent of intra-industry trade (i.e. the. Grubel–Lloyd index), and the addition of the *t* subscript is due to the panel nature of our regression model. The variable definitions are all as described above, with $LOCK_{ij}$ taking on the value 0, 1 or 2 depending on whether none, one or both countries are landlocked respectively. There has been a great deal of debate in the literature on the appropriate specification of gravity models in a panel context (see Matyas, 1997; Egger, 2000; Baldwin and Taglioni, 2006), which lead us to make a number of modifications to equation (3). We include a set of time dummies to take account of bilateral-pair invariant time-specific effects in all of our regressions. We further adopt the recommendation of Baldwin and Taglioni (2006) who argue that one way of dealing with the time-varying multilateral price terms is to include time-varying country dummies. It can be shown that the inclusion of country dummies removes the correlation between the cross-country price term and the included variables, but does not remove the cross-time correlation. As argued by Baldwin and Taglioni (2006) however, the inclusion of time-varying country effects is appropriate. With such a large number of countries and time periods there are a large number of country-year dummies to include, making it difficult for us to estimate such a gravity model with the software and computing power available to us. As such, we proceed to construct for each country in our data set a dummy variable for each five-year period, meaning that rather than include up to 39 dummies for each country, we include a maximum of eight. The inclusion of such dummies should also help account for other time-varying factors that may determine the timing of PTA formation, such as bargaining costs and political feasibility. Baldwin and Taglioni (2006) go on to argue that while country-time dummies help address the problem of the multilateral resistance term they do not remove the bias resulting from the correlation between included determinants of bilateral trade and unobservable determinants. As such, in further specifications we also adopt their solution of including time-invariant country-pair dummies in our gravity model. The inclusion of bilateral-pair fixed effects means that we cannot estimate the coefficients on time-invariant variables such as distance. Our estimating equation in this case becomes therefore,

$$TRADE_{ijt} = \beta_1(GDP_{it} \times GDP_{jt}) + \beta_2(POP_{it} \times POP_{jt}) + \beta_3 PTA_{ijt} + \delta_t + \sigma_{it} + \varphi_{jt} + \omega_{ij} + \varepsilon_{ijt} \quad (4)$$

where δ_t and ω_{ij} refer to the time and bilateral-pair fixed effects, and σ_{it} and φ_{jt} refer to the country-time dummies as described above.

In addition to examining the importance of PTAs for total trade and trade structure in general, we also consider the trade creation effects of specific PTAs. To account for trade creation effects we include a set of dummies for particular PTAs. The PTAs we consider are the same as used by Eicher et al. (2004).[9] The regression model with bilateral-pair and country-time fixed effects in this case is thus,

$$TRADE_{ijt} = \beta_1(GDP_{it} \times GDP_{jt}) + \beta_2(POP_{it} \times POP_{jt}) + \sum_{s=1}^{11} \varphi_s PTA_{sijt} + \delta_t + \sigma_{it} + \varphi_{jt} + \omega_{ij} + \varepsilon_{ijt} \quad (5)$$

3.2. Data

Data on the GDP and population of the importer and exporter are from the *World Development Indicators* (World Bank, 2008) data set. Data on distance, common language and adjacency are from CEPII[10]. The data on the landlocked variable is constructed based on data from Wikipedia[11]. Data on PTAs is taken from the WTO website[12] (accessed at various dates) and

[9] These are the Association of South-East Asian Nations (AFTA), Australia-New Zealand Trade Agreement (ANZCERTA), Asian Pacific Economic Cooperation (APEC), Andean Pact (AP), Central American Common Market (CACM), Caribbean Community (CARICOM), European Economic Area (EEA), European Free Trade Agreement (EFTA), European Union (EU), Latin America Integration Agreement (LAIA), Southern Cone Common Market (MERCOSUR) and the North America Free Trade Agreement (NAFTA).
[10] http://www.cepii.fr/anglaisgraph/bdd/distances.htm
[11] http://en.wikipedia.org/wiki/Landlocked
[12] http://rtais.wto.org/UI/PublicAllRTAList.aspx

complemented with information from Baier et al. (2008) and Wikipedia.[13] The PTA dummy variable is defined as equal to one if exporter and importer were in any one of the PTAs listed on either the WTO website or one of the alternative sources. Finally, the trade data is taken from the data set of Feenstra et al. (2005), which reports data on imports and exports at the SITC four-digit level (around 1,000 categories) over the period 1962-2000. In our analysis we follow the approach of Baldwin and Taglioni (2006) and use nominal data on trade and GDP alongside time dummies, which they argue gets around the problem of deflating trade values and GDP back to a common year. We also adopt the common approach of excluding observations for which the value of trade is reported as zero.[14] This approach implies that we don't have to distinguish between cases where IIT is zero due to there being no trade and cases where there is no IIT.

To measure the extent of IIT we use the popular Grubel–Lloyd index.[15] We follow Egger et al. (2008) and formulate the Grubel–Lloyd index (GLI) of intra-industry trade as,

$$GLI_{ijt} = \sum_k \frac{2\times\min\left(export_{ijkt}, import_{ijkt}\right)}{\sum_k export_{ijkt} + \sum_k import_{ijkt}} \tag{6}$$

where *i* and *j* refer to countries and *k* refers to industries or product categories. The measure is an indicator of the intensity of IIT between country *i* and *j* in period *t*. The index takes on values between 0 and 1, with higher values indicating more IIT.[16] This index is often adjusted to take account of the fact that goods trade can be unbalanced due to profit repatriation (see for example

[13] The reason for considering alternative sources is that the WTO data set only includes PTAs in force, thus excluding a number of PTAs that are no longer in force, but that would have been in the period of interest, examples being the PTAs agreed between the EU-15 and Romania, Bulgaria and others in the 1990s, but which are no longer in force now that these countries are members of the EU.

