Graduate Institute of
International Studies | Geneva
Economics

HEI Working Paper No: 07/2005

What Drives Regional Trade Agreements that Work?

Tammy Holmes
Graduate Institute of International Studies

Abstract

Economists have recently begun trying to explain that pattern of Regional Trade Agreement (RTA) formation around the world. This paper adds to the developing literature by taking into account the fact that many of the RTAs signed are not effectively implemented. The analysis proceeds in two steps: the gravity model is used to establish which RTAs are effectively implemented, in the sense that they positively and significantly increase trade flows between member countries compared to the flows predicted by the gravity model; second a hypothesis is tested about the pattern of effective RTAs – that successful RTAs are found between pairs of countries which send a large share of their exports to each other's markets. Convincing evidence is found to support this hypothesis, including evidence that export interest from one partner alone does not improve the probability of an effective RTA.

Contents

Introduction & Literature Review 3

Theory 7

The Gravity Model 7

Models of Regional Trade Agreement Formation 8

Data & Econometric Issues 11

Data 11

Estimation Part I: The Gravity Model 12

Estimation Part II: Reasons for Effective RTA Formation 16

Results 20

Results Part I: Identifying Effective RTAs 20

Results Part II: Explaining the Pattern of Effective RTAs 24

Conclusions 30

References 32

Appendices 34

Introduction & Literature Review

Since the start of the 1990s there has been a huge acceleration in the number of regional trade agreements (RTAs) signed between countries around the world (see Figure 1). This has prompted much discussion amongst economists about what has caused this sudden rush; how it will affect the chances of successful multilateral liberalisation; and whether or not these agreements will be welfare improving. Some contributors to the debate, such as Jagdish Bhagwati, have emphasised the danger that regional blocks will constitute stumbling blocks to the global liberalisation process, and cause large amounts of trade diversion.[1] However others, such as Sherman Robinson, argue that the empirical evidence supports the view that regional trade agreements have been net trade-creating and world welfare improving.[2] With the current lack of progress at the World Trade Organisation (WTO) this continues to be a hugely important and controversial topic, and much effort is being made to get a better understanding of the forces underlying regionalism.

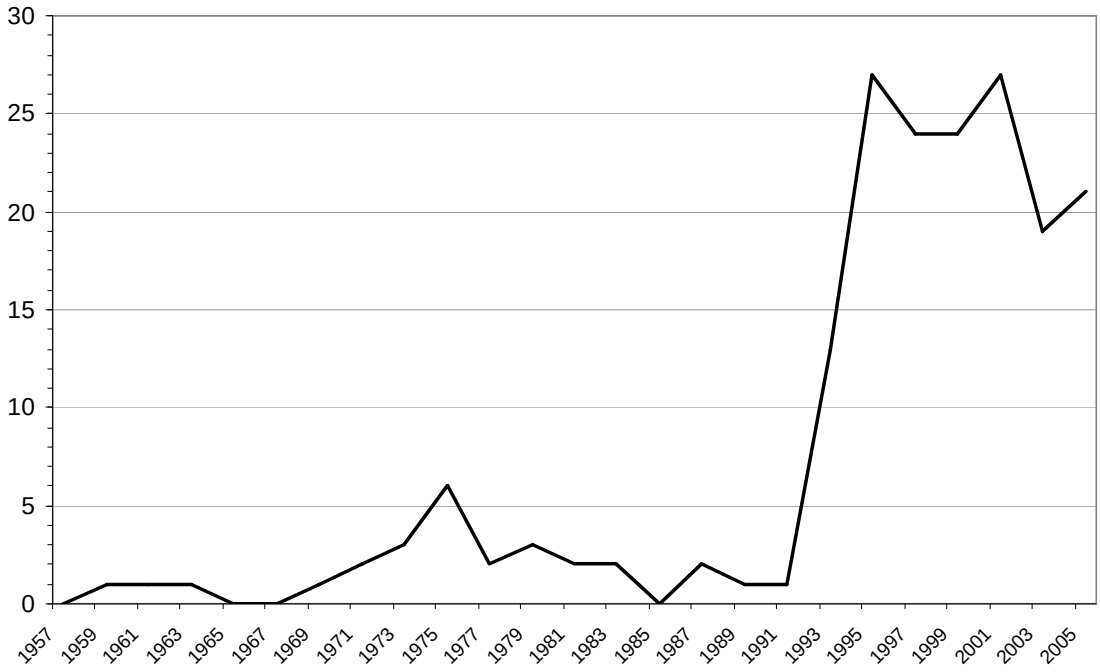
In this dissertation I contribute to the ongoing debate by looking behind the pattern of regional trade agreement formation. I carry out a comprehensive survey of the impact of existing agreements between their members, and then explore the reasons behind the trading relationships that have emerged. This involved constructing an entirely new data set including country and trade data for most of the world's countries, as well as separate series capturing the formation of each of 158 regional trade agreements. Using this data the impact of all existing RTAs was completely re-examined in order to generate a binary series indicating, for any country pair, whether an agreement with a significant positive impact on trade flows between members was in force. Finally these results were used, in one of the first studies of this kind, to test certain political economy hypotheses about the motivations of the countries that enter into effective trade agreements.

---

[1] Bhagwati (1993)

[2] Robinson et al (2003)

Figure 1: New Regional Trade Agreements by Date of Entry into Force



Source: WTO and TUCK Trade Agreements Database

In general Article 1 of the General Agreement on Tariffs and Trade 1947 (GATT) forbids any preferential trading arrangements (the 'Most Favoured Nation' principle). An exception to this is that Regional Trade Agreements are permitted, so long as they take the form of customs unions or free trade areas satisfying the conditions of Article 24, essentially that 'substantially all trade' is fully liberalised, and that there is no overall increase in external protection. There are also further exceptions for developing countries under the Generalised System of Preferences (GSP) and the 'enabling clause'.

Understanding the emerging pattern of functioning RTAs is crucial to understanding what the effects of these RTAs are likely to be. It will help to distinguish between the prediction that RTAs will lead to regional blocs of free trade between natural trading partners, and the suggestion put forward by Baldwin (2003) that RTAs are likely to emerge in a hub-spoke formation, where the spokes tend to be marginalised in terms of trade and investment. In order to get a clear picture of how RTAs affect trade flows, it is important to distinguish between those RTAs which have been signed, and those that are signed and actually make a difference to trade.

While the discussion of the effects of RTAs is well developed, there have been few attempts to model and test the reasons behind RTA formation. Baier and Bergstrand (2003) were among the first to address this issue. They used a general equilibrium model of world trade to make predictions about which country pairs would enhance their welfare most by forming trade agreements, with the hypothesis that these countries would be more likely than others to do so. This prediction was then tested by identifying particular characteristics which should make an agreement more likely and using them as explanatory variables. The variables included in the model were: NATURAL, a measure of pair closeness; REMOTE, a measure of pair remoteness from the rest of the world; RGDP, real GDP; DRGDP, difference in real GDP; DKL, the difference in capital to labour ratio; SQDKL, difference in capital/labour ratio squared; and DROWKL, which picked up the difference in capital to labour ratio of the countries to the rest of the world. These were used as explanatory variables in a probit model where the dependent variable was a binary indicator of whether a country pair had an agreement covering bilateral trade flows. They found that their model was able to explain around 85% of free trade agreements. All of the variables included were found to be significant and had the expected signs. The dependent variable covered RTAs signed by 1996 that had been notified to the WTO by 2002 (no partial RTAs were included).

Magee (2004) provides one of the first attempts to model RTA formation on the basis of political economy factors. His results show that countries are more likely to form agreements if they are already major trading partners, if they are similar in size, and if they are both democracies. These results are then used endogenise the RTA variable in a gravity model, in order to get a better measure of the effect of preferential agreements on trade volumes. This is an attempt to deal with the problem noted by several other authors, for example Winters and Soloaga (2001), that RTAs are more likely to be formed between countries that already have a close trading relationship. A ‘naive’ application of the gravity model, which does not take into account the existing trading relationships of countries, therefore leads an RTA dummy to pick up existing pair-specific ties between countries, and not only the effect of the RTA itself, biasing the coefficient upwards.

This paper seeks to add to the developing literature by: 1) taking into account the fact that many RTAs that are signed do not impact on trade flows; and 2) testing for the importance of ‘mercantilism’ in driving the formation of those RTAs which are effective.

Up to now explanations of the pattern of RTAs have not tried to distinguish between those RTAs which affect trade flows between member countries and those that do not. Even after an RTA has been signed it will face significant costs, and perhaps opposition, to its implementation. Only if the interest in bilateral liberalisation in each country is strong enough is an RTA likely to be fully and effectively implemented. Otherwise it may not be implemented at all, or it may be implemented in such a way that it is unlikely to have any effects.

One example of a case where an agreement might be signed but not implemented in an effective way would be cases in which a free trade agreement includes burdensome rules of origin regulations that reduce take-up percentages for preferential trade. Members of a customs union agree to set a common external tariff, but members of other types of agreement (which represent the vast majority of those signed) rely on rules of origin to prevent external goods entering their markets via other member countries with lower external tariffs. Usually this involves some sort of minimum proportion of a good which must be produced within a free trade area in order to qualify for preferential treatment.

This paper will focus on political economy explanations of effective RTA formation. In particular, it will test the hypothesis that an important driving force behind the implementation of effective RTAs is mercantilism, in other words the desire for access to export markets. The analysis proceeds in two stages. First a gravity model is used to determine which RTAs that have been signed have had a positive and significant effect on trade flows between member countries. The results from this stage are then used to generate a binary series capturing whether or not a particular country pair has an effective bilateral RTA. This series (called realRTA) will take the value 1 wherever an 'effective' RTA exists between two countries and 0 otherwise. In the second part of the analysis the hypothesis that the formation of these effective RTAs is driven, at least in part, by the export interests of the countries concerned is tested.

The rest of the paper is divided into four sections. The first of these discusses the theoretical background for this research, including the theory behind the gravity model, and a discussion of previous attempts to model RTA formation. The next section goes on to discuss issues associated with the econometric estimations, including how the data set was constructed and how each stage of the analysis was carried out. The results of each stage are then presented, with a short discussion of how they can be interpreted. The final section concludes the paper.

Theory

The Gravity Model

The standard tool used to measure the impact of RTAs or other liberalisation policies on trade flows is the gravity model. The gravity model is adapted from Newton's Law of Gravity, and in essence states that the attraction of goods between countries depends positively on their economic masses, and negatively on the distance between them. The original model has been refined since its early applications, in order to take into account theoretical justifications for its use. The gravity equation adopted in this paper is shown below (a simple theoretical derivation for the model is provided in Appendix 1):

$$V_{od,t} = \frac{\tau_{od,t}^{1-\sigma}}{\Omega_{o,t}\Delta_{d,t}} E_{o,t}E_{d,t}$$

Where:

$V_{od,t}$ = total value of trade from country of origin (country *o*) to destination country (country *d*) at time *t*

$\tau_{od,t}$ = variable capturing the bilateral trade costs between the countries *o* and *d*

σ = elasticity of substitution between all varieties.

$\Omega_{o,t}$ = variable capturing the openness of the world to country *o*'s goods at time *t*

$\Delta_{d,t}$ = variable capturing the openness of the destination country to the world's goods at time *t*

$E_{o,t}$ = Expenditure of country *o* at time *t*

$E_{d,t}$ = Expenditure of country *d* at time *t*

The aim of this application of the gravity model is to determine the effectiveness of a number of RTAs. The existence of an RTA should reduce bilateral trade costs, and result in a reduction in τ. The econometric methodology is discussed in a later section.