[14] A number of other approaches have been suggested including Tobit estimation and adding one to the value of trade, which then allows one to calculate the log of trade. More recently, Helpman et al (2008) have proposed a two-stage estimation procedure. In the first stage a Probit model is estimated relating the probability of country *j* exporting to country *i* as a function of observables. Predicted components of this equation are then used in the second stage to estimate the gravity equation in log-linear form. Santos and Tenreyro (2006) have proposed a Poisson Pseudo Maximum Likelihood estimation technique which is consistent in the presence of heteroscedasticity and also provides a natural way of dealing with zero observations.

[15] See Grubel and Lloyd (1971 and 1975).

[16] The measures of IIT are calculated at the four-digit level. The paper thus uses more disaggregated data than is often used in the literature, which tends to use data at the one- or two-digit level.

Grubel and Lloyd, 1971, and Egger et al., 2008). The corrected index (CGLI) is calculated as follows,

$$CGLI_{ijt} = \sum_k \frac{2\times \min\,(export_{ijkt}, import_{ijkt})}{\sum_k export_{ijkt} + \sum_k import_{ijkt} - \left|\sum_k export_{ijkt} - \sum_k import_{ijkt}\right|} \qquad (7)$$

4. Results

The initial results are split into 2 subsections. The first subsection reports the results when we include a dummy for the presence of a PTA between country pairs; the second considers the twelve PTAs considered by Eicher et al. (2004) separately and examines how the structure of trade has been affected by each of these PTAs.

4.1. PTAs and the Structure of Trade

The first three columns of Table 1 report the results for total trade, GLI and CGLI respectively from pooled regressions, where only time dummies are included, the second three columns report results when including country-time fixed effects alongside time dummies, while the final three columns report the results when including time, country-time and bilateral-pair fixed effects in the regression model.[17]

In column (1) we see that the coefficients on the majority of the gravity determinants are as expected, with a negative coefficient on distance (slightly smaller in absolute value than the usual coefficient of around minus one) and landlockedness, and positive coefficients on the common border and common language dummies. The coefficients on the product of the GDP's are

[17] Given the fact that a large number of the observations on GLI and CGLI are zero (i.e. we have a corner solution problem, see Wooldridge, 2009) we also estimate our gravity equation using a Tobit model, as done in a gravity context by Felbermayr and Kohler (2006) for example. The results we obtain using the Tobit model are consistent with those reported, and are thus excluded from the paper for brevity. These results are available upon request however. It would also be possible to adopt the approaches of Helpman et al (2008) and Santos and Tenreyro (2006) mentioned in footnote 14 to consider the issue of zero values of the IIT index.

positive, with a value around one, as expected, and we obtain small, negative (but significant) coefficients on the product of the importer's and exporter's populations. Finally, the coefficient on the PTA dummy is positive and significant, indicating significant trade creation effects. The size of the coefficient is in line with estimates in the literature (see for example, Baier and Bergstrand, 2002). When considering the GLI and CGLI indices of IIT we find coefficients on the gravity determinants that are consistent, in terms of sign and significance, with those for total trade (except for landlocked, which varies in sign and tends to be insignificant). The coefficients on the PTA variable are also found to be positive and significant, indicating that countries sharing a PTA tend to engage in higher levels of intra-industry trade.

The results in the second and final three columns of the table are largely consistent with those reported in the first three columns. The coefficients on the product of the GDPs remain positive and significant, though in column (7) the size of the coefficient is about half the size of that in column (1), while the coefficients on the product of the populations tend to remain negative and significant, except in column (7) where the coefficient becomes positive and significant. The coefficients on the PTA dummies are again positive and significant for both total trade and GLI and CGLI. Interestingly, while the coefficients on the PTA variable in columns (4-6) are similar to those reported in columns (1-3), they are somewhat different in columns (7-9). In particular, when considering total trade the coefficient is larger than that reported in column (1), consistent with findings in other studies (e.g. Baier et al., 2008), while the coefficients on the PTA dummies when considering GLI and CGLI are somewhat smaller than the corresponding results in columns (2) and (3), though they remain highly significant.

The coefficient estimates when considering the level of trade (columns (1), (4) and (7)) range from 0.308 to 0.538 depending on which set of fixed effects are included, and imply that the formation of a PTA will increase trade between member countries by between 36 and 71%, holding other factors constant.[18] While the former value is lower than those often found in the literature, the latter value is very close to the estimate obtained by Baier and Bergstrand (2009a). Consistent with much of the recent literature the coefficient estimate tends to increase once endogeneity is correctly accounted for (i.e. column (7)). In terms of IIT the coefficient estimates indicate that entering a PTA will increase IIT between members by between 2 and 3.5 percentage points.[19] These figures are somewhat smaller than those found by Egger et al. (2008) – who found a figure of around 4% – and may reflect the different methodology employed or the broader sample of developed and developing countries used in the current study. In contrast to the results for the level of trade, in the case of IIT the effect of PTAs is found to be smallest when we adequately account for endogeneity (i.e. columns (8) and (9)). It is difficult to explain why this difference arises when accounting for the natural trading partner effect. With regard to the trade effect however one possible argument is that the trade creating effect of PTAs is greater between non-natural trade partners, implying that the coefficient on PTAs would increase once the endogeneity was accounted for.[20] One argument that may explain the results on IIT would be that non-natural trading partners also tend to be dissimilar in other respects. When accounting for the natural trading partner effect we may expect a lower coefficient on PTAs therefore, since more dissimilar economies would tend to engage in IIT to a lesser extent. This is suggested by Bergstrand (1990) who shows that IIT is decreasing with greater inequality in relative capital-labour endowment ratios, per capita income, economic sizes and average tariff levels.

4.2. Trade Creating and Diverting Effects of Specific PTAs

Rather than lumping all PTAs together in one dummy variable it may be interesting to examine the impact of specific PTAs on trade and the structure of trade. This could, for example, provide

[18] This is calculated as $(e^{\beta_{PTA}} - 1)$.

[19] Since the IIT variable varies between zero and one we can interpret the coefficients on the PTA variable as the change in the share of IIT in total trade.

[20] It would be interesting therefore to examine empirically whether the trade-creating effects of PTAs are stronger between close or more distant trade partners. As far as we know this hasn't been attempted to date.

insights into whether PTAs between rich countries produce greater trade creation effects or greater trade structure effects. To consider this we introduce dummies for each of the twelve PTAs considered by Eicher et al. (2004) and examine the coefficients on the dummies for both total trade and the measures of IIT. The results are reported in Table 2. Once again the first three columns report the pooled results where no country effects are included, the second three include country-time and time effects, and the final three columns include country-time, time and bilateral-pair fixed effects.

The coefficients on the gravity determinants in Table 2 are largely consistent with those from Table 1, and so we turn immediately to the results on the PTA variables. In column (1) we find positive and significant trade creation effects for seven of the 12 PTAs (ANZCERTA, APEC,AFTA, CACM, CARICOM, EFTA and MERCOSUR) and negative and significant effects for two (EEA and NAFTA). The results in columns (4) are largely similar, though the coefficient on the EU PTA becomes negative and significant. The results in column (7) are somewhat different with the coefficients on EU and LAIA now becoming positive and significant, while those on NAFTA and ANZCERTA are now insignificant. When considering the impacts of specific PTAs on IIT (columns (2) and (3)) we find positive and significant coefficients in all cases that report positive trade creation effects in column (1), as well as the cases of the EU and NAFTA, indicating that members of these PTAs engage in greater IIT between themselves. For AP and LAIA we find some evidence of a negative effect of PTA membership on IIT. The implication for these two PTAs is that the benefit in terms of trade of being a member of these PTAs arises due to increases in specialisation and inter-industry trade. The results when including the alternative sets of dummy variables (columns (5-6) and (8-9)) are largely consistent with those in columns (2-3).

To help summarise these results Table 3 reports the average change in our measures of trade (i.e. the log of bilateral trade, GLI and CGLI) for each of the PTAs considered (columns (1-3)) along with the average change in our measures of trade (columns (4-6)) and the range of estimates reported in Table 2 (columns (7-9)).[21] Considering the estimated effects on the level of trade when we look at the lower bound of the estimates we find negative effects in the case of ANZCERTA (-20%), EEA (-10%), EU (-10%), LAIA (-8%) and NAFTA (-54%), though with the exception of ANZCERTA – for which the coefficient is not significant anyway – these negative effects are found when we do not account for endogeneity. Considering the upper bounds we tend to find trade creating effects of between zero and 120%, which is consistent with much of the recent literature on PTAs and trade. The effects are found to be relatively low for NAFTA (3.5%) and high for ANZCERTA (91%) and MERCOSUR (113%). In some cases we find much larger effects, examples being APEC (240%), AFTA (431%), CACM (747%) and CARICOM (3893%). Such results are consistent with the result of Medvedev (2010) that South-South agreements tend to provide the largest trade creation benefits. It should be noted however that all of these estimates are obtained from regressions where we don't account for endogeneity adequately and so are likely to be biased. When considering the level of IIT we find relatively large effects for ANZCERTA, EU and NAFTA, and to a lesser extent MERCOSUR, CACM and CARICOM. The first three of these agreements involve mainly high-income countries, while the latter ones also involves countries at largely similar income levels, as defined by the World Development Report (World Bank, 2000). The possibility of differential effects of PTAs on both trade and IIT due to differences in partner's levels of development is something to which we now turn.

4.3. A Non-Linear Effect of PTAs on IIT?

[21] To be consistent with the estimates for GLI and CGLI we report the estimated percentage increase in the level of trade following membership in one of the PTAs. This is calculated as in footnote 17.

The results presented in the previous section suggest that the presence of PTAs can have a different effect on trade and IIT for different country-pairs. A number of arguments suggest that such differences may be related to the (relative) levels of development of PTA partners, as measured by per capita income. In particular, differences in per capita income may represent differences in tastes, as suggested by Linder (1961), with IIT being lower for countries exhibiting such differences. Alternatively, differences in per capita income across countries may be interpreted as differences in capital-labour ratios (see for example, Helpman and Krugman, 1985). Similar arguments can be employed when considering the level (or product) of trade partner's per capita income: Trade partners with a higher product of per capita income may engage in IIT to a greater extent due to their higher level of development and having a higher demand for differentiated products, or because their higher capital-labour ratios result in greater trade in differentiated products.

Such arguments suggest that the formation of a PTA between country-pairs with large differences in per capita income may reduce the extent of IIT, while PTAs formed between pairs with a higher per capita income may increase the extent of IIT. Globerman (1992) argues however that the formation of a PTA between country-pairs with dissimilar per capita income may increase the potential for IIT. Globerman's explanation for this is that developing countries have suffered from high levels of industrial concentration and made scant use of economies of scale, such that developing countries would benefit from the powerful stimulus toward rationalisation of production provided by free trade. Mexico, for example, has experienced a rapid increase in IIT since the late 1980s and has simultaneously seen trade links with the United States increasing following the implementation of various stages of the NAFTA agreement. As a result, the elimination of tariff barriers and Mexico's relatively low labour costs have led to the setting up of the '*maquiladora* ' in the border region, which are devoted to the assembly and reexport of goods. Among them, the scope for IIT in manufactured goods is much higher than other goods.