Models of Regional Trade Agreement Formation

There have been a few attempts to model RTA formation in the literature. Grossman and Helpman (1995) model the formation of RTAs in two separate stages. First there is a process of competition between different political forces *within* a state, whereby the government's policy preferences are determined. It is assumed that governments place some weight on the welfare of the average voter, but are also swayed by pressure from political interest groups. This results in two types of situations where a government might favour an RTA: those where an agreement would generate substantial welfare gains for voters and adversely affected interest groups fail to exert offsetting pressure; and those where liberalisation would result in profits for exporters which outweigh the losses in import-competing industries plus the political cost of any harm to voters. In a second stage states' governments interact internationally (in the context of bilateral negotiations) and an agreement is signed if both governments are in favour. The model predicts that this outcome is most likely where there is a relative balance in the potential trade between the partners and when the agreement affords enhanced protection, rather than reduced protection to most sectors (with enhanced protection an exporting industry captures the benefits of high domestic prices in the partner country). Since enhanced protection is associated with trade diversion, this means that RTAs would be more likely in circumstances where they reduced aggregate social welfare.

An alternative vision of regionalism can be found in Baldwin's work, where the idea is put forward that RTA formation is driven by the export interests of the countries involved. Baldwin (1993, 1997) describes a process of regional integration driven by the reluctance of countries to be left out of expanding free trade areas. This is formalised in a footloose capital model, which shows that the welfare benefits of entering a free trade area increase as the size of the markets covered by existing agreements increases. A 'domino effect' follows, whereby a single agreement between two countries could provoke a rash of other RTAs. Baldwin asserts that this is likely to result in a 'Juggernaut' effect, in other words an increasing and unstoppable trend towards further liberalisation. However, the size of the partner's export market is an important determinant of RTA formation, and agreements are more likely to be made with regional 'hubs' (which represent important export markets for all surrounding countries), and hub-spoke-systems may emerge, in which the smaller 'spoke' countries do not enter agreements with one another. These countries may then suffer as trade is diverted

towards hub countries (spokes will also eventually become less desirable locations for investment) resulting in a welfare outcome which compares unfavourably with the outcome of a free trade area where all countries in a region liberalise indiscriminately with one another.

In a later paper Baldwin (2003) develops an empirical measure which determines the attractiveness of an export partner for RTA formation. This 'hubness measure' is given by:

$$HM = s^{X}_{od}(1 - s^{M}_{od})$$

Where s^{M}_{od} is the share of nation *o*'s goods that are sold in nation *d*'s market and vice versa for s^{X}_{od}. This measure is based on the assumption that the interest of countries in forming RTAs with partners is primarily due to the desire to get access to export markets.

Following the general ideas outlined by Baldwin, I adopt the hypothesis that RTA formation is driven by the export interests of the countries involved, but the analysis is simplified somewhat for the purposes of this paper. I assume that governments will want to implement an RTA with a trade partner if there is enough domestic political support for bilateral liberalisation. More specifically an RTA will be implemented between two countries if the export interest of *both* countries is strong enough with the other.

A variable 'M_{ij}' is defined to represent the power of mercantilist interest in country *i* with respect to access to market *j*. An agreement will be effectively implemented if this interest is strong enough in both country *i* and country *j*. In other words mercantilist interest, M, must be above some critical value (M*) in both countries. If the binary variable realRTA[3] captures cases where an effective RTA is implemented then:

$$\text{realRTA}_{ij} = 1 \quad \text{IF} \quad M_{ij} > M^* \quad \text{and} \quad M_{ji} > M^*$$

[3] This variable will be determined by the econometric results from the first stage and will take the value 1 when the results of the gravity model suggest that bilateral trade flows between members are positively and significantly affected by the entry into force of the RTA, and 0 otherwise.

It is recognised that other historical, geographical and political factors will also facilitate the implementation of RTAs. In the econometric work some attempt will be made to proxy for these factors, but the main aim of this research will be to test the specific hypothesis that interest in export market access drives the implementation of effective RTAs, rather than to create a comprehensive model with maximum explanatory power. Support for certain aspects of the domino theory is also explored in the econometrics section.

Data & Econometric Issues

Data

In order to carry out the gravity model analysis it was necessary to build a large data set incorporating trade, GDP (nominal), and other country data over as many years as possible. Bilateral trade data[4] from the UN COMTRADE database was extracted through World Integrated Trading Solution (WITS) and data on GDP was extracted from the World Bank Development Indicators (WDI) database. In addition, other descriptive country data was downloaded from the website of the Centre D'Etudes Prospectives et D'Informations Internationales (CEPII).[5] This data was combined using the Access database programme to create an unbalanced panel data set covering 42 years (1962 to 2004) and 178 countries. The panel used in the estimations contained 148,802 observations.[6] The results from this data set were supplemented using earlier results obtained using an existing data set made available by Andrew Rose.[7] This was useful since this other panel continued back as far as 1948, thus covering the dates of entry of some of the earlier agreements. For the main analysis the new data was preferred since it contained five years of more recent data and avoids certain problems with the Rose data

[4] For trade flows reported imports rather than exports were used to compile the data, since these are generally regarded to be reported more reliably.

[5] www.cepii.com

[6] This panel used average trade flows between countries as the dependent variable, rather than including flows in each direction as separate observations. Another data set in which flows were not averaged was also created, however this data set contained 427,318 separate observations and proved too large to handle using the computing facilities available.

[7] http://faculty.haas.berkeley.edu/arose/

set such as the use of real GDP instead of nominal, and the use of the log of average trade flows rather than the average of the logged trade flows as the dependent variable.[8]

The first part of the analysis generates the data for the dependent variable in the second stage (the binary 'effective RTA' series called realRTA). In addition export data from the UN COMTRADE database was extracted through WITS (World Integrated Trading Solution) and country pair variables were added from CEPII, including distance, contiguity, common language, continent etc. The second data set is cross-section data for 2002 and covers 131 countries (5,426 observations). The year 2002 was chosen in place of the most recent year for which data was available because of the difficulty of assessing the effectiveness of RTAs brought into force since that date based on only a few years of data.[9]

Estimation Part I: The Gravity Model

Specification

The first part of the analysis is based on the gravity model described above. Taking logs one obtains:

$$\ln(V_{od,t}) = \ln(E_{o,t}) + \ln(E_{d,t}) + (1-\sigma)\ln(\tau_{od,t}) - \ln(\Omega_{o,t}) - \ln(\Delta_{d,t})$$

However, for the purposes of these estimations it was assumed that bilateral trade barriers were symmetrical, allowing the average of the flows to be used, rather than including a separate observation for exports in each direction. Following the literature, the populations of the countries were also included as a further measure of the economic size of a country.

[8] See Baldwin (2005) for a full discussion of the problems with the Rose data set and their implications for gravity model estimations.

[9] It transpired that only one RTA implemented since 2002 was judged to be effective, and this was left out of the realRTA series as it came into force in July 2003.

$$\ln(X_{od,t}) = \ln(Y_{o,t}) + \ln(Y_{d,t}) + \ln(pop_{o,t}) + \ln(pop_{d,t}) + (1-\sigma)\ln(\tau_{od,t}) - \ln(\Omega_{o,t}) - \ln(\Delta_{d,t})$$

Where:

$\boldsymbol{X_{od,t}}$ = average value of real bilateral trade between *o* and *d* at time *t*

$\mathbf{Y_{o,t}}$ = real GDP of country *o* at time *t*

$\boldsymbol{pop_{o,t}}$ = population in country *o* at time *t*

In the final estimation any non-time varying pair-specific variables are subsumed into the country-pair fixed effects. A separate time-dummy was also included for each year, so that the form of the final estimated equation was:

$$\ln(X_{od,t}) = \beta_{0,od} + \beta_2 \ln(Y_{o,t}) + \beta_3(Y_{d,t}) + \beta_4(\ln pop_{o,t}) + \beta_5(\ln pop_{d,t}) + \gamma RTA_t + \phi t + \varepsilon$$

Where:

$\boldsymbol{RTA_t}$ = matrix of RTA dummies (including 158 separate series).

$\boldsymbol{t}$ = matrix of time dummies including separate dummy for each year 1963-2004

The RTA Variables

The matrix of RTA dummies was generated using information on agreements notified to the WTO[10] and contained in the Tuck Trade Agreements Database.[11] For each of the 158 RTAs that had entered into force by 2003 a separate series was generated using STATA,[12] taking the value 1 when countries *o* and *d* had signed an RTA covering bilateral trade at time *t* and 0 otherwise. For multi-country agreements such as the EU a

[10] http://www.wto.org/english/tratop_e/region_e/region_e.htm

[11] http://cibresearch.tuck.dartmouth.edu/trade_agreements_db/index.php

[12] This approach seems to be fairly new. Most studies either use a single RTA dummy (implicitly assuming that all RTAs lead to an identical shift in the intercept), or introduce separate dummies, but for a limited selection of RTAs, e.g. Magee (2004).

single variable was created to capture the effect of the EU on all member countries. A separate dummy was generated for each bilateral agreement between a customs union and a non-member country. This series took the value 1 between (for example) the non-EU country and each individual EU member.

Each RTA dummy takes the value 1 from the date of entry into force of the RTA. Every attempt was made to ensure that where an RTA was dissolved (for example as countries left EFTA to join the EU) the dummy returned to 0. However information on the termination of RTAs was not very readily available and it is possible that there are some errors in the data with respect to this issue.

There were several cases where inclusion of the RTA dummy introduced perfect multicollinearity with the pair fixed effects. This was the case for country pairs where there was no data on trade flows outside the period when the RTA was in force. Most of these RTAs involved countries in the former Soviet Union, and in such cases the RTAs were dropped during the estimation process.

Use of Country-Pair Fixed Effects

In some studies, for example Rose (2003) an attempt is made to model Δ, Ω and τ explicitly, by introducing includes a plethora of dummy variables capturing cases where countries have a common language, a shared border etc. I opted instead to use country-pair fixed effects. The first reason for this was that it seemed much easier to use fixed effects than to include every conceivable variable that might affect relative trade costs. In particular, it is difficult to find data on Δ and Ω, which capture what has become known as 'multilateral resistance'. Since most of the variables included in the Rose estimations are not time-varying, for example distance or contiguity, their impact is subsumed into the country-pair fixed effects.

The form of the theoretically grounded gravity model suggests that it is very important to account not just for bilateral trade costs, but bilateral costs relative to multilateral resistance. The intuition behind this is that the effects of factors such as distance between countries will depend not only on bilateral distance, but also on distance from the rest of the world. The classic example is Australia and New Zealand. Although these countries are geographically very far away from each other their distance from any other industrialised nation means that they trade disproportionately with each other compared, for example, to European countries that are much closer together.

Some studies account for these issues by using country fixed effects (for partner and reporter separately). This allows the use of fixed effects which vary in each time period, which would not be possible using country-pair fixed effects since the degrees of freedom would be reduced to zero (at least when using averaged bilateral data). However this approach does not capture all of the pair-specific factors which affect relative trade costs. This point alludes to the second major reason why country-pair fixed effects are important in this particular study. Soloaga and Winters (2001) and Magee (2004) point out that the effect of an RTA is difficult to capture accurately in the gravity model due to endogeneity. In other words RTAs are more likely to be formed between country pairs that already have unusually large bilateral trade flows. If this effect is not controlled for then the estimated coefficient on an RTA dummy is likely to be biased upwards.

In order to obtain a less biased estimate of the effect of an RTA on trade it is necessary to introduce other variables to capture the existing bilateral relationship between trade partners. Country specific fixed effects will not do this but country-pair fixed effects will. The validity of this approach rests on the assumption that bilateral fixed effects (or rather the factors driving the coefficients on them) do not vary too much over time. Trading relationships between countries are slow to evolve, but it is unrealistic to think that they have not changed at all for any country pairs over the last 42 years. In cases where the fixed effects would have been negative in 1962 but positive in 2004 the introduction of an RTA dummy some way through the period is likely to pick up this change in the relationship.

This problem will be dealt with in this paper by reducing the number of years used in the data set when measuring the impact of the agreements. The agreements will be divided into groups which entered into force within a particular five year period, and for each of these an estimation will be carried out using data beginning about seven years before the first agreement came into force and ending about seven years after the last (covering roughly 20 years in total). This is judged to provide a sufficient run-up period prior to the first agreement coming into force, bearing in mind the possibility that trade could increase slightly earlier due to an anticipation effect. Similarly there is sufficient time after the last agreement in the group comes into force to judge its effectiveness even if

there were some delay in the impact. By reducing the time period covered in the data the effects of the RTAs are isolated as far as possible from other earlier or later changes in a trading relationship.[13]

Estimation Part II: Reasons for Effective RTA Formation

Specification

The dependent variable in this second part of analysis is 'realRTA'. This series takes the value 1 between countries whose bilateral trade is covered by an RTA that was found to have a positive and significant effect on trade flows between members in the gravity estimation, and zero otherwise. The estimation was carried out using the logit model.

In general, the prediction to be tested is that the probability of realRTA formation depends on the mercantile interest of the two countries in a trading relationship, along with other factors:

$$P(realRTA = 1) = f(M_{12}, M_{21}, other)$$

The variable 'M', defined in the theory section, is not observable. Nor is the critical value 'M*' required in both countries for RTA formation. To proxy for the impact of M another variable is introduced:

s_{ij} = share of exports to country j in total exports of country i

s_{ij} captures the fact that the interest in country i for implementing an effective RTA with country j depends on what share of i's exports already go to country j. If country j is a very important export partner then the export interest in bilateral liberalisation will be greater since exporters will improve their terms of trade on a large volume of goods, and there is also likely to be an important trade creation effect. Therefore M_{ij} is increasing in s_{ij}.

[13] Unfortunately it is very difficult in this type of study to completely isolate the effects of a trade agreement from those of other contemporaneous changes in a trading relationship.

One prediction of the theory is that an agreement will only be effectively implemented if mercantilist interest is sufficient in *both* countries. If this is true, then it will be the minimum of the export shares in each direction which will be the key determinant of a successful RTA, rather than both shares. In order to test this element of the hypothesis, the following variables are introduced:

*min*s = s_{ij} IF $s_{ij} < s_{ji}$ and s_{ji} otherwise

*max*s = s_{ij} IF $s_{ij} > s_{ji}$ and s_{ji} otherwise

After introducing these variables one would expect to see that the variable *min*s has a positive and significant effect on the probability of successful RTA formation, but that *max*s should not have a significant effect on the probability of a 'realRTA'.

The variable s_{ij} is used as a proxy for M_{ij}, but no attempt is made to identify a critical value of s which would correspond to M*, the threshold value above which a country has an incentive to see that an RTA becomes effective. The min and max s values are used instead (if *min*s were over the threshold then the level of *max*s would be irrelevant, similarly if it were below the threshold then *max*s would again have no effect). It also seems more sensible not to assume that 's' behaves in precisely the same way as 'M', or that other omitted factors do not cloud the simple relationship outlined in the theory section.

Following the similar literature on currency union formation[14] other variables are also included in order to proxy for omitted factors which would facilitate the implementation of RTAs:

DIST: Distance between the two most important cities in the two countries. It is assumed that countries which are far away from each other will be less likely to make effective agreements. Opportunities to meet and carry out political negotiations are likely to be more difficult the further two countries are away from each other. (Expected sign of coefficient - *negative*)

[14] Tenreyro et al (2003), Persson (2001).

CONTIG: Dummy variable taking value 1 for contiguous countries. One would expect contiguous countries to be more likely to form effective agreements. This similar to the reasoning for countries which have smaller distances between them, but will capture any specific effects associated with a shared land border. (Expected sign – *positive*)

COMLANG_OFF: Dummy variable taking value 1 if countries share common official language. A common official language would be expected facilitate negotiations and strengthen political ties. (Expected sign – *positive*)

COLONY: Dummy variable taking value 1 if the countries have ever had a colonial link. A former colonial relationship may mean lasting ties and a closer political relationship between two countries. (Expected sign – *positive*)

COMCOL: Dummy taking value 1 if the two countries have shared a common coloniser in the period since 1945. Again, countries which have shared a colonial ruler could have lasting political links or relationships which might facilitate the formation of successful RTAs. (Expected sign – *positive*).

In a further estimation, dummy variables which take the value 1 when *both* partners are on the same continent will be added to the specification. Separate dummies are included for each of five continents (Africa, America, Asia, Europe and Pacific[15]). If the domino theory outlined in Baldwin (1993) is true, then we would expect to see that on certain continents RTA formation has 'taken off', whereas on others it has not. Evidence for this would be positive and significant coefficients for some continents, and negative or insignificant coefficients for others.

Specifications estimated:

$$\textbf{(1)} \quad \begin{aligned} &P(realRTA = 1) = \beta_0 + \beta_1 s_{12} + \beta_2 s_{21} \\ &+ \beta_3 DIST + \beta_4 CONTIG + \beta_5 COMLANG\_OFF + \beta_6 COLONY + \beta_7 COMCOL + \varepsilon \end{aligned}$$

[15] Continent categories are taken from the CEPII geographical information dataset.

(2)
$$P(realRTA=1)=\beta_0+\beta_1\min s+\beta_2\max s + \beta_3 DIST+\beta_4 CONTIG+\beta_5 COMLANG\_OFF+\beta_6 COLONY+\beta_7 COMCOL+\varepsilon$$

(3)
$$P(realRTA=1)=\beta_0+\beta_1\min s+\beta_2\max s + \beta_3 DIST+\beta_4 CONTIG+\beta_5 COMLANG\_OFF+\beta_6 COLONY+\beta_7 COMCOL + \beta_8 AFRICAboth+\beta_9 AMERICAboth+\beta_{10} ASIAboth+\beta_{11} EUROPEboth+\beta_{12} PACIFICboth+\varepsilon$$

Endogeneity

By definition, countries which have an effective RTA in operation between them have seen in increase in trade with each other at some point in their recent past. Therefore the share of trade to each other's markets is not completely exogenous. This endogeneity problem is likely to bias the coefficient on trade shares upwards in my estimations and the result should be treated with some caution. However one mitigating effect may be that countries which have signed at least one effective agreement may be more likely to sign agreements with other countries (domino effect) or to liberalise more generally than other countries. In this case, although we know from the gravity model results that the volume of trade between members of an agreement has risen, the *share* in each other's exports may not have.[16] It is quite difficult to get round the problem of two-way causation, but it is important to realise that there is a real difference between the share of a partner in a countries exports, and the marginal impact of a trading agreement (in other words this exercise does not amount to attempting to estimate an identity).

[16] One way round this problem would be to use export share data from immediately before the implementation of any agreement to calculate s, but this would vary by agreement, and the year to use for countries not in any agreement would not be obvious.

Results

Results Part I: Identifying Effective RTAs

The gravity model outlined above was run first with pooled data then country pair and year fixed effects were added. In each case robust standard errors are reported[17] and the full results are given in Appendix 3. In both cases the coefficients on the logs of the GDPs are positive and close to unity, in line with the theory. The coefficients on log of population are also positive and significant in both cases; consistent with the idea that population is a further measure of economic mass. However there is a big change in the coefficients on population once country pair fixed effects and year dummies are introduced. A possible explanation for this is that much of the variation in population is cross-sectional, and once the fixed effects are introduced some of this is absorbed.[18]

The next step of the estimation process was to run the model on shorter time periods, and test smaller groups of RTAs that were brought into effect over the same five-year period. The results of these regressions are given in Appendix 4. In these estimates there is some variation in the coefficients on the gravity variables. The regression period has now been reduced to 15-20 years of data, and less of the variation in GDP and population is therefore likely to be attributed to changes over time, and even more to cross-sectional variation. This probably accounts for the strange GDP and Population coefficients. However, since the aim of this study is not to get a better overall understanding of how to model trade flows, but to isolate the effects of RTAs, the coefficients on the RTA dummies are considered reliable enough to generate the realRTA series which will be used in the next stage.

---

[17] Graphical evidence of heteroskedasticity can be seen in Appendix 5 where the residuals are plotted.

[18] This suggests that some care should be taken in interpreting the coefficients of the gravity variables once fixed effects have been introduced (a suggestion that will become even more apparent in the later estimations), but since these are not the focus of the research, and the interpretation of the coefficients of the RTA variables should not be affected, this problem is not considered to be too important.

Out of 122 RTAs tested, 55 proved to have positive and significant coefficients (at the 5% level). In other words more than half of the agreements induced no measurable increase in trade flows between member countries. The 5% level was used as a cut-off, but the vast majority (45) of the effective agreements were significant at the 1% level, and only four agreements fell in the 2-5% significance band. The measured marginal effects range from 10% to a somewhat incredible 4.85 for the Latvia-Slovenia agreement, but most are below 100%. A full list of the 'effective' agreements is provided here:[19]

Table 1: Full List of Effective Regional Trade Agreements

Common Name	Type of Agreement	Entered into Force
EC (Treaty of Rome)	Customs Union Primary Agreement	01-Jan-58
EFTA (Stockholm Convention)	Regional/Plurilateral Free Trade Agreement	03-May-60
CACM	Customs union	12-Oct-61
EC – Malta	Association Free Trade Agreement	01-Apr-71
PTN	Preferential arrangement	11-Feb-73
Bangkok Agreement	Preferential Arrangement	17-Jun-76
EC – Egypt	Association Free Trade Agreement	01-Jun-77
CER	Free trade agreement	01-Jan-83
CAN	Preferential arrangement	25-May-88
GSTP	Preferential arrangement	19-Apr-89
MERCOSUR	Customs Union Primary Agreement	29-Nov-91
EC - Czech Republic	Association Free Trade Agreement	01-Mar-92
EC – Hungary	Association Free Trade Agreement	01-Mar-92
EC – Poland	Association Free Trade Agreement	01-Mar-92
EC – Slovakia	Association Free Trade Agreement	01-Mar-92
EFTA – Turkey	Association Free Trade Agreement	01-Apr-92
CEFTA	Free trade agreement	01-Mar-93
EFTA - Romania	Association Free Trade Agreement	01-May-93
EC – Romania	Association Free Trade Agreement	01-Jun-93
EFTA – Bulgaria	Association Free Trade Agreement	01-Jul-93
EFTA – Hungary	Association Free Trade Agreement	01-Oct-93
EFTA – Poland	Association Free Trade Agreement	15-Nov-93
EC – Bulgaria	Association Free Trade Agreement	31-Dec-93
North American Free Trade Agreement (NAFTA)	Regional/Plurilateral Free Trade Agreement	01-Jan-94
EC – Latvia	Association Free Trade Agreement	01-Jan-95
EC – Lithuania	Association Free Trade Agreement	01-Jan-95