The discussion above has been formalised by Bergstrand (1990) and Bergstrand and Egger (2006) who develop a theoretical model of the determinants of bilateral intra-industry trade. In Bergstrand (1990) consumers maximise utility across two goods: a homogenous non-manufactured commodity and a differentiated manufactured product. This yields a bilateral import demand function where demand depends on national income, per capita income, prices, transport costs, exogenous tariffs and the exogenous exchange rate. Firms maximise profits in a Chamberlain monopolistic competition framework using capital and labour as inputs, which results in a mark-up pricing function. Under the full employment assumption for capital and labour the number of firms in equilibrium can be derived. Multiplying the number of firms by the respective output and applying this function in the bilateral Grubel–Lloyd index results in a rather complex function allowing one to study the effects of changes in various variables on IIT.

Based on this model Bergstrand (1990) develops a number of propositions, including the proposition that the share of IIT between two countries is lower the greater their average tariff level (Proposition 8). This is in line with the findings already reported in Table 1: namely that PTAs have a positive effect on our measures of IIT. The model also has implications for the degree of IIT between dissimilar countries and country-pairs with a high per-capita income. In terms of the former, Bergstrand (1990) shows that the share of IIT will be lower between dissimilar countries, as measured by differences in per capita GDP. On the one hand, this holds because countries with different levels of per capita income also exhibit different capital-labour ratios, and as shown by Helpman (1981) such differences lead to lower levels of IIT. On the other hand, larger differences in per capita income imply differences in tastes, which also reduce the extent of IIT.[22] In terms of the average level (or product) of per capita income, the model of Bergstrand (1990) is more ambiguous, as there is an 'uncoupling' of per capita income and the capital-labour ratio. To the extent that per capita income differences capture differences in capital-labour ratios, country-pairs with a higher average per capita income can have either higher or lower shares of IIT, depending upon the factor intensity of the two products. If the differentiated product is capital-intensive then it can be shown that IIT will be higher between countries with a higher average per capita GDP, but if the differentiated product is labour-intensive then IIT between countries with a higher average income will be lower. While for specific industries Bergstrand (1990) is able to show that a higher capital-labour ratio is associated with reduced IIT, at the aggregate level it is more likely that a higher capital-labour ratio would be associated with increased IIT however. Bergstrand (1990) also shows that IIT will be higher in country-pairs with higher average levels of development. This is due to the assumption that the differentiated product is the luxury good, with a higher average income increasing the volume of trade in the differentiated product.

To consider the possibility of a non-linear relationship between PTAs and IIT we include interactions between the PTA variable and both the product of the country-pairs' per capita income (*GDPPCPROD*) and the (absolute) difference in per capita GDP between country pairs (*GDPPCDIF*). We re-estimate the regression models in Table 1 including these interaction terms. The results when including these interactions are reported in Tables 4-6, with Table 4 including the interaction with *GDPPCPROD*, Table 5 the interaction with *GDPPCDIF* and Table 6 both interactions.

The results in Table 4 indicate that the positive effect on trade volumes of PTAs still remains, though the effect is lower for country-pairs characterised by a higher per capita income as indicated by the significantly negative coefficient on the interaction term. This result is found to

[22] This result is consistent with Markusen (1986).

be robust across the various specifications. With respect to IIT we find a significant negative coefficient on the PTA variable and a positive and significant one on the interaction term. This negative effect has to be interpreted with care however. In column (8) the effect of a PTA on IIT becomes positive at a logged product of per capita GDP of around 3.92. The values of the product of the GDPs range between 7.75 and 21.36, indicating that the effect of PTAs on IIT is always positive, but becomes stronger for higher values of per capita GDP. This indicates that the formation of a PTA between two rich countries has a greater impact on IIT than one formed between two poor countries. Such a result is in line with those reported in Section 4.2.

In Table 5 we present result when including the interaction between PTAs and *GDPPCDIF*. In all specifications the effect of PTAs on either trade or IIT is positive and significant (with one exception). With respect to trade the results suggest that the trade creating effect is larger the more similar countries are as indicated by the negative coefficients on the interaction term. With respect to IIT however we find positive and significant effects suggesting that the more dissimilar countries are in terms of GDP per capita the higher is the effect of PTAs on IIT. This result is at odds with the results of Bergstrand (1990) which suggests that the share of IIT is lower the greater the inequality between the per capita income of country-pairs, due to greater inequality in relative capital-labour ratios and greater inequality in tastes.[23] These results change however when including the interaction of the PTA variable with both *GDPPCPROD* and *GDPPCDIF* as reported in Table 6. Here we find a positive coefficient on the PTA variable for the volume of trade and negative coefficients for IIT, with the coefficients significant in all but one case. The coefficients on *GDPPCPROD* are consistent with those reported in Table 4, with negative coefficients on this interaction for the volume of trade and positive coefficients on the interaction for IIT. When including the interaction with *GDPPCDIF* alongside that with *GDPPCPROD* we find a positive and significant coefficient on the *GDPPCDIF* interaction for the volume of trade and negative coefficients on the interaction for IIT. This latter result is

[23] The results are consistent with the arguments of Globerman (1992) however.

consistent therefore with the theoretical results of Bergstrand (1990) suggesting that countries with different levels of per capita income engage in less IIT due to differences in capital-labour ratios and tastes.