[19] See Appendix 2 for a guide to RTA acronyms

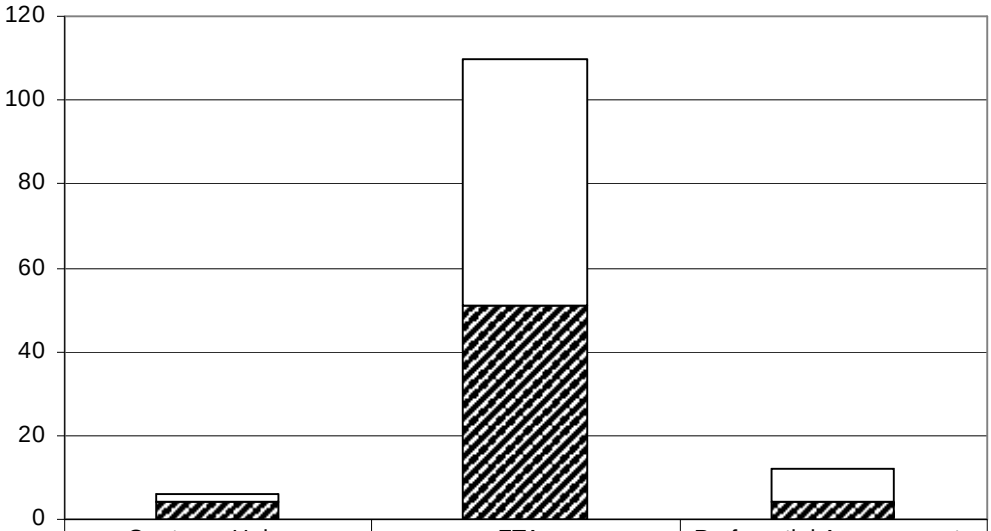
Common Name	Type of Agreement	Entered into Force
Mexico - Colombia – Venezuela	Regional/Plurilateral Free Trade Agreement	01-Jan-95
Mexico - Costa Rica	Bilateral Free Trade Agreement	01-Jan-95
Moldova - Romania	Bilateral Free Trade Agreement	01-Jan-95
EFTA – Slovenia	Association Free Trade Agreement	01-Jul-95
EC – Turkey	Customs Union Primary Agreement	01-Jan-96
EFTA – Estonia	Association Free Trade Agreement	01-Jun-96
EFTA - Latvia	Association Free Trade Agreement	01-Jun-96
EFTA – Lithuania	Association Free Trade Agreement	01-Aug-96
Latvia – Slovenia	Bilateral Free Trade Agreement	01-Aug-96
Estonia - Slovenia	Bilateral Free Trade Agreement	01-Jan-97
EC – Slovenia	Association Free Trade Agreement	01-Jan-97
Lithuania – Poland	Bilateral Free Trade Agreement	01-Jan-97
Lithuania – Slovenia	Bilateral Free Trade Agreement	01-Mar-97
Israel – Turkey	Bilateral Free Trade Agreement	01-May-97
Latvia - Slovakia	Bilateral Free Trade Agreement	01-Jul-97
Canada — Chile	Bilateral Free trade agreement	05-Jul-97
Estonia – Hungary	Bilateral Free Trade Agreement	01-Jan-98
Romania – Turkey	Bilateral Free Trade Agreement	01-Feb-98
Lithuania - Turkey	Bilateral Free Trade Agreement	01-Mar-98
Hungary – Turkey	Bilateral Free Trade Agreement	01-Apr-98
Slovakia – Turkey	Bilateral Free Trade Agreement	01-Sep-98
Bulgaria — Turkey	Bilateral Free trade agreement	01-Jan-99
Latvia – Poland	Bilateral Free Trade Agreement	01-Jun-99
Chile — Mexico	Bilateral Free trade agreement	01-Aug-99
EC - South Africa	Association Free Trade Agreement	01-Jan-00
Hungary – Latvia	Bilateral Free Trade Agreement	01-Jan-00
Poland – Turkey	Bilateral Free Trade Agreement	01-May-00
Slovenia – Turkey	Bilateral Free Trade Agreement	01-Jun-00
EC – Mexico	Association Free Trade Agreement	01-Jul-00
Mexico – Israel	Bilateral Free Trade Agreement	01-Jul-00
India - Sri Lanka	Bilateral Free Trade Agreement	15-Dec-01
United States – Jordan	Bilateral Free Trade Agreement	17-Dec-01
Turkey – Croatia	Bilateral Free trade agreement	01-Jul-03

Three of the agreements originally came into force before the time period covered by the data set used (EU, EFTA and CACM). This means that the coefficients are based on late joiners and countries that left these agreements. However in each case the coefficient on the RTA dummy was also positive and significant in a similar estimation using the data set provided by Rose, which goes back as far as 1948 for many countries. In combination these results seemed to justify including these agreements as effective RTAs.

The overall success rate for RTAs was 46%, with a certain amount of variation between types of agreement and date of entry etc. As shown in Figure 2, customs unions were

more likely to succeed than other types of agreement, with 2/3 of these agreements having an appreciable effect on trade between members. Free Trade Agreements followed the sample mean, but Preferential Arrangements, which do not necessarily amount to a complete liberalisation of bilateral flows, are less likely to be successful than those in the general sample, with only 1/3 measured as effective. Half of the agreements between the EU and a third country were found to be effective, and the same percentage of EFTA's agreements with external countries appear to 'work' (bilateral agreements between the EU and EFTA and other countries account for 49 out of the 157 agreements that had come into force by 2005). By contrast, only a third of standalone agreements between single countries seem to increase trade flows between signatories.

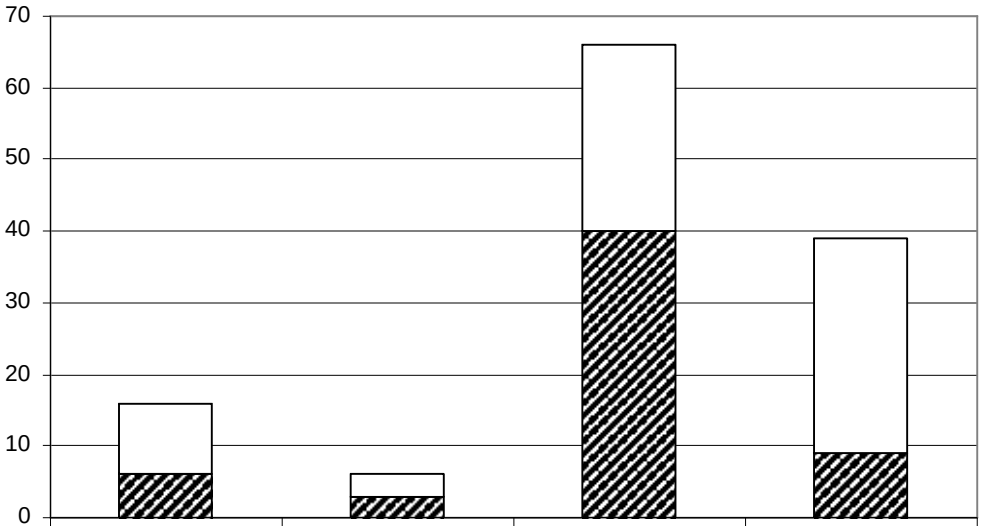
Figure 2: Effectiveness of RTAs by Type of Agreement



	Customs Unions	FTAs	Preferential Arrangements
% effective	0.67	0.46	0.33
☐ Not Effective	2	59	8
▨ Effective	4	51	4

On the whole, RTAs prior to 1980 seem to have been less successful than those in the following decades. The most successful period for RTAs was also the most prolific – the 1990s - when nearly two-thirds of RTAs seem to have been effective. Only 23 percent of RTAs entering into force since 2000 were found to be effective in this analysis, although the primary reason for this may well be that many of these RTAs have entered into force too recently to have a measurable impact on trade flows.

Figure 3: Effectiveness of RTAs by Date of Entry into Force



	up to 1980	1980 - 1990	1990 - 2000	2000 onwards
% effective	0.38	0.50	0.61	0.23
Not Effective	10	3	26	30
Effective	6	3	40	9

Results Part II: Explaining the Pattern of Effective RTAs

In this section the aim is to explain the probability that an effective RTA is implemented between two countries (using the dependent variable 'realRTA' as defined above). The model aims to predict, for any given country pair, the probability that an RTA is both signed and effective, compared to the possibility of either having an ineffective RTA or none at all. Since the dependent variable is binary, it is not appropriate to use an ordinary linear model, and a logit estimation was carried out. This restricts the prediction based on the right hand side variables to between zero and one, which is then interpreted as a probability that the dependent variable takes the value one. In the goodness of fit statistics a 'predicted' realRTA is one for which the predicted probability was greater than 0.5.

The hypothesis outlined earlier was that there is some threshold value below which the share of exports to a partner is insufficient to justify the effort of implementing an

effective RTA. In this case only the export share of the country with its exports less concentrated towards its partner should have a significant effect on the probability of realRTA formation. However in the first estimation no attempt was made to distinguish between countries in the trading relationship or their importance to each other:

Table 2: Predicting realRTAs

Dependent Variable = realRTA

	Coefficient	Std.Err.	P>|z|		
s12	0.5903	0.4495	0.189		
s21	1.3597	0.5230	0.009		
Dist	-0.0001	0.0000	0		
Contig	1.1346	0.1965	0	Number of obs	5356
comlang_off	-0.3631	0.1458	0.013	LR chi2(7)	310.39
colony	0.7151	0.3524	0.042	Prob > chi2	0
comcol	-1.8216	0.3520	0	Pseudo R2	0.0845
_cons	-1.2159	0.0859	0	Log likelihood	-1681.51

	Actual		
Predicted	realRTA=1	realRTA=0	Total
realRTA=1	20	7	80
realRTA=0	560	4769	5276
Total	580	4776	5356
Sensitivity		Pr(+| D)	3.45%
Specificity		Pr(-|~D)	99.85%
Positive predictive value		Pr(D| +)	74.07%
Negative predictive value		Pr(~D| -)	89.49%
Correctly classified			89.41%

In the first estimation s_{21} is positive and significant, as expected, but s_{12}, though positive, is insignificant at the 10 percent level. Hence there is already an indication that the shares of the different countries do not enter symmetrically into the model (since the order of countries in the data set is more or less random nothing specific can be deduced at this stage from the difference in the two coefficients). The sign and significance of s_{21} also provides evidence that export shares do have an important effect on the probability of a successfully implemented RTA.

The performance of the other variables is mixed. Distance and contiguity have the expected signs but a common official language appears to reduce the probability of a successful trade agreement, as does a common coloniser. In this specification it appears

that countries are more likely to implement agreements with countries that they have colonised, or been colonised by.

The explanatory power of the model is not high. Only 3.45 percent of realRTAs were correctly predicted by the model (20 out of 580), and the pseudo-R^2 was 0.085. However there is already interesting evidence to support the hypothesis that the success of RTAs is driven by the export interests of the countries involved. In the next specification, a distinction was made between the minimum and maximum export shares of the countries involved, and these entered into the model as separate variables:

Table 3: Predicting realRTAs - 'min' and 'max' Export Shares

Dependent Variable = realRTA

	Coefficient	Std.Err.	P>|z|		
Mins	68.9663	7.2285	0		
Maxs	-0.2153	0.5264	0.683		
Dist	-0.0001	0.0000	0		
Contig	0.1969	0.2417	0.415	Number of obs	5356
comlang_off	-0.5314	0.1592	0.001	LR chi2(7)	441.75
colony	0.5205	0.3735	0.164	Prob > chi2	0
comcol	-1.8670	0.3768	0	Pseudo R2	0.1203
_cons	-1.4553	0.0912	0	Log likelihood	-1615.83

	Actual		
Predicted	realRTA=1	realRTA=0	Total
realRTA=1	54	26	80
realRTA=0	526	4750	5276
Total	580	4776	5356
Sensitivity		Pr(+| D)	9.31%
Specificity		Pr(-|~D)	99.46%
Positive predictive value		Pr(D| +)	67.50%
Negative predictive value		Pr(~D| -)	90.03%
Correctly classified			89.69%

The *min*s variable (which represents the lower of the two export shares) is positive and highly significant. The coefficient is much larger than that on the either of the export shares in the previous estimation. By contrast, the *max*s variable is negative and not significant. Together these results provide strong evidence to support the hypothesis outlined above. They support the view that even if one country exports a very large proportion of its goods to another, an effective RTA will only emerge if the second country also sends a large share of its exports in the other direction. For example there

may be many small countries that are heavily dependent on their exports to the United States but which do not have an effectively implemented free trade agreement since the United States has no particular interest in their export market.

The coefficient on distance remains negative and significant as expected,[20] reflecting the fact that countries which are further away from each other are less likely to implement effective RTAs. The coefficients on the other variables are less convincing. Contiguity and a colonial link now appear to be insignificant, and common language and common coloniser are significant, but do not have the expected sign. It is difficult to think of a convincing economic explanation for these results. It is slightly worrying to see the signs of the coefficients switching like this between estimations, but reassuringly, the sign and significance of the coefficient on *min*s is robust to changes of specification, including dropping insignificant variables.

The predictive power of the model has improved, with 89.69 percent of relationships correctly classified (including pairs where the absence of an effective RTA was correctly predicted). The pseudo-R^2 has risen to 0.12, and 54 out of 580 realRTAs were correctly predicted (9.31%).

In the third specification dummies are added to capture cases where the two countries are on the same continent. The other variables are retained even where they were not significant in the previous estimation to see if there is any change in the results, and to minimise the possibility of omitted variable bias.