6. Conclusions

Over the past two decades there has been a proliferation in the number of PTAs. Originally PTAs were agreed with geographically close countries as well as countries with similar levels of income, but more recently PTAs have been agreed with more geographically diverse countries and countries at highly different levels of development. Empirical research over the past fifteen years or so has shown that the effects of the formation of such PTAs has been to create trade between PTA members. The evidence on whether such PTAs divert trade from non-members to members of a PTA is more mixed, but some evidence at least exists to suggest that such effects may be present. What has largely been neglected in the empirical literature to date is the question of how such trade creation and diversion effects occur.

In this paper we add to the literature by examining for a large panel of countries the extent to which PTA membership affects the structure of trade, and in particular whether membership affects the extent of IIT. Our results suggest that the formation of a PTA is associated with an increase in IIT between PTA members. When considering individual PTAs we again find that with only a couple of exceptions the effect of PTA membership on IIT is positive. The cases in which a negative effect is found are for lower- and middle-income Latin American countries, while the largest positive effects tend to be found for PTAs between advanced, high-income countries. Our results also indicate the presence of non-linear effects in the relationship between PTA presence and IIT. In particular, we find that the impact of PTA presence on IIT is stronger when the two trade partners are developed countries. Much of the observed effect of PTAs on

IIT would therefore seem to be driven by PTAs agreed between developed countries. When considering non-linearities due to differences in per capita GDPs the results are more mixed, but tend to suggest that the formation of a PTA between dissimilar countries has a negative effect on IIT.

The main results from the above analysis suggest that increased IIT is an important contributor to the trade creating effects of PTA formation. Our results indicate that this is especially the case for PTAs formed between richer countries, with the effects of PTAs between poorer countries found to be smaller. Future research in this area may consider examining in more detail the country-pairs that are likely to benefit in terms of trade creation and IIT from forming a PTA. Such factors may include the country's level of development, economic size and factor endowments.

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Table 1: Impact of PTAs on the Volume and Structure of Trade

	Trade	GLI	CGLI	Trade	GLI	CGLI	Trade	GLI	CGLI
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDP product	0.964***	0.0182***	0.0236***	0.961***	0.0185***	0.0241***	0.425***	0.0105***	0.0164***
	(0.00252)	(0.000109)	(0.000229)	(0.00272)	(0.000120)	(0.000251)	(0.00353)	(0.000164)	(0.000426)
Population product	-0.185***	-0.0104***	-0.0169***	-0.178***	-0.0106***	-0.0173***	0.696***	-0.0304***	-0.0516***
	(0.00261)	(0.000113)	(0.000237)	(0.00282)	(0.000124)	(0.000261)	(0.0147)	(0.000684)	(0.00177)
Distance	-0.765***	-0.0264***	-0.0385***	-0.796***	-0.0269***	-0.0391***	-	-	-
	(0.00573)	(0.000248)	(0.000520)	(0.00578)	(0.000254)	(0.000534)	-	-	-
Contiguity	0.495***	0.0388***	0.0432***	0.496***	0.0397***	0.0436***	-	-	-
	(0.0270)	(0.00117)	(0.00245)	(0.0264)	(0.00116)	(0.00244)	-	-	-
Common language	0.612***	0.0140***	0.0320***	0.626***	0.0136***	0.0306***	-	-	-
	(0.0111)	(0.000483)	(0.00101)	(0.0111)	(0.000489)	(0.00103)	-	-	-
Landlocked	-0.397***	0.00411***	0.000359	-0.407***	0.00375***	-0.000456	-	-	-
	(0.00967)	(0.000419)	(0.000878)	(0.0105)	(0.000459)	(0.000967)	-	-	-
PTA	0.319***	0.0353***	0.0338***	0.308***	0.0359***	0.0355***	0.538***	0.0205***	0.0222***
	(0.0145)	(0.000627)	(0.00131)	(0.0144)	(0.000634)	(0.00133)	(0.0142)	(0.000661)	(0.00171)
Constant	-22.46***	-0.236***	-0.142***	-22.46***	-0.230***	-0.126***	-0.168***	0.0135***	0.0205***
	(0.0971)	(0.00421)	(0.00881)	(0.116)	(0.00511)	(0.0108)	(0.0421)	(0.00196)	(0.00508)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-time effects	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral-pair effects	No	No	No	No	No	No	Yes	Yes	Yes
R-squared	0.723	0.313	0.153	0.741	0.339	0.178	0.591	0.116	0.049
F-test	7526***	1310***	522.3***	359.2***	64.40***	27.23***	182.4***	16.58***	6.520***

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

Standard errors in parentheses

Table 2: Impact of Specific PTAs on the Volume and Structure of Trade

	Trade	GLI	CGLI	Trade	GLI	CGLI	Trade	GLI	CGLI
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDP product	0.966***	0.0155***	0.0210***	0.964***	0.0158***	0.0215***	0.419***	0.00941***	0.0150***
	(0.00258)	(0.000107)	(0.000233)	(0.00278)	(0.000117)	(0.000255)	(0.00361)	(0.000166)	(0.000433)
Population product	-0.183***	-0.00851***	-0.0151***	-0.177***	-0.00864***	-0.0154***	0.764***	-0.0255***	-0.0459***
	(0.00263)	(0.000109)	(0.000237)	(0.00284)	(0.000120)	(0.000261)	(0.0150)	(0.000690)	(0.00180)
Distance	-0.762***	-0.0210***	-0.0330***	-0.794***	-0.0218***	-0.0339***	-	-	-
	(0.00584)	(0.000242)	(0.000526)	(0.00587)	(0.000247)	(0.000540)	-	-	-
Contiguity	0.522***	0.0414***	0.0471***	0.514***	0.0417***	0.0467***	-	-	-
	(0.0273)	(0.00113)	(0.00246)	(0.0267)	(0.00112)	(0.00245)	-	-	-
Common language	0.593***	0.0166***	0.0347***	0.602***	0.0161***	0.0333***	-	-	-
	(0.0112)	(0.000466)	(0.00101)	(0.0112)	(0.000474)	(0.00103)	-	-	-
Landlocked	-0.390***	0.00459***	0.00164*	-0.401***	0.00411***	0.000599	-	-	-
	(0.00963)	(0.000399)	(0.000868)	(0.0104)	(0.000439)	(0.000957)	-	-	-
ANZCERTA	0.596*	0.224***	0.160***	0.645*	0.228***	0.171***	-0.218	0.161***	0.0880**
	(0.353)	(0.0146)	(0.0319)	(0.344)	(0.0145)	(0.0316)	(0.287)	(0.0132)	(0.0344)
APEC	1.227***	0.0557***	0.0858***	1.173***	0.0527***	0.0809***	0.668***	0.0522***	0.0778***
	(0.0460)	(0.00191)	(0.00415)	(0.0455)	(0.00192)	(0.00419)	(0.0331)	(0.00152)	(0.00397)
AP	0.321***	-0.0103**	-0.00346	0.260***	-0.00843**	0.00121	0.317***	-0.00270	-0.0324**
	(0.102)	(0.00425)	(0.00924)	(0.101)	(0.00424)	(0.00924)	(0.108)	(0.00499)	(0.0130)
AFTA	1.669***	0.0497***	0.0592***	1.448***	0.0444***	0.0529***	0.600***	0.0277***	0.0412***
	(0.0927)	(0.00384)	(0.00836)	(0.0906)	(0.00382)	(0.00833)	(0.101)	(0.00464)	(0.0121)
CACM[a]	2.089***	0.151***	0.161***	2.137***	0.147***	0.155***	-	-	-
	(0.114)	(0.00472)	(0.0103)	(0.112)	(0.00474)	(0.0103)	-	-	-
CARICOM	3.687***	0.0843***	0.118***	3.664***	0.0827***	0.116***	0.493**	0.0380***	0.0161
	(0.147)	(0.00611)	(0.0133)	(0.145)	(0.00611)	(0.0133)	(0.215)	(0.00988)	(0.0258)
EEA	-0.104*	0.00127	0.00305	0.0191	0.00120	0.000757	0.119***	0.00107	0.00481
	(0.0604)	(0.00250)	(0.00545)	(0.0599)	(0.00252)	(0.00550)	(0.0402)	(0.00185)	(0.00483)
EFTA	0.502***	0.0852***	0.0557***	0.475***	0.0841***	0.0584***	0.0707	0.00261	-0.00575
	(0.0666)	(0.00276)	(0.00601)	(0.0655)	(0.00276)	(0.00603)	(0.0620)	(0.00285)	(0.00743)
EU	0.0702	0.195***	0.198***	-0.104**	0.190***	0.193***	0.524***	0.0646***	0.0692***
	(0.0465)	(0.00193)	(0.00419)	(0.0458)	(0.00193)	(0.00421)	(0.0445)	(0.00205)	(0.00534)
LAIA	-0.0613	-0.0255***	-0.0427***	0.0541	-0.0233***	-0.0383***	0.419***	0.00740	-0.0176
	(0.0396)	(0.00164)	(0.00357)	(0.0396)	(0.00167)	(0.00364)	(0.120)	(0.00553)	(0.0144)
MERCOSUR	0.756***	0.0884***	0.103***	0.642***	0.0893***	0.102***	0.648***	0.107***	0.123***
	(0.240)	(0.00994)	(0.0216)	(0.235)	(0.00989)	(0.0216)	(0.165)	(0.00759)	(0.0198)
NAFTA	-0.770***	0.198***	0.180***	-0.634**	0.194***	0.175***	0.0339	0.110***	0.114***
	(0.291)	(0.0121)	(0.0263)	(0.284)	(0.0119)	(0.0261)	(0.202)	(0.00931)	(0.0243)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-time effects	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral-pair effects	No	No	No	No	No	No	Yes	Yes	Yes
R-squared	0.727	0.380	0.176	0.744	0.400	0.198	0.589	0.132	0.054
F-test	6163***	1420***	494.0***	361.8***	82.75***	30.63***	179.0***	18.92***	7.064***

[a] Note that we cannot estimate the coefficient for the trade creating effects of CACM in our sample when country-pair fixed effects are included. This is because the PTA was implemented prior to the start of the sample period implying that there is no variation in the dummy over time.
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