[20] The coefficient on distance is small, reflecting the fact that distance, the magnitude of which is usually in the thousands, has a small marginal effect on the probability of realRTA formation.

Table 4: Predicting realRTAs - Same Continent Dummies

Dependent Variable = realRTA

	Coefficient	Std.Err.	P>|z|		
Mins	55.70552	7.517582	0		
Maxs	-0.61298	0.629829	0.33		
Dist	0.000115	1.68E-05	0		
Contig	0.37485	0.272098	0.168		
comlang_off	-0.2396	0.183956	0.193		
Colony	0.656156	0.41903	0.117		
Comcol	-1.42613	0.38171	0		
Africaboth	0.663216	0.345312	0.055		
Americaboth	2.336071	0.221257	0	Number of obs =	5356
Asiaboth	0.702179	0.292858	0.016	LR chi2(7) =	966.96
Europeboth	3.616355	0.188399	0	Prob > chi2 =	0
Pacificboth	0.658307	1.107372	0.552	Pseudo R2 =	0.2632
_cons	-4.0917	0.194709	0	Log likelihood =	-1353.23

	Actual		
Predicted	realRTA=1	realRTA=0	Total
realRTA=1	147	51	198
realRTA=0	433	4725	5158
Total	580	4776	5356
Sensitivity		Pr(+| D)	25.34%
Specificity		Pr(-|~D)	98.93%
Positive predictive value		Pr(D| +)	74.24%
Negative predictive value		Pr(~D| -)	91.61%
Correctly classified			90.96%

The key result, the positive and significant coefficient on *min*s, remains unchanged, and *max*s continues to be insignificant. In addition, three of the continent dummies are positive and significant at the 5% level. From these results, it appears that countries which are both in Europe, the Americas, or Asia, are more likely to form effective RTAs with each other than pairs which are not both on these continents. The largest marginal effect is for countries in Europe, then America. The 'Africaboth' variable is significant at the 10% level, but this is not very robust to changes of specification. The positive coefficient on the Asian dummy does not seem to be robust to changes of specification either, but the European and American pro-RTA effects are much less sensitive and tend to remain positive and significant (with the European coefficient remaining larger than the American one). This is consistent with the prediction of the domino theory that liberalisation between certain countries will instigate regional waves of agreements.

The descriptive dummies (e.g. for contiguity) perform badly again; here none of them have a significant coefficient of the expected sign. This time the coefficient on distance does not have the expected sign either. A possible explanation for this is that the use of continent dummies clouds the relationship with distance, since countries on the same continent are likely to be relatively close together.[21]

The predictive power of the model has increased significantly. The pseudo R^2 is 0.26, compared to 0.12 in the previous model, and 25% of realRTAs were correctly predicted. Overall 91% of pairs were correctly classified. However there remains a lot of unexplained variance in the dependent variable. Clearly many explanatory factors have been omitted from the model, and these are likely to include both economic and political factors. Consideration of any specific agreement leads rapidly to the view that most RTAs are result from a complex mix of political and economic motivations. For example the European Union, which is much broader in scope than a simple free trade agreement was motivated in part by a desire to stabilise the European continent in the wake of two world wars. These factors are difficult to capture in a simple econometric model, and no real attempt has been made to do so in this estimation.

In comparable literature the predictive power also tends to be fairly low. Magee (2004) manages to predict 50-55% of *signed* agreements correctly. Tenreyro et al (2003) attempt to model the determinants of currency unions, and obtain a pseudo R-squared of 0.56 (their model includes 15 explanatory variables). Although Baier and Bergstrand manage to correctly predict 85% of signed RTAs, their sample includes only 54 countries and 1431 pairings, in comparison to the 5356 observations in this sample.

---

[21] Another factor in this is that there are a couple of unusual effective agreements covering a very large dispersion of countries. The GSTP and PTN preferential arrangements both cover a large number of developing countries, some of which are very far away from each other. The results of the estimation are quite sensitive to their inclusion since, although they are only two agreements, they cover a large number of bilateral relationships. If these two agreements are left out of the realRTA variable then distance becomes negative and significant again. There is no reasonable justification for leaving these RTAs out of the realRTA coefficient, but this example serves to illustrate the important point that multi-member agreements do have a large influence on the results of these estimations.

Conclusions

In this dissertation I have tried to shed new light onto some of the questions underlying the debate about regional trade agreements. Most importantly I have focussed on the question of which types of countries are most likely to implement agreements with each other. However, in order to generate meaningful results it was necessary to isolate and consider only those agreements which genuinely increase trade flows between members. This in itself was a complex and time-consuming process.

In the first part of the research a gravity model was used to assess the effectiveness of all RTAs for which information on date of entry was readily available, a total of 158 agreements. For each agreement the effectiveness was tested using a dummy variable taking the value 1 between member countries in the years after the agreement came into force. If the dummy had a positive and significant coefficient the agreement was considered to be effective. The results revealed that less than half of signed RTAs were effective. Agreements prior to 1980 were less likely to be successful than those signed in the 1980s and 1990s, and customs unions were more likely to be effective than other types of agreement. Although the 5% significance level was used to judge significance, of the effective agreements the majority (45 out of 55) had coefficients that were significant at the 1% level (a further six were significant at the 2 percent level). This indicates a quite clear distinction between those that work, and those that don't. Overall, the results were consistent with the idea that many signed RTAs are not effective, justifying the effort to measure their effectiveness in the first place.

The second part of this study shows that the formation of effective RTAs between countries is an endogenous outcome. Mercantile interest in access to export markets is a highly significant determinant of this, as measured by the share of exports to a particular partner in total exports from a particular country. However countries with a disproportionate interest in access to their trade partner's market (compared to their partner's interest in them) appear not to have any influence on the probability of a successful RTA emerging with this partner. In other words dominant partners (or hubs representing important export markets to many of their trading partners) can pick and choose who to implement (effective) agreements with, whereas smaller countries, or spokes, may not always be able to instigate such an arrangement, either with a hub, or another spoke. This implies that the pattern of regional trade agreements that emerges

might not always be in the interests of the smaller trading nations. Although the results are somewhat preliminary, they do suggest the value of exploring this avenue further, possibly using an instrumental variable approach to deal with the endogeneity problem.

Another interesting result was seen after the inclusion of dummy variables for pairs of countries on the same continent. This revealed that two countries both being on certain continents significantly increased their chances of signing an effective RTA, independently of their importance to each other as trading partners. The continent for which this effect was the most pronounced was Europe. This is consistent with Baldwin's domino theory, in which waves of agreements will be signed in the wake of the first few important agreements in a region, as countries that are left out seek to get access to the expanding export markets covered by the earlier liberalisation. It is less consistent with any explanation based purely on the regional proximity of countries wishing to participate in agreements since in this view any dummy capturing a common continent would be expected to raise the likelihood of effective agreement formation. The results of these estimations suggest that dominoes are falling in Europe and America, and the first may be beginning to fall in Asia, but not yet in the Pacific region or Africa.

Another way to look at the continent dummies is that they have picked up some of the complexities behind the decision to create trade agreements. Whereas the model effectively treated all decisions about whether to join regional trade agreements as bilateral ones, in regions where extensive integration has already taken place this is not necessarily realistic. If a large regional trading block has already been formed, then countries outside of that block might see the block, rather than the set of smaller export markets within it, as the unit with which they wish to form an agreement (in the case of customs unions this would be the only possibility). In such regions the probability of effective agreements would be raised.

There remains considerable scope for research in this field, but this dissertation has begun to explore some of the issues behind the pattern of those regional trade agreements which genuinely play a role in shaping trade flows around the world. It is only by obtaining an understanding of such forces that it will be possible to make inferences about how the current proliferation of agreements is likely to affect the world trading system and its members.

References

Anderson, J. and van Wincoop, E. (2001). 'Gravity with Gravitas: a Solution to the Border Puzzle.' American Economic Review.

Baier, S. and Bergstrand, G. (2003). 'Economic Determinants of Free Trade Agreements' Journal of International Economics 64 pp29-63.

Baldwin, Richard E. (1993). 'A Domino Theory of Regionalism' NBER WP4465 (Cambridge).

Baldwin, Richard E. (1997). 'The Causes of Regionalism' The World Economy, Vol 20, No 7. pp865-888.

Baldwin, Richard E. (2003). 'The Spoke Trap: hub and spoke bilateralism in East Asia'

Baldwin, Richard E. (2004). 'Stepping Stones or Building Blocks? Regional and Multilateral Integration'

Baldwin, Richard E. (2005). 'The Euro's Trade Effects', Prepared for ECB Workshop, 'What effects is EMU having on the euro area and its member countries?' Frankfurt 16 June 2005.

Bhagwati, J. and Krueger, A. (1993). 'The Dangerous Drift to Preferential Trade Agreements' (Washington: American Enterprise Institute).

Cheng, I. and Wall, H. (2004). 'Controlling for Heterogeneity in Gravity Models of Trade and Integration', Working Paper, Federal Reserve Bank of St Louis.

Foroutan, Faezeh (1998). 'Does Membership in a Regional Preferential Trade Agreement Make a Country More or Less Protectionist?' World Economy 21(3) pp305-35

Grossman, Gene M, and Helpman, Elhanan (1995). 'The Politics of Free Trade Agreements' The American Economic Review, Vol 85. No 4. pp667-690.

Magee, C. (2004). 'Endogenous Preferential Trade Agreements: An Empirical Analysis', Berkeley Electronic Press.

Nitsch, V. and Sturm, D. (2005). 'Trade Liberalisation Effects of Regional Trade Agreements'.

Persson, T. (2001). 'Currency Unions and Trade: How Large is the Treatment Effect?' Paper presented at the Economic Policy panel meeting in Stockholm on April 6-7, 2001

Robinson, S. Burfisher, M. and Thierfelder, K. (2003). 'Regionalism: Old and New, Theory and Practice', Paper presented to International Agricultural Trade Research Consortium Conference, Capri Italy.

Rose, Andrew, (2003), 'Which International Institutions Promote International Trade?' *accepted in* Review of International Economics.

Soloaga, Isidro, and Winters, Alan (2001). 'Regionalism in the Nineties: What Effect on Trade?' North American Journal of Economics and Finance 12(1) 1-29.

Tenreyro, S. and Barro, R. (2003). 'Economic Effects of Currency Unions' National Bureau of Economic Research, Working Paper 9435.

Tenreyro, S., Barro, R. and Alesina, A. (2002) 'Optimal Currency Area' National Bureau of Economic Research, Working Paper 9078.

Thede, Susanna (2004). 'Determinants of Bilateral Protection', Blackwell Publishing, Oxford.

Appendices

Appendix 1: Derivation of the Gravity Model[22]

Expenditure share identity for a single variety:

$$p_{od} x_{od} \equiv share_{od} E_d ;$$

Where:
x_{od} = the quantity of bilateral exports of a single variety from nation *o* to nation *d*
p_{od} = the price of the good inside country *d*
E_d = the destination nation's nominal expenditure
$share_{od}$ = (by definition) the good's share of expenditure in nation *d*

The expenditure share depends on relative prices and income levels. Using the CES demand function (assuming that all goods are traded):

$$share_{od} \equiv \left(\frac{p_{od}}{P_d} \right)^{1-\sigma}, \quad P_d^{1-\sigma} = \Delta_d, \quad \Delta_d \equiv \sum_{k=1}^{m} n_k \left(p_{kd} \right)^{1-\sigma}, \sigma > 1$$

Where:
p_{od}/P_d = the relative price
P_d = nation-d's CES price index
m = the number of nations from which nation-d buys things
σ = the elasticity of substitution among all varieties
n_k = the number of varieties exported from nation k.
Δ = denominator of the CES demand function.

Assuming full pass-through[23] all trade costs are passed on to the consumer:

$$p_{od} = p_o \tau_{od}$$

---

[22] This derivation closely follows Baldwin (2005).

[23] Consistent with Dixit-Stiglitz monopolistic competition and perfect competition.