Table 3: Summary of Results

	Averages			Changes			Range of Estimates		
	Trade[a]	GLI[b]	CGLI	ΔTrade	ΔGLI	ΔCGLI	Trade[c]	GLI	CGLI
ANZCERTA	14.15 (1.14)	0.244 (0.126)	0.298 (0.108)	0.12 (0.13)	0.012 (0.021)	0.018 (0.030)	-0.196; 0.906	0.161; 0.228	0.088; 0.171
APEC	11.86 (2.82)	0.057 (0.092)	0.097 (0.154)	0.15 (0.56)	0.003 (0.03)	0.005 (0.069)	0.95; 2.411	0.0522; 0.0557	0.0778; 0.0858
AP	10.12 (2.31)	0.021 (0.038)	0.063 (0.146)	0.093 (0.53)	0.004 (0.024)	0.001 (0.088)	0.297; 0.379	-0.0103; -0.0027	-0.0324; 0.00121
AFTA	10.86 (2.75)	0.047 (0.094)	0.082 (0.144)	0.097 (0.90)	0.004 (0.027)	0.009 (0.070)	0.822; 4.307	0.0277; 0.0497	0.0412; 0.0592
CACM	10.31 (1.09)	0.217 (0.110)	0.301 (0.138)	0.16 (0.40)	-6.6e-6 (0.046)	0.003 (0.092)	7.077; 7.474	0.147; 0.151	0.155; 0.161
CARICOM	9.49 (1.37)	0.089 (0.082)	0.213 (0.196)	0.20 (0.62)	0.004 (0.028)	0.008 (0.201)	0.637; 38.925	0.038; 0.0843	0.0161; 0.118
EEA	13.31 (2.37)	0.200 (0.164)	0.250 (0.185)	0.11 (0.21)	0.004 (0.027)	0.006 (0.043)	-0.099; 0.126	0.00107; 0.00127	0.00305; 0.119
EFTA	12.65 (2.05)	0.199 (0.161)	0.242 (0.180)	0.09 (0.19)	0.003 (0.026)	0.002 (0.035)	0.073; 0.652	0.00261; 0.0852	-0.00575; 0.0852
EU	13.83 (2.16)	0.235 (0.164)	0.291 (0.181)	0.10 (0.17)	0.005 (0.025)	0.007 (0.037)	-0.099; 0.689	0.0646; 0.195	0.0692; 0.198
LAIA	10.45 (2.47)	0.033 (0.059)	0.065 (0.117)	0.14 (0.55)	0.003 (0.035)	0.003 (0.073)	-0.059; 0.520	-0.0255; 0.0074	-0.0427; -0.0176
MERCOSUR	12.34 (1.93)	0.100 (0105)	0.141 (0.135)	0.17 (0.31)	0.007 (0.024)	0.013 (0.047)	0.9; 1.130	0.0884; 0.107	0.102; 0.123
NAFTA	16.00 (2.48)	0.235 (0.163)	0.281 (0.179)	0.12 (0.28)	0.006 (0.055)	0.007 (0.040)	-0.537; 0.035	0.110; 0.198	0.114; 0.180

Notes: (a) Standard errors are reported in parentheses. (b) The figures reported here are smaller than those often reported. This is due to the use of four-digit data in this study rather than more aggregated two- and three-digit data often used in the literature. (c) This is calculated as $(e^{\beta_{PTA}} - 1)$.

Table 4: Interaction with the Product of GDP Per Capita

	Trade	GLI	CGLI	Trade	GLI	CGLI	Trade	GLI	CGLI
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDP product	0.975***	0.0154***	0.0208***	0.973***	0.0157***	0.0215***	0.436***	0.00974***	0.0158***
	(0.00270)	(0.000115)	(0.000244)	(0.00289)	(0.000125)	(0.000267)	(0.00372)	(0.000173)	(0.000448)
Population product	-0.195***	-0.00772***	-0.0142***	-0.190***	-0.00789***	-0.0147***	0.661***	-0.0282***	-0.0498***
	(0.00278)	(0.000119)	(0.000252)	(0.00298)	(0.000129)	(0.000275)	(0.0151)	(0.000703)	(0.00182)
Distance	-0.772***	-0.0245***	-0.0365***	-0.804***	-0.0251***	-0.0373***	-	-	-
	(0.00577)	(0.000246)	(0.000522)	(0.00582)	(0.000252)	(0.000536)	-	-	-
Contiguity	0.481***	0.0427***	0.0472***	0.481***	0.0433***	0.0471***	-	-	-
	(0.0270)	(0.00115)	(0.00244)	(0.0264)	(0.00114)	(0.00243)	-	-	-
Common language	0.608***	0.0149***	0.0329***	0.622***	0.0144***	0.0313***	-	-	-
	(0.0111)	(0.000475)	(0.00101)	(0.0111)	(0.000482)	(0.00103)	-	-	-
Landlocked	-0.393***	0.00293***	-0.000808	-0.402***	0.00253***	-0.00163*	-	-	-
	(0.00968)	(0.000412)	(0.000875)	(0.0105)	(0.000453)	(0.000964)	-	-	-
PTA	1.258***	-0.216***	-0.215***	1.357***	-0.206***	-0.198***	0.975***	-0.00709***	-0.000934
	(0.0884)	(0.00377)	(0.00800)	(0.0880)	(0.00381)	(0.00811)	(0.0462)	(0.00215)	(0.00557)
PTA × GDPPCPROD	-0.0593***	0.0158***	0.0157***	-0.0662***	0.0152***	0.0147***	-0.0286***	0.00181***	0.00152***
	(0.00551)	(0.000235)	(0.000498)	(0.00547)	(0.000237)	(0.000504)	(0.00288)	(0.000134)	(0.000347)
Constant	-22.54***	-0.214***	-0.120***	-22.54***	-0.210***	-0.107***	-0.157***	0.0129***	0.0199***
	(0.0973)	(0.00415)	(0.00880)	(0.117)	(0.00504)	(0.0107)	(0.0421)	(0.00196)	(0.00508)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-time effects	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral-pair effects	No	No	No	No	No	No	Yes	Yes	Yes
R-squared	0.723	0.336	0.160	0.741	0.359	0.183	0.592	0.117	0.049
F-test	7371***	1426***	536.6***	359.4***	70.46***	28.22***	182.5***	16.77***	6.533***

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

Standard errors in parentheses

Table 5: Interaction with the Absolute Difference of GDP Per Capita

	Trade	GLI	CGLI	Trade	GLI	CGLI	Trade	GLI	CGLI
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDP product	0.965***	0.0180***	0.0234***	0.962***	0.0183***	0.0240***	0.433***	0.0101***	0.0162***
	(0.00256)	(0.000111)	(0.000232)	(0.00276)	(0.000121)	(0.000255)	(0.00365)	(0.000170)	(0.000440)
Population product	-0.186***	-0.0103***	-0.0167***	-0.180***	-0.0104***	-0.0172***	0.674***	-0.0294***	-0.0509***
	(0.00265)	(0.000115)	(0.000241)	(0.00286)	(0.000126)	(0.000264)	(0.0149)	(0.000694)	(0.00180)
Distance	-0.765***	-0.0264***	-0.0385***	-0.796***	-0.0269***	-0.0391***	-	-	-
	(0.00573)	(0.000248)	(0.000520)	(0.00578)	(0.000254)	(0.000534)	-	-	-
Contiguity	0.491***	0.0399***	0.0445***	0.490***	0.0405***	0.0443***	-	-	-
	(0.0271)	(0.00117)	(0.00246)	(0.0265)	(0.00117)	(0.00245)	-	-	-
Common language	0.611***	0.0142***	0.0322***	0.625***	0.0137***	0.0306***	-	-	-
	(0.0111)	(0.000483)	(0.00101)	(0.0111)	(0.000490)	(0.00103)	-	-	-
Landlocked	-0.397***	0.00403***	0.000276	-0.407***	0.00370***	-0.000509	-	-	-
	(0.00967)	(0.000419)	(0.000878)	(0.0105)	(0.000459)	(0.000967)	-	-	-
PTA	0.410***	0.0110***	0.00651	0.461***	0.0187***	0.0191***	0.858***	0.00498***	0.0114**
	(0.0619)	(0.00268)	(0.00562)	(0.0611)	(0.00268)	(0.00565)	(0.0400)	(0.00186)	(0.00483)
PTA × GDPPCDIF	-0.0119	0.00319***	0.00359***	-0.0201***	0.00226***	0.00215***	-0.0422***	0.00204***	0.00142**
	(0.00791)	(0.000343)	(0.000718)	(0.00779)	(0.000342)	(0.000720)	(0.00492)	(0.000229)	(0.000594)
Constant	-22.47***	-0.234***	-0.139***	-22.47***	-0.229***	-0.125***	-0.159***	0.0131***	0.0202***
	(0.0972)	(0.00421)	(0.00882)	(0.116)	(0.00512)	(0.0108)	(0.0421)	(0.00196)	(0.00508)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-time effects	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral-pair effects	No	No	No	No	No	No	Yes	Yes	Yes
R-squared	0.723	0.313	0.154	0.741	0.339	0.178	0.592	0.117	0.049
F-test	7362***	1285***	511.6***	358.9***	64.41***	27.22***	182.4***	16.65***	6.519***

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Interaction with the Product and Absolute Difference of GDP Per Capita

	Trade	GLI	CGLI	Trade	GLI	CGLI	Trade	GLI	CGLI
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDP product	0.976***	0.0151***	0.0205***	0.974***	0.0154***	0.0211***	0.436***	0.00973***	0.0158***
	(0.00271)	(0.000115)	(0.000245)	(0.00290)	(0.000125)	(0.000267)	(0.00372)	(0.000173)	(0.000448)
Population product	-0.196***	-0.00743***	-0.0139***	-0.191***	-0.00759***	-0.0144***	0.661***	-0.0281***	-0.0496***
	(0.00279)	(0.000118)	(0.000252)	(0.00299)	(0.000128)	(0.000275)	(0.0151)	(0.000704)	(0.00182)
Distance	-0.775***	-0.0237***	-0.0358***	-0.806***	-0.0243***	-0.0366***	-	-	-
	(0.00579)	(0.000245)	(0.000523)	(0.00583)	(0.000251)	(0.000537)	-	-	-
Contiguity	0.496***	0.0385***	0.0431***	0.495***	0.0391***	0.0430***	-	-	-
	(0.0271)	(0.00115)	(0.00245)	(0.0265)	(0.00114)	(0.00244)	-	-	-
Common language	0.609***	0.0146***	0.0326***	0.624***	0.0140***	0.0310***	-	-	-
	(0.0111)	(0.000472)	(0.00101)	(0.0111)	(0.000479)	(0.00103)	-	-	-
Landlocked	-0.392***	0.00278***	-0.000951	-0.401***	0.00236***	-0.00180*	-	-	-
	(0.00967)	(0.000410)	(0.000874)	(0.0105)	(0.000450)	(0.000963)	-	-	-
PTA	1.205***	-0.201***	-0.202***	1.309***	-0.192***	-0.184***	0.977***	-0.00667***	-0.000340
	(0.0888)	(0.00376)	(0.00802)	(0.0883)	(0.00380)	(0.00813)	(0.0463)	(0.00215)	(0.00558)
PTA × GDPPCPROD	-0.0873***	0.0233***	0.0229***	-0.0917***	0.0228***	0.0220***	-0.0256***	0.00252***	0.00254***
	(0.00699)	(0.000296)	(0.000631)	(0.00691)	(0.000297)	(0.000636)	(0.00502)	(0.000234)	(0.000606)
PTA × GDPPCDIF	0.0654***	-0.0174***	-0.0167***	0.0596***	-0.0175***	-0.0170***	-0.00638	-0.00148***	-0.00214**
	(0.0100)	(0.000425)	(0.000907)	(0.00983)	(0.000423)	(0.000905)	(0.00858)	(0.000399)	(0.00104)
Constant	-22.54***	-0.216***	-0.122***	-22.54***	-0.211***	-0.108***	-0.157***	0.0129***	0.0200***
	(0.0973)	(0.00412)	(0.00879)	(0.117)	(0.00501)	(0.0107)	(0.0421)	(0.00196)	(0.00508)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-time effects	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral-pair effects	No	No	No	No	No	No	Yes	Yes	Yes
R-squared	0.723	0.344	0.162	0.741	0.368	0.186	0.592	0.118	0.049
F-test	7218***	1449***	533.7***	359.2***	73.01***	28.61***	182.3***	16.76***	6.531***

Standard errors in parentheses

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