Where:

p_o = producer price of nation-o exports

τ_{od} = all trade costs

Multiply the expenditure share function by the number of varieties nation *o* has to offer (n_o) to get aggregate bilateral exports from *o* to *d*. Using V to indicate the total value of trade:

$$V_{od} = n_o p_o^{1-\sigma} \frac{\tau_{od}^{1-\sigma}}{\Delta_d} E_d$$

Nation-o's expenditure must equal the total value of its output (general equilibrium condition ignoring current account imbalances). To make this happen, *o*'s producer prices must adjust to ensure that:

$$E_o = n_o \sum_k (s_{ok} E_k)$$

Using the CES expenditure share function and solving for $n_o p_o^{1-\sigma}$:

$$n_o p_o^{1-\sigma} = \frac{E_o}{\Omega_o}, \qquad \Omega_o = \sum_k \tau_{ok}^{1-\sigma} \frac{E_k}{\Delta_k}$$

Finally, substitute the above into the expression for the volume of trade:

$$V_{od,t} = \left(\frac{\tau_{od,t}^{1-\sigma}}{\Omega_{o,t}\Delta_{d,t}}\right) E_{o,t} E_{d,t}$$

Appendix 2: Current RTAs and Membership

AFTA	**ASEAN Free Trade Area**	Brunei Darussalam Cambodia Indonesia Laos Malaysia Myanmar Philippines Singapore Thailand Vietnam
ASEAN	**Association of South East Asian Nations**	Brunei Darussalam Cambodia Indonesia Laos Malaysia Myanmar Philippines Singapore Thailand Vietnam
BAFTA	**Baltic Free-Trade Area**	Estonia Latvia Lithuania
BANGKOK	**Bangkok Agreement**	Bangladesh China India Republic of Korea Laos Sri Lanka
CAN	**Andean Community**	Bolivia Colombia Ecuador Peru Venezuela
CARICOM	**Caribbean Community and Common Market**	Antigua & Barbuda Bahamas Barbados Belize Dominica Grenada Guyana Haiti Jamaica Monserrat Trinidad & Tobago St. Kitts & Nevis St. Lucia St. Vincent & the Grenadines Surinam
CACM	**Central American Common Market**	Costa Rica El Salvador Guatemala Honduras Nicaragua
CEFTA	**Central European Free Trade Agreement**	Bulgaria Croatia Romania
CEMAC	**Economic and Monetary Community of Central Africa**	Cameroon Central African Republic Chad Congo Equatorial Guinea Gabon
CER	**Closer Trade Relations Trade Agreement**	Australia New Zealand
CIS	**Commonwealth of Independent States**	Azerbaijan Armenia Belarus Georgia Moldova Kazakhstan Russian Federation Ukraine Uzbekistan Tajikistan Kyrgyz Republic
COMESA	**Common Market for Eastern and Southern Africa**	Angola Burundi Comoros Democratic Republic of Congo Djibouti Egypt Eritrea Ethiopia Kenya Madagascar Malawi Mauritius Namibia Rwanda Seychelles Sudan Swaziland Uganda Zambia Zimbabwe
EAC	**East African Community**	Kenya Tanzania Uganda
EAEC	**Eurasian Economic Community**	Belarus Kazakhstan Kyrgyz Republic Russian Federation Tajikistan
EC	**European Communities**	Austria Belgium Cyprus Czech Republic Denmark Estonia Finland France Germany Greece Hungary Ireland Italy Latvia Lithuania Luxembourg Malta Poland Portugal Slovak Republic Slovenia Spain Sweden The Netherlands United Kingdom
ECO	**Economic Cooperation Organization**	Afghanistan Azerbaijan Iran Kazakhstan Kyrgyz Republic Pakistan Tajikistan Turkey Turkmenistan Uzbekistan
EEA	**European Economic Area**	EC Iceland Liechtenstein Norway

EFTA	**European Free Trade Association**	Iceland Liechtenstein Norway Switzerland
GCC	**Gulf Cooperation Council**	Bahrain Kuwait Oman Qatar Saudi Arabia United Arab Emirates
GSTP	**General System of Trade Preferences among Developing Countries**	Algeria Argentina Bangladesh Benin Bolivia Brazil Cameroon Chile Colombia Cuba Democratic People's Republic of Korea Ecuador Egypt Ghana Guinea Guyana India Indonesia Islamic Republic of Iran Iraq Libya Malaysia Mexico Morocco Mozambique Myanmar Nicaragua
LAIA	**Latin American Integration Association**	Argentina Bolivia Brazil Chile Colombia Cuba Ecuador Mexico Paraguay Peru Uruguay Venezuela
MERCOSUR	**Southern Common Market**	Argentina Brazil Paraguay Uruguay
MSG	**Melanesian Spearhead Group**	Fiji Papua New Guinea Solomon Islands Vanuatu
NAFTA	**North American Free Trade Agreement**	Canada Mexico United States
OCT	**Overseas Countries and Territories**	Greenland New Caledonia French Polynesia French Southern and Antarctic Territories Wallis and Futuna Islands Mayotte Saint Pierre and Miquelon Aruba Netherlands Antilles Anguilla Cayman Islands Falkland Islands South Georgia and South Sandwich Islands Mon
PATCRA	**Agreement on Trade and Commercial Relations between the Goverment of Australia and the Government of Papua New Guinea**	Australia, Papua New Guinea
PTN	**Protocol relating to Trade Negotiations among Developing Countries**	Bangladesh Brazil Chile Egypt Israel Mexico Pakistan Paraguay Peru Philippines Republic of Korea Romania Tunisia Turkey Uruguay Yugoslavia
SADC	**Southern African Development Community**	Angola Botswana Lesotho Malawi Mauritius Mozambique Namibia South Africa Swaziland Tanzania Zambia Zimbabwe
SAPTA	**South Asian Preferential Trade Arrangement**	Bangladesh Bhutan India Maldives Nepal Pakistan Sri Lanka
SPARTECA	**South Pacific Regional Trade and Economic Cooperation Agreement**	Australia New Zealand Cook Islands Fiji Kiribati Marshall Islands Micronesia Nauru Niue Papua New Guinea Solomon Islands Tonga Tuvalu Vanuatu Western Samoa
TRIPARTITE	**Tripartite Agreement**	Egypt India Yugoslavia
UEMOA WAEMU	**West African Economic and Monetary Union**	Benin Burkina Faso Côte d'Ivoire Guinea Bissau Mali Niger Senegal Togo

Source: WTO

Appendix 3: Results of the Pooled and Panel Gravity Models

POOLED			PANEL with Country Pair Fixed Effects and Year Dummies		
R-squared = 0.6855			R-squared = 0.9174		
Adj R-squared = 0.6852			Adj R-squared = 0.9108		
Root MSE = 1.9751			Root MSE = 1.0515		
Regression with robust standard errors			Regression with robust standard errors		
Number of obs = 139825			Number of obs = 139825		
ltrade	Coefficient		ltrade	Coefficient	
_cons	-20.996	**	_cons	-56.331	**
lgdp1	0.937	**	lgdp1	0.870	**
lgdp2	0.928	**	lgdp2	0.866	**
lpop1	0.027	**	lpop1	0.980	**
lpop2	0.051	**	lpop2	0.986	**
ldist	-1.145	**			
pairEU58	-0.067	**	**pairEU58**	0.555	**
pairEFTA59	1.508	**	**pairEFTA59**	0.229	**
pairCACM60	2.530	**	pairCACM60	(dropped)	**
pairCARICOM72	3.354	**	**pairCARICOM72**	0.398	**
pairEUOCTs70	0.724	**	pairEUOCTs70	-0.668	
pairMERCUSOR94	0.464	**	**pairMERCUSOR94**	0.267	**
pairNAFTA93	0.375	**	**pairNAFTA93**	0.770	**
pairCOMESA94	-0.495	**	pairCOMESA94	0.247	
pairEAEC96	1.053	**	pairEAEC96	0.022	
pairSAPTA95	-0.223		pairSAPTA95	-0.173	
pairCIS94	1.930	**	pairCIS94	(dropped)	**
pairMSG92	0.124		**pairMSG92**	0.921	**
pairCER82	-0.803	**	**pairCER82**	0.400	**
pairCAN87	0.478	**	**pairCAN87**	0.843	**
pairTRIPARTITE67	0.562	**	pairTRIPARTITE67	-2.010	**
pairPTN72	-0.383	**	**pairPTN72**	0.914	**
pairPATCRA76	-0.060		pairPATCRA76	-0.173	
pairBANKOK75	-0.123		**pairBANKOK75**	1.910	**
pairSPARTECA80	3.288	**	pairSPARTECA80	-0.062	
pairLAIA80	0.808	**	pairLAIA80	-0.067	
pairGSTP88	-0.631	**	**pairGSTP88**	0.776	**
pairCEMAC98	-0.305		pairCEMAC98	-0.913	**
pairCEFTA92	0.424	**	**pairCEFTA92**	0.443	**
pairWAEMU99	1.178	**	pairWAEMU99	-0.010	
pairEAC99	-4.230	**	pairEAC99	(dropped)	**
pairSADC99	1.012	**	pairSADC99	-0.032	
pairEUSWISS72	-0.235	**	**pairEUSWISS72**	0.214	**
pairEUICELAND72	0.639	**	**pairEUICELAND72**	0.122	**
pairEUNORWAY72	0.114	**	**pairEUNORWAY72**	0.300	**
pairEUALG75	-0.713	**	pairEUALG75	-0.313	**
pairEUSYR76	-0.171	**	pairEUSYR76	-0.115	
pairEUROM92	-0.445	**	**pairEUROM92**	1.288	**
pairEUBULG92	-0.094		**pairEUBULG92**	0.609	**
pairEUTURK95	-0.301	**	**pairEUTURK95**	0.941	**
pairEUTUN97	-0.332	**	pairEUTUN97	0.051	
pairEUSTHA99	1.066	**	pairEUSTHA99	0.036	
pairEUMOR99	-0.265	**	pairEUMOR99	-0.075	

pairEUISR99	0.135	
pairEUMEX99	-0.550	**
pairEUMAC00	-0.847	**
pairEUCRO01	-1.165	**
pairEUJOR01	-0.940	**
pairEUCHL02	0.850	**
pairEULEB02	-1.125	**
pairEFTATURK91	-0.943	**
pairEFTAISRA92	0.058	
pairEFTAROM92	-0.923	**
pairEFTABULG92	-0.817	**
pairEFTAMOR98	-1.122	**
pairEFTAMAC99	-1.454	**
pairEFTAMEX00	-1.282	**
pairEFTAJOR01	-3.268	**
pairEFTACRO01	-1.386	**
pairEFTASNG02	1.815	**
pairUSISRAEL84	1.492	**
pairARMRUS92	-0.028	
pairKRYGRUS92	1.097	**
pairGEORUS93	-0.543	**
pairROMMOLD94	2.039	**
pairKYRGARM95	-3.513	**
pairKYRGKAZAK95	0.016	
pairARMMOLD95	-0.817	**
pairGEORUKR95	-0.332	**
pairARMTURKM95	3.571	**
pairGEORGAZER95	0.880	**
pairKYRGMOL96	0.653	
pairARMUKR96	-0.635	**
pairCANISRAE96	0.662	**
pairISRATURK96	0.185	
pairCANCHILE96	1.082	**
pairKRYGUKR97	0.429	**
pairROMTURK97	-0.087	
pairGEORGARM97	-0.126	
pairBULTUR98	0.483	**
pairGEOKAZ98	-0.553	
pairCHIMEX98	1.705	**
pairMEXISR99	-0.123	**
pairBULMAC99	0.967	**
pairGEOTUM99	3.550	**
pairTURMAC99	-0.542	**
pairNZLSNG01	2.761	**
pairINDSRI01	1.324	**
pairUSAJOR01	0.581	**
pairARMKAZ01	-2.428	**
pairBULISR01	-0.434	**
pairCHLCTR01	1.850	**
pairCHLELS01	0.441	
pairALBMAC01	-0.628	**
pairJAPSNG02	1.788	**
pairCROALB02	-1.067	**
pairCROTUR02	-1.495	**
pairAUSSNG02	2.682	**

pairEUISR99	-0.408	**
pairEUMEX99	0.237	**
pairEUMAC00	0.126	
pairEUCRO01	0.115	
pairEUJOR01	0.152	
pairEUCHL02	0.252	
pairEULEB02	-0.139	**
pairEFTATURK91	0.573	**
pairEFTAISRA92	-0.582	**
pairEFTAROM92	0.923	**
pairEFTABULG92	0.773	**
pairEFTAMOR98	0.022	
pairEFTAMAC99	0.266	
pairEFTAMEX00	0.220	
pairEFTAJOR01	-0.398	
pairEFTACRO01	0.009	
pairEFTASNG02	-0.397	**
pairUSISRAEL84	0.042	
pairARMRUS92	(dropped)	**
pairKRYGRUS92	(dropped)	**
pairGEORUS93	(dropped)	**
pairROMMOLD94	0.117	**
pairKYRGARM95	(dropped)	**
pairKYRGKAZAK95	0.248	**
pairARMMOLD95	(dropped)	**
pairGEORUKR95	(dropped)	**
pairARMTURKM95	(dropped)	**
pairGEORGAZER95	(dropped)	**
pairKYRGMOL96	0.237	
pairARMUKR96	(dropped)	**
pairCANISRAE96	-0.122	
pairISRATURK96	0.873	**
pairCANCHILE96	0.637	**
pairKRYGUKR97	-0.146	
pairROMTURK97	0.543	**
pairGEORGARM97	-0.585	**
pairBULTUR98	0.465	**
pairGEOKAZ98	0.437	
pairCHIMEX98	0.039	
pairMEXISR99	0.097	
pairBULMAC99	-0.228	**
pairGEOTUM99	-0.325	
pairTURMAC99	-0.243	
pairNZLSNG01	-0.862	**
pairINDSRI01	0.302	
pairUSAJOR01	0.987	**
pairARMKAZ01	-0.695	**
pairBULISR01	0.029	
pairCHLCTR01	1.299	**
pairCHLELS01	1.188	**
pairALBMAC01	-0.935	**
pairJAPSNG02	-0.742	**
pairCROALB02	-0.280	**
pairCROTUR02	0.336	**
pairAUSSNG02	-0.524	**

pairALBBUL02	-1.724	**	pairALBBUL02	-0.021	
pairEUMAL70	0.993	**	**pairEUMAL70**	0.280	**
pairEUCYP72	0.652	**	pairEUCYP72	-0.200	**
pairEUEGY76	-0.119		pairEUEGY76	0.145	
pairEUCZH91	-0.462	**	**pairEUCZH91**	0.267	**
pairEUHUN91	-0.200	**	**pairEUHUN91**	0.938	**
pairEUPOL91	-0.635	**	**pairEUPOL91**	0.804	**
pairEUSLO91	-0.594	**	pairEUSLO91	(dropped)	**
pairEUEST94	0.189	**	pairEUEST94	(dropped)	**
pairEULAT94	-0.240	**	**pairEULAT94**	0.750	**
pairEULIT94	-0.161	**	**pairEULIT94**	0.684	**
pairEUSLV96	-0.389	**	**pairEUSLV96**	0.235	**
pairEFTACZE91	-0.573	**	pairEFTACZE91	(dropped)	**
pairEFTASLO91	-0.966	**	pairEFTASLO91	-0.342	**
pairEFTAHUN92	-0.666	**	**pairEFTAHUN92**	0.224	**
pairEFTAPOL92	-0.620	**	**pairEFTAPOL92**	0.379	**
pairEFTASLV94	-0.789	**	**pairEFTASLV94**	0.499	**
pairEFTAEST95	0.795	**	**pairEFTAEST95**	0.657	**
pairEFTALAT95	0.195		**pairEFTALAT95**	1.161	**
pairEFTALIT95	0.173		**pairEFTALIT95**	0.668	**
pairCHIBOL94	1.629	**	pairCHIBOL94	-0.484	**
pairESTHUN97	1.051	**	**pairESTHUN97**	1.218	**
pairESTSLO96	-0.088		**pairESTSLO96**	1.181	**
pairESTTUR97	-0.729	**	pairESTTUR97	-0.388	
pairESTUKR95	1.872	**	pairESTUKR95	(dropped)	**
pairHONPAN72	2.398	**	**pairHONPAN72**	0.222	**
pairHUNISR97	-0.187	**	pairHUNISR97	0.142	
pairHUNLAT99	-0.343	**	**pairHUNLAT99**	0.222	**
pairHUNLIT99	-0.057		pairHUNLIT99	-0.074	
pairHUNTUR97	-0.620	**	**pairHUNTUR97**	0.593	**
pairINDNEP90	0.666	**	pairINDNEP90	0.526	
pairISRPOL97	-1.046	**	pairISRPOL97	0.462	
pairISRSLO96	-1.158	**	pairISRSLO96	-0.313	**
pairLATPOL98	-0.357	**	**pairLATPOL98**	0.543	**
pairLATSLO96	0.489	**	**pairLATSLO96**	0.905	**
pairLATSLV95	0.015		**pairLATSLV95**	1.742	**
pairLATTUR99	-2.025	**	pairLATTUR99	-0.227	
pairLITPOL96	0.197	**	**pairLITPOL96**	0.299	**
pairLITSLO96	-0.188	**	pairLITSLO96	-0.176	**
pairLITSLV96	-0.308	**	**pairLITSLV96**	0.321	**
pairLITTUR96	-0.174		**pairLITTUR96**	0.692	**
pairMEXBOL94	-0.236	**	pairMEXBOL94	0.382	
pairMEXCTR94	0.594	**	**pairMEXCTR94**	0.679	**
pairMEXNIC97	0.636	**	pairMEXNIC97	-0.156	
pairPOLTUR99	-0.927	**	**pairPOLTUR99**	0.684	**
pairSLOTUR97	-0.812	**	**pairSLOTUR97**	0.522	**
pairSLVMAC95	2.784	**	pairSLVMAC95	-0.470	**
pairSLVTUR99	-0.365	**	**pairSLVTUR99**	0.649	**
pairBAFTA93	2.805	**	pairBAFTA93	(dropped)	**
pairMEXCOLVEN94	-0.286	**	**pairMEXCOLVEN94**	0.554	**
pairMERCHI99	0.652	**	pairMERCHI99	-0.234	**
pairCHICA01	-0.676	**	pairCHICA01	(dropped)	**
pairMEXTN00	-0.538	**	pairMEXTN00	(dropped)	**

** shows significant at the 5% level, 'effective' agreements highlighted

Appendix 4: Results of Gravity Estimations Split by Period

RTAs Entering into Force 1950-1970			
R-squared = 0.9394			
Adj R-squared = 0.9290			
Root MSE = .89314			
ltrade	Coef.	P>|t|	Marginal Effect
lgdp1	0.784	0	
lgdp2	0.780	0	
lpop1	0.703	0	
lpop2	0.707	0	
pairEU58	0.184	0.001	0.202
pairEFTA59	0.146	0.011	0.157
pairCACM60	(dropped)		
pairTRIPA~67	-0.693	0	
_cons	-43.957	0	

RTAs Entering into Force 1970-1975			
R-squared = 0.9306			
Adj R-squared = 0.9219			
Root MSE = .95732			
ltrade	Coef.	P>|t|	Marginal Effect
lgdp1	0.735	0	
lgdp2	0.731	0	
lpop1	0.712	0	
lpop2	0.713	0	
pairEUOCTs70	-0.429	0.489	
pairEUMAL70	0.342	0	0.407
pairCARIC~72	0.076	0.24	
pairPTN72	0.403	0	0.496
pairEUSWI~72	-0.088	0.061	
pairEUICE~72	-0.285	0	
pairEUNOR~72	-0.045	0.243	
pairEUCYP72	(dropped)		
pairHONPAN72	0.176	0.125	
_cons	-41.989	0	

RTAs Entering into Force 1975-1980			
R-squared = 0.9270			
Adj R-squared = 0.9188			
Root MSE = .99259			
ltrade	Coef.	P>|t|	Marginal Effect
lgdp1	0.732	0	
lgdp2	0.731	0	
lpop1	0.480	0	
lpop2	0.480	0	
pairBANKOK75	1.612	0	4.012
pairEUALG75	-0.118	0.417	

pairPATCRA76	-0.339	0.001	
pairEUSYR76	-0.202	0.052	
pairEUEGY76	0.818	0	1.266
_cons	-35.228	0	

RTAs Entering into Force 1980-1985

R-squared = 0.9286
Adj R-squared = 0.9210
Root MSE = .98386

ltrade	Coef.	P>|t|	Marginal Effect
lgdp1	0.646	0	
lgdp2	0.644	0	
lpop1	0.723	0	
lpop2	0.723	0	
pairSPART~80	-0.131	0.245	
pairLAIA80	-0.200	0	
pairCER82	0.218	0.045	0.244
pairUSISR~84	0.031	0.615	
_cons	-38.480	0	

RTAs Entering into Force 1985-1990

R-squared = 0.9336
Adj R-squared = 0.9253
Root MSE = .95093

ltrade	Coef.	P>|t|	Marginal Effect
lgdp1	0.735	0	
lgdp2	0.729	0	
lpop1	1.048	0	
lpop2	1.054	0	
pairCAN87	0.206	0.018	0.229
pairGSTP88	0.475	0	0.608
pairLAOST~90	(dropped)		
pairINDNEP90	0.058	0.883	
_cons	-53.976	0	

RTAs Entering into Force 1990-1995

R-squared = 0.9389
Adj R-squared = 0.9306
Root MSE = .91231

ltrade	Coef.	P>|t|	Marginal Effect
lgdp1	0.649	0	
lgdp2	0.646	0	
lpop1	1.312	0	
lpop2	1.314	0	
pairEFTAT~91	0.259	0.017	
pairEUCZH91	(dropped)		
pairEUHUN91	0.770	0	1.160
pairEUPOL91	0.741	0	1.098

pairEUSLO91	0.242	0	0.273
pairEFTAC~91	-0.259	0	
pairEFTAS~91	(dropped)		
pairMSG92	0.454	0.248	
pairCEFTA92	0.346	0	0.414
pairEUROM92	1.039	0	1.828
pairEUBULG92	0.464	0	0.590
pairEFTAI~92	-0.291	0	
pairEFTAR~92	0.757	0	1.132
pairEFTAB~92	0.714	0.008	1.042
pairARMRUS92	(dropped)		
pairKRYGR~92	(dropped)		
pairFAROEN~2	(dropped)		
pairFAROEI~2	(dropped)		
pairEFTAH~92	0.249	0	0.282
pairEFTAP~92	0.280	0.018	0.324
pairNAFTA93	0.497	0	0.644
pairGEORUS93	(dropped)		
pairBAFTA93	(dropped)		
pairMERCU~94	0.222	0	0.249
pairCOMESA94	0.130	0.443	
pairCIS94	(dropped)		
pairROMMO~94	0.120	0	0.127
pairFAROE~94	(dropped)		
pairEUEST94	(dropped)		
pairEULAT94	0.694	0	1.002
pairEULIT94	0.621	0	0.861
pairEFTAS~94	0.571	0.024	0.770
pairARMKYR94	(dropped)		
pairCHIBOL94	-0.197	0.065	
pairMEXBOL94	0.293	0.097	
pairMEXCTR94	0.514	0.025	0.673
pairMOLROM94	(dropped)		
pairMEXCO~94	0.643	0	0.902
_cons	-58.544	0	

RTAs Entering into Force 1995-2000

R-squared = 0.9463
Adj R-squared = 0.9390
Root MSE = .86276

ltrade	Coef.	P>|t|	Marginal Effect
lgdp1	0.641	0	
lgdp2	0.642	0	
lpop1	0.866	0	
lpop2	0.863	0	
pairSAPTA95	-0.141	0.269	
pairEUTURK95	0.517	0	
pairKYRGA~95	(dropped)		

pairKYRGK~95	0.204	0.097	
pairARMMO~95	(dropped)		
pairGEORU~95	(dropped)		
pairARMTU~95	(dropped)		
pairGEORG~95	(dropped)		
pairEFTAE~95	0.681	0	0.975
pairEFTALA~5	1.180	0	2.253
pairEFTALI~5	0.691	0.016	0.996
pairESTUKR95	(dropped)		
pairLATSLV95	1.765	0	4.844
pairSLVMAC95	-0.536	0.019	
pairEAEC96	-0.079	0.292	
pairEUFAR~96	(dropped)		
pairKYRGM~96	0.137	0.756	
pairARMUKR96	(dropped)		
pairCANIS~96	0.132	0.085	
pairISRAT~96	0.916	0	1.499
pairCANCH~96	0.105	0.011	0.111
pairEUSLV96	0.194	0	0.214
pairESTSLO96	1.209	0	2.350
pairISRSLO96	-0.290	0	
pairLATSLO96	0.951	0	1.589
pairLITPOL96	0.388	0	0.474
pairLITSLO96	-0.112	0.234	
pairLITSLV96	0.378	0.007	0.459
pairLITTUR96	0.758	0.014	1.133
pairEUTUN97	-0.105	0.12	
pairKRYGUK~7	-0.256	0.057	
pairROMTU~97	0.466	0.006	0.593
pairKRYGUZ~7	(dropped)		
pairGEORG~97	-0.582	0	
pairESTFAR97	(dropped)		
pairESTHUN97	1.282	0	2.603
pairESTTUR97	-0.351	0.17	
pairHUNISR97	0.147	0.095	
pairHUNTUR97	0.628	0	0.873
pairISRPOL97	0.525	0.138	
pairMEXNIC97	0.193	0.231	
pairSLOTUR97	0.528	0.038	0.695
pairCEMAC98	-0.435	0.297	
pairEFTAM~98	-0.083	0.584	
pairBULTUR98	0.452	0	0.572
pairGEOKAZ98	0.373	0.398	
pairCHIMEX98	0.701	0.001	1.015
pairFARPOL98	(dropped)		
pairLATPOL98	0.618	0.001	0.855
pairWAEMU99	0.173	0.209	
pairEAC99	(dropped)		

pairSADC99	0.033	0.786	
pairEUSTHA99	0.156	0	0.169
pairEUMOR99	-0.037	0.426	
pairEUISR99	-0.222	0	
pairEUMEX99	0.205	0	0.228
pairEFTAM~99	0.220	0.242	
pairMEXISR99	0.422	0	0.524
pairBULMAC99	-0.220	0.002	
pairGEOTUM99	-0.325	0.306	
pairTURMAC99	-0.292	0.067	
pairHUNLAT99	0.295	0	0.343
pairHUNLIT99	0.001	0.994	
pairLATTUR99	-0.186	0.642	
pairPOLTUR99	0.649	0.001	0.914
pairSLVTUR99	0.618	0	0.856
pairMERCHI99	-0.178	0.013	
_cons	-43.883	0	

RTAs Entering into Force 2000 onwards

R-squared = 0.9535
Adj R-squared = 0.9457
Root MSE = .81827

ltrade	Coef.	P>|t|	Marginal Effect
lgdp1	0.563	0	
lgdp2	0.567	0	
lpop1	0.401	0	
lpop2	0.397	0	
pairEUMAC00	0.038	0.585	
pairEFTAM~00	0.143	0.254	
pairCROBOS00	(dropped)		
pairMEXTN00	(dropped)		
pairEUCRO01	0.078	0.22	
pairEUJOR01	-0.120	0.379	
pairEFTAJ~01	-0.110	0.753	
pairEFTAC~01	-0.017	0.911	
pairNZLSNG01	-0.215	0.005	
pairINDSRI01	0.519	0	0.680
pairUSAJOR01	0.845	0	1.329
pairARMKAZ01	-0.641	0.094	
pairBULISR01	0.013	0.856	
pairCHLCTR01	-0.120	0.471	
pairCHLELS01	-0.350	0.194	
pairALBMAC01	-0.857	0	
pairCANCTR01	(dropped)		
pairCHICA01	(dropped)		
pairEUCHL02	-0.097	0.05	
pairEULEB02	-0.135	0.042	
pairEFTAS~02	-0.439	0.012	

pairJAPSNG02	-0.375	0	
pairCROALB02	-0.152	0.266	
pairTURBOS02	(dropped)		
pairCROTUR02	0.377	0	0.458
pairAUSSNG02	-0.159	0	
pairALBBUL02	0.124	0.294	
_cons	-25.294	0	

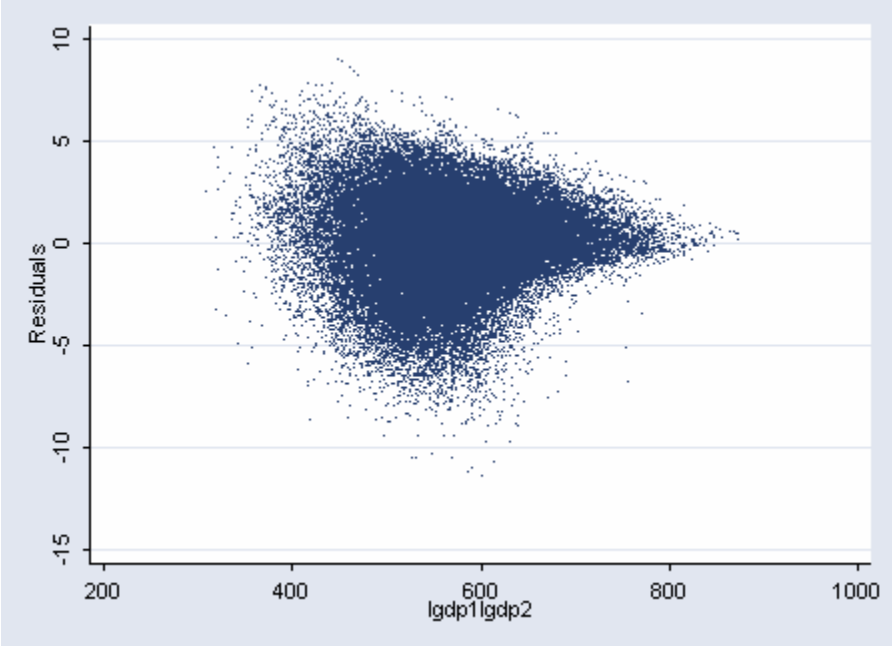
Appendix 5: Residuals Plotted for Gravity Models

It is informative to examine the pattern of residuals when ordered in certain ways. The residuals shown here are from regressions including the full time period and all RTA dummies (for the purposes of brevity the residuals from the individual shorter-period estimations actually used to generate the realRTA series are not all displayed).

A) Evidence of Heteroskedasticity

Pooled Model:

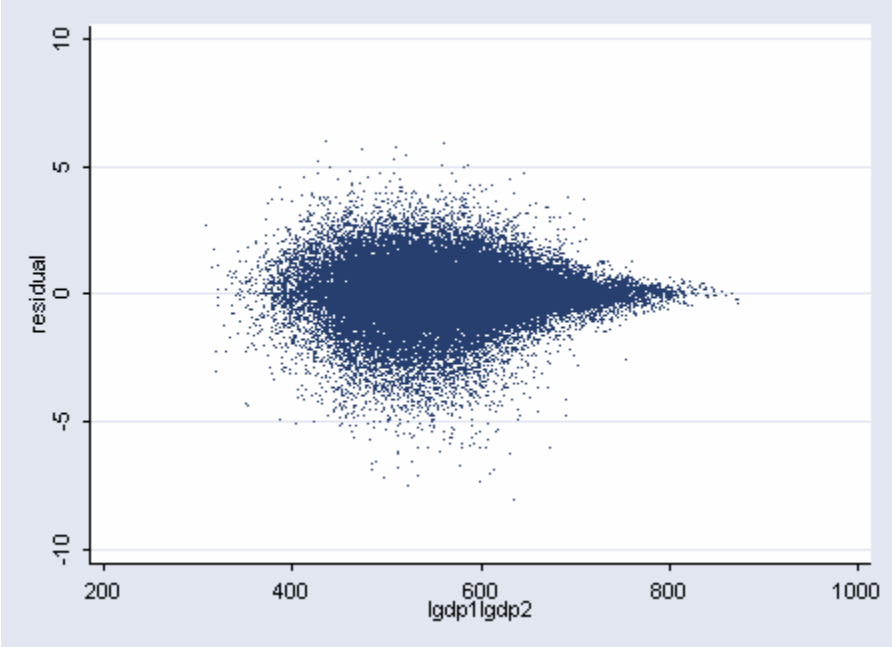
In the graph below the residuals from the pooled model are ordered by the product of the logs of the GDPs of the countries (for the year of the observation). There is a clear wedge shape, indicating that the variance of the residuals is not independent of the explanatory variables (although they enter the specification additively, rather than multiplicatively). This illustrates why it was necessary to take into account heteroskedasticity using robust standard errors.



Final Specification using Fixed Effects:

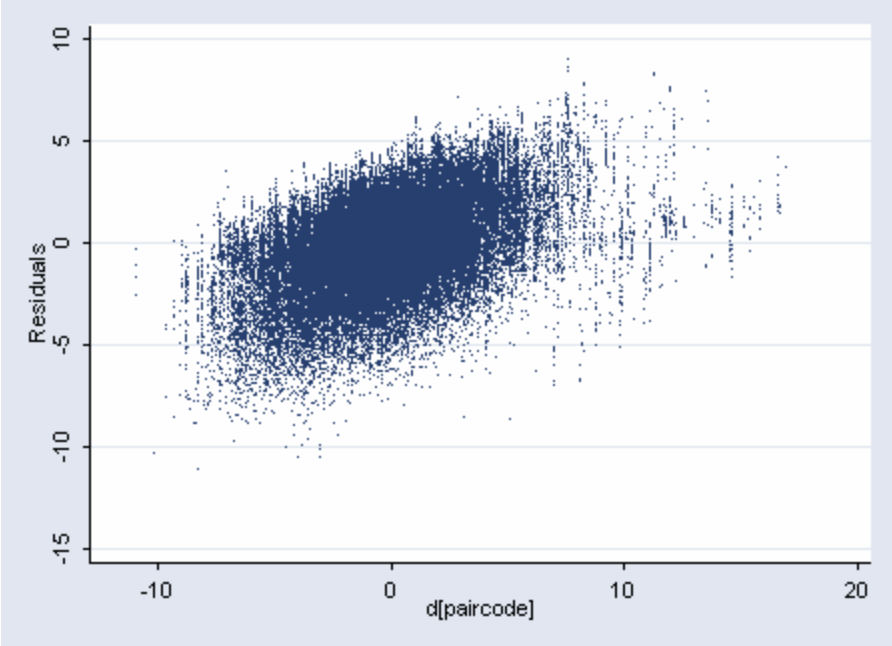
The same plot is shown for the residuals of the estimation in which country pair fixed effects were added. Again, the variance of the errors is negatively related to the product

of the logs of the GDPs of the country pair. This is consistent with the common observation that the gravity model is a better predictor of trade flows between developed, than developing countries.



B) The Use of Country Pair Fixed Effects

In the next plot, the residuals from the pooled model are plotted again, but this time the horizontal axis plots the coefficients on the fixed effects of each country pair. To the left-hand side are those pairs where the fixed effect was negative, in other words allowing the intercept to vary by country pair reveals that these pairs have a consistently less strong trading relationship than what would be predicted by the model. As you would expect, these country pairs have more negative residuals in the original pooled estimation than the others, and there is an obvious upward sloping shape to the cloud of points. This simply highlights the importance of using the country pair fixed effects, since there is obviously a great deal of variation in the mean of the residuals by country pair.



Once the fixed effects are added into the specification this problem is rectified by introducing differences in intercepts between country pairs: