

Development of trade blocs in an era of globalization: Proximity still matters

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Abstract

This article investigates the development of international trade blocs in the global economy for the period 1950-2005. We introduce a new trade bloc variable based on the intramax hierarchical clustering technique, which defines trade blocs on actual trade intensities and not—as was previously done—by traditional geographic and political factors, such as the division into a triad of economic regions based on North America, the European Union and Japan. Nevertheless, the results of intramax hierarchical clustering indicate that actual trade flows are very much influenced by geographical, cultural, historical and political factors; after all, proximity matters. To explain how mechanisms of globalization changed trade patterns over the last half century and how, in the end, proximity is one of the most explanatory variables, we apply multivariate analysis with gravity-equation based variables that can be associated with the existence of trade clusters.

Keywords: International trade, proximity, trade clusters, intramax, gravity model (*JEL* F13, F18, R11, R12).

1 Introduction

Geographic space can be defined by its administrative, economic, cultural, historic, socio political and/or legal context. However, this does not strictly mean that business and economic activities occur along the same lines. In describing trade blocs, for example, economic studies typically divide space

into regions that are based on geographic (e.g. continents) or political factors (e.g. nation states). But is there a way to identify trade blocs that are independent of such factors? The answer is: Yes. And it is still geographically relevant, since trade among countries is imbalanced and influenced by changes in political and institutional factors, their (shared) history, colonial ties language and culture. In other words: the centripetal and centrifugal forces of regionalization and globalization (compare Andresen, 2009*b*).

Much has been written about the so-called “triad” of economic regions based on North America, the European Union and Japan, which defines trade blocs by traditional geographic and political factors. As Poon et al. (2000) and Poon and Pandit (1996) show with trade data spanning 40 years, this triad of economic regions is a myth, while the regionalization of nations that trade more together within a cluster is reality (compare Glenn, 2008). Poon et al. (2000) and Poon and Pandit (1996) find that international trade does increasingly focus on a few clustered regions, but find no evidence for a triad-based world economy. Interesting is the change in clusters and directions of trade over the years. If one studies longitudinal data, the first impression is that trade and the direction of trade is not stable. How can one investigate such fluctuations and do these fluctuations affect trade clusters? Are there international trade clusters to be found and how stable are they over time? How can possible differences and shifts over time be explained? Contrary to Poon and Pandit (1996), we investigate a number of variables—geographical, political, historical and cultural—that are associated with these trade clusters, and how they change over time. It needs to be underlined that we only focus on aggregate merchandise trade flows, and not foreign direct investment (FDI).

Summarizing, our main goal is to investigate the drivers of (geographical) clustering of trading nations into trade blocs. We do so by applying the intramax clustering techniques to a dataset spanning 1950-2005. This is a more elaborate dataset than used in previous research concerning trade clusters. Moreover, we apply gravity-equation variables in a multivariate analysis (compare Frankel et al., 1995, 1996) to investigate why certain regions trade with each other in larger (relative) trade volume than with other countries. Is geographical proximity the main determinant as Krugman (1991) suggests, or do other factors contribute as well? We expect that, in addition to geodesic distance, trade partners’ gross domestic product (GDP), population size, shared languages, shared colonial history, shared border(s), grade of isolation (landlocked, island, common continent) and/or their involvement in a common trade agreement can all be associated with the formation of trade blocs.

The intramax technique is a hierarchical clustering method that is used in spatial studies. It groups predefined areas (districts, countries, etc.) based on the level of interaction between them. For example, this technique is used to gain a better understanding of urban regions and their catchment areas

by using data on commuter flows. The resulting clusters are also known as functional areas. In this study, the intramax method uses bilateral trade data to identify functional trade blocs. Note that although an initial amount of space is identified (i.e. countries), the intramax method does not require neighboring countries to belong to the same trade bloc. Whether countries belong to the same trade bloc strictly depends on bilateral trade flows, as will be explained below.

The literature review is given in section 2, which elaborates on the issues raised in the introduction. Section 3 explains the methodology and discusses the choices made in instruments and data. Section 4 presents the results. Section 5 provides a discussion and draws conclusions.

2 Literature review

Our main goal is to investigate what drives (geographical) clustering of trading nations. The literature indicates that regionalization of nations is increasing and very much a realistic division of economic spaces in the world economy. Many studies (amongst others Poon, 1997*a,b*; Poon and Pandit, 1996; Poon et al., 2000; Glenn, 2008; MacLeod and Jones, 2007; Andresen, 2009*a,b*) indicate (geographical) clustering of nations due to forces of natural and institutional regionalization.

2.1 Regionalization of trade clusters

Economic activities are increasingly occurring within supranational spaces or regional states, which results in functionally interconnected transnational spaces. The “space” in which trade takes place is defined by the flows of economic activity, rather than by political boundaries (Glenn, 2008). Political boundaries can be identified either physically (e.g. by an ocean or river) or as a (real or imagined) line in the sand that defines the boundary of a nation, state, city or other jurisdiction, separating the rights and laws of one from the other’s rights and laws (Gregory et al., 2009). In this study, we use political boundary as the division between the nation states. Emerging from economic activities, this “regional state” therefore comprises the whole of two or more nation states, based on the outcome of global trade and multinational activity (Poon and Pandit, 1996).

Due to intensifying forces of globalization in the 1990s, the number and volume of linkages between countries has also been strengthened and forced integration of otherwise spatially separate economic activities (Poon et al., 2000). Glenn (2008) finds similar evidence for an increasing number of countries to be more integrated into a common economic system. He defines regionalization as follows: “. . . economic activity is becoming ever more concentrated within clearly identifiable geographical regions” (p. 80).

Poon (1997*b*) argues that this regionalization of international trade is said to be a “natural phenomenon”. But in accordance with Frankel et al. (1995), he also emphasizes that the governmental promotion of linkages between countries by joining preferential trading agreements (PTAs), such as free trade areas and customs unions, can spur the natural process of regionalization, especially if the main goal is to increase economic integration. Frankel et al. (1995, 1996) reflect that close historical and geographical ties between the countries drive this “natural” process of regionalization. Poon (1997*a,b*) adds, however, that very often regionalization happens without these explicit aims or measures and underlines that regionalization of countries is often only driven by market forces. These “natural trading regions” consist of countries with high trading intensities among each other due to geographical proximity, lower transaction costs and cultural affinities creating spatial biases (compare Frankel et al., 1995, 1996). The trade regions that come forward from regionalization are the combination of two or more nation states, based on economic activity, rather than political boundaries. It must be underlined that this regionalization process based on trade differs significantly from closed trade blocs. The latter is formed basically by political institutions and decisions, whereas the former reveals the workings of global capital and markets (Poon and Pandit, 1996). Andresen (2009*a*) adds that the trade clusters are not “forced” due to preferential trade agreements—although they can have a positive influence—this process is called regionalism.

2.2 Importance of distance

Now that we are in an era of globalization, an increasing number of countries has become integrated in the global economic system. Many named the forces of globalization to indicate the “end of geography” (see, among others, Greig, 2002; Friedman, 2005; Baldwin, 2006). This spurred the powerful counterargument that “the world is not flat” (for an excellent overview, see Christopherson et al., 2008), which argues that globalization makes geodesic distance sometimes less important, e.g. by the increase in mobile communication and introduction of the Internet, but with an increase in trade in knowledge intensive sectors; distance, or proximity, is getting more important. Face-to-face contacts are necessary in the transfer of this specific sectoral knowledge and consequently for trade (Dicken, 2007). This remains important even with the change in decreased costs in accessing foreign markets (Andresen, 2009*b*). He argues that geographical or cultural distance “still” play a role, and maybe even a growing one, for international trade relationships. On one side regionalization and on the other side globalization; both play part in determining international trade patterns (Michalak and Gibb, 1997). When defining international trade as moving goods from one place to another influenced by special transfer costs (transport, tariffs,

etc.), geographical distance obviously is important (Hanink and Cromley, 2005).

Most countries have a growing quantity of their national economic activities in some sort of a “relationship” with a growing number of other countries (Andresen, 2009*a,b*). Do these global flows of trade increase the probability of regionalization with a larger number of countries? Are fewer trade clusters the result of this growing number of relationships? According to Glenn (2008), the answer is “no”. Even though trade might increase at a global level, the distance to trade partners influences the volume of trade and therefore the regionalization processes. In a conceptual framework, MacLeod and Jones (2007) agree that distance is the most dominant determinant for generating economic regions, but underline the influence of culture, politics and history on *relative* distance (“spatial flows”) as discontinuous or strengthening forces. The territories (or economic regions rather) that are created by these spatial flows have strong ties, but are not unbreakable, but rather victim to continuous “territorial restructuring” (p. 1182) in a politically and economically turbulent world. Our study provides an empirical application to this conceptual idea.

Poon et al. (2000) find that international trade has organized around fewer and fewer world regions since 1985, but find no evidence for a triadization of the world economy. They do argue that forces of globalization have led to the decrease in the number of trade regions they find. The authors find that the changing shape and nature of trade clusters is largely ascribed to continental lines and at the same time strengthened by FDI, which does appear to have a “network” shape and does not need continuous continental regions. Andresen (2009*a*) agrees with those findings. According to Poon et al. (2000), the fluctuation of trade clusters is “operated by centrifugal and centripetal forces operating simultaneously, resulting in constellations of relationship (e.g. trade clusters) where space is both sticky (important) and fluid (flexible) at the same time” (p.440). Concluding, it can be said that economic flows do not only follow absolute space, but they are also led by relative distance, formed by historical ties, shared cultures and (changing) political systems. Countries trade with “natural partners” (Michalak and Gibb, 1997).

The importance of spatial structure was investigated by Poon and Pandit (1996) in the process of regionalization. They find, rather than a triad structure of global trade, evidence for six trade clusters focused around six core market countries (the US, Germany, France, the UK and the former USSR), underlining that these clusters are not geographically contiguous regions, but “functional units”, not defined by only geographical proximity, but more by the volume of trade interactions. The functional regions described by the authors are explained by the intensity of bilateral trade between the members. The authors argue that “scale economies and large efficient markets are instrumental in shaping emerging regional configuration” (p. 284), which

is in accordance with the New Trade Theory. This evidence was indicated by Michalak and Gibb (1997, p. 266) as a strong case for “regionalism as one of the most influential factors determining world-trade flow”. Andresen (2009*a*) finds that over time, trade clusters have fewer members of geographically closer countries. This is because the importance of shared past and colonial ties is decreasing, while the importance of distance (as a proxy for transportation costs) is increasing in importance. So, nations in trade clusters do not need to be neighboring per se, as in shared borders, but close geographical proximity does improve the chance of being in the same trade cluster. In a case study on trade patterns of France, Lafourcade and Paluzie (2010) find with a gravity model that in the period 1978-2000, the trade of France has changed, probably due to the European integration, especially in the border regions. They find that border regions of France trade on average 73% more with neighboring countries than predicted by the gravity norm, even when controlled for bilateral distance and origin and destination specific characteristics. Similar results for the importance of proximity to increasing trade intensification are found by Hanink and Cromley (2005). They even claim that it matters not just between countries, but also within nations. As Andresen (2009*a,b*) states, the arrangements of nations in economic space originate from a trading network. The author argues that trading networks are strongly influenced by historical and political ties (see also Lee and Park, 2005). Having historical similarities and political ties decreases the relative distance between nations and increases the intensity of trade between the involved countries. According to Andresen (2009*a*)’s analysis, he finds significant results of the influence of historical ties until 1981 for regionalization, especially if the historical ties have led to a shared institutional context. For example, a shared religious majority could create similar cultures for nations, as Yamazaki (1996) finds that Christianity has provided a unifying framework for Europe. Also other cultural ties, such as language, can improve trade relationships, especially since a shared language is often combined with historical colonial ties (Frankel et al., 1995; Lee and Park, 2005).

Following the literature described above, we expect regionalism to be an influential factor in the volume of trade between nation states. We expect that geographically close countries—in both absolute and relative terms—have a higher probability of being in the same trade region, or trade bloc, as we define it. We expect this due to the influence of shared past and colonial ties, however, this effect is likely to have been stronger in the mid-1900s. During the last few decades we expect an increase in the importance of absolute distance, as a proxy for transportation costs. So, nations in trade clusters do not need to be neighboring per se, as in shared borders, but close geographical proximity does improve the chance of being in the same trade cluster. Furthermore, we expect that next to geodesic distance, GDP, population, shared languages, shared colonial history, shared border(s), grade

of isolation (landlocked, island, common continent) and/or being in a common trade agreement influence the clustering of nations into “natural” trade blocs. This paper identifies such clusters and applies multivariate analysis with gravity-equation based variables to investigate the influence of those variables on the chance for two nations to be in the same trade bloc.

3 Methodology

The outline of this section is as follows. First, trade clusters throughout the global economy are identified for the period 1950-2005 using the intramax hierarchical clustering technique, as discussed in section 3.1. We then explain the empirical model used to determine how geographical, cultural, political and historical factors are associated with the development of these trade blocs in section 3.2. Section 3.3 provides details on the underlying data.

3.1 Intramax

The intramax hierarchical clustering technique identifies functional areas using flow data and works as follows.¹ First, all trade flow data are arranged in a square contingency table, or an origin-destination matrix, for a given year. The origins (exporting countries) are in rows, while the destinations (importing, reporting countries) are in columns. The intramax algorithm maximizes the proportional amount of within-group interaction while minimizing the number of cross-boundary movements.

Masser and Brown (1975, p. 510) stress the importance of the size of the flows and formulate an ‘objective function in terms of the differences between the observed and the expected probabilities that are associated with [the] marginal [row and column] totals.’ The objective function that is applied is:

$$\max I = (a_{ij} - a_{ij}^*) + (a_{ji} - a_{ji}^*), i \neq j \quad (1)$$

In applying this function, a transformed matrix is calculated which measures the largest total interactions between pairs of countries in excess of the total of the expected values derived from row and column totals. The expected value of each element is the product of the column sum times the ratio of the row sum to the total interaction. For example, the expected flow out of Country 2 to Country 1, a_{21} , where a_{ij} is the element in row i

¹We use the FlowMap software package to perform the intramax procedure. See <http://flowmap.geog.uu.nl>.

and column j of the contingency table, is given as:

$$a_{21}^* = \sum_i a_{i1} \frac{\sum_j a_{2j}}{\sum_i \sum_j a_{ij}} = \sum_i a_{i1} \frac{\sum_j a_{2j}}{n} \quad (2)$$

The row sum of the contingency table is $a_{i*} = \sum_j a_{ij}$, the column sum is $a_{j*} = \sum_i a_{ij}$ and the total interaction is the sum of row sums, $n = \sum_i \sum_j a_{ij}$. Normalizing the flows such that $n = 1$ and $a_{ij}^* = a_{i*} a_{j*}$ means that 'the difference between observed and expected values $a_{ij} - a_{ij}^*$ for the flow between zone i and j may be taken as a measure of the extent to which the observed flow exceeds (or falls below) the flow that would have been expected, simply on the basis of the size of the row and column marginal totals' (Masser and Brown, 1975, p. 512).

Based on this, the pair of countries with the highest absolute level of interaction are merged and henceforth considered to belong to the same functional area. Their interaction (i.e. cross-border trade) becomes intrazonal. This merger causes the matrix to be reduced by one column and one row. The objective function can then be reapplied and the modified matrix recalculated to yield the next pair of countries with the highest absolute level of interaction. This procedure is repeated until the $(n - 1)$ th iteration has been completed.

Our output is conveniently drawn in dendograms that show how countries have been clustered, based on the degree of intrazonal interaction. If the degree of intrazonal interaction is 0%, each country is taken as its own unique functional area. If this number is 100%, it means that all countries have been merged into one and the same cluster.

At what degree of intrazonal interaction should a functional area be identified? The literature does not provide a uniform answer. Some authors draw the proverbial line at a level of clustering where homogeneity within a cluster is lost (Goetgeluk, 2006)—but it is unclear how homogeneity should then be defined. One way is by choosing clusters if there is a large increase in the intra-zonal flows. However, a large increase in the intrazonal flows during the fusion process does not generally indicate 'a merger of two rather homogeneous zones'. Still, the most practical "stop criterion" is one that uses the functional areas found "just before the high increase in intra-zonal flows" (Goetgeluk, 2006, p. 11)—although some degree of freedom may need to be maintained to identify realistic clusters. This approach is consistent with ours, and recommended by the software developers.

For each year of output, we use the dendograms to determine if countries belong to the same functional area. Starting with 100% intrazonal interaction where there is only one trade cluster, we consider the first time this cluster branches into smaller clusters, in practice 2. If a country-pair belongs to the same trade cluster, it is assigned a 1 and otherwise 0. This is the first "split". We then look at how each of these clusters is subdivided

into even smaller functional areas. This typically gives rise to 4 clusters. Again, countries in the same cluster are assigned a 1 and otherwise 0. This variable is the second split. The third split gives up to 8 clusters, and the final (fourth) split we consider gives up to 18 clusters. We do not break the functional regions down beyond the fourth split because we observe large increases in the intrazonal flows between functional areas between the third and fourth or fourth and fifth split. We therefore conclude that the third and fourth splits yield the best representation of trade blocs in our dataset.

3.2 Trade bloc variables

The intramax hierarchical clustering technique has been used to determine if country-pairs belong to the same trade bloc in a given year. But what drives this trade bloc formation? This subsection discusses our modeling strategy which is used to obtain insight into how geographical, cultural, political and historical factors are associated with the trade blocs identified by the intramax procedure. We estimate a probit model,

$$Pr(B_k = 1|X) = \Phi(\beta X') \quad (3)$$

where B is a binary variable that is 1 if both countries in a dyad belong to the same functional area after the k^{th} split, as identified by the intramax hierarchical clustering technique, and X is a vector of regressors, with:

$$\begin{aligned} X = & \ln(Distance_{ij}) + \ln(GDP_{ijt}) + \ln(Population_{ijt}) \\ & + Border_{ij} + Landlocked_{ij} + Island_{ij} + Language_{ij} \\ & + Colony_{ij} + ComCol_{ij} + Same_{ij} + PTA_{ijt}. \end{aligned} \quad (4)$$

Subscript i (j) indicates the importing (exporting) country in year t . The time-varying regressors include the average real GDP of both trade partners, GDP_{ijt} , the dyad's average population $Population_{ijt}$, and PTA_{ijt} is a binary variable that is 1 if the country-pair has a preferential trade agreement and 0 otherwise. The time-invariant regressors include the geographic distance between countries i and j in kilometers, $Distance_{ij}$, $Border_{ij}$ is a binary variable that is 1 if the countries share a land border and 0 otherwise, $Landlocked_{ij}$ takes on the values 0, 1 or 2, depending on the number of countries in the dyad that are landlocked, $Island_{ij}$ is 0, 1 or 2, indicating the number of nations in the dyad that are islands, $Language_{ij}$ is a binary variable that is 1 if the country-pair shares a common language and 0 otherwise, $Colony_{ij}$ is a binary variable that is 1 if the country-pair has ever been in a colonial relationship and 0 otherwise, $ComCol_{ij}$ is a binary variable that is 1 if the country-pair has had a common colonizer after 1945, and $Same_{ij}$ is a binary variable that is 1 if both countries were or are the same country and 0 otherwise.

3.3 Data

Our panel dataset covers a maximum of 211 countries and contains observations for the period 1950-2005 in 5-year intervals. Table A1 lists the countries included in the dataset. The panel is arranged by country-pair and year, regardless of missing or zero values. Each country-pair is represented twice, once as ij and once as ji . This is done because bilateral *imports* are used as the dependent variable.

Bilateral trade data (imports c.i.f. and exports f.o.b. in US\$ millions) were obtained from IMF (1995, 2008). The dependent variable of choice is bilateral imports. In case of missing values, the country's trade partner's bilateral exports are used as a proxy of that country's bilateral imports. We assume a 10 percent c.i.f. rate when exports are used to replace missing imports. We obtain real trade by deflating with the US Consumer Price Index (All Consumer Goods, 1983-4 = 100) obtained from the Bureau of Labor Statistics.

Data on GDP (in 1990 international dollars) were obtained from Maddison (2007). Additional data were obtained from the World Bank's World Development Indicators (2007) using the GDP in 2000 international dollars series, which was reconverted to be consistent with Maddison's data. Data on population were also obtained from Maddison (2007). Population data for 1948-49 were taken from World Bank (1951). As with the trade data, GDP and population data were also converted to units.

Several variables were obtained from the CEPII Distance Database: simple geodesic distance (in kilometers), country size (in square kilometers), whether countries share a common major/official language, a border, or are part of the same continent, whether countries are islands or landlocked, and details on their colonial history (CEPII, 2008). Details on countries' participation in preferential trade agreements (PTAs) were obtained from Kohl (2010). Note that these agreements can be both regional (e.g. European Community, North American Free Trade Agreement) or interregional (e.g. Canada-Costa Rica, US-Singapore). A complete list of PTAs included in this study is provided in Table A2.

4 Results

This section provides two sets of results. Visual representations of the trade clusters obtained by the intramax method are displayed in section 4.1. Results from our probit analyses are presented in section 4.2.

4.1 Trade blocs obtained from intramax

The trade clusters obtained from the intramax procedure are graphically represented for the period 1950-2005 in Figure 1-7. Since the large number

of clusters after the fourth “split” (as discussed in section 3.1) complicates comparison and discussion, these figures show the trade blocs obtained after the third split. For ease of comparison, each cluster is labeled as being oriented towards the major economy (country) in that cluster.

Visual inspection of the trade clusters throughout the years indicates that there is a decrease in the number of clusters over time. The stronger geographical focus of the clusters over time becomes evident. While in the 1950s some clusters obviously have colonial ties (e.g. clusters that contain African countries, India or Indonesia), in 2005 the clusters are much more geographically continuous. Interesting to see is that the North and South American clusters are much more stable over time in terms of the number of countries and the trade bloc orientation. Most “turbulence” seems to take place in Europe, Africa and Asia. It can be seen very clearly that the importance of historical/colonial ties seems to fade away after the 1980s (compare Head et al., 2010; Andresen, 2009*a,b*; Poon et al., 2000). Furthermore, no triadization is to be found by the intramax method. We do find clusters with a trade bloc orientation to the US, Japan and Germany in the period 1950-2000, but in 2005 Japan disappears as a trade bloc orientation. Furthermore, we find strong evidence of other trade clusters next to the so-called triad. Notable is that the Brazil, India, China, and Russia-oriented clusters have been important for their regional economies for many decades, though only since the past decade have they attracted more attention as “emerging markets”.

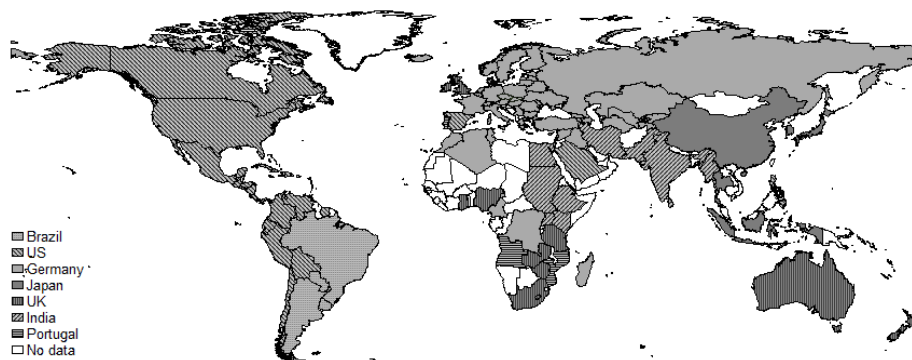


Figure 1: Trade bloc orientations in 1950.

4.2 Trade bloc variables

Estimates of the probit model specified in section 3.2 are provided in Table 1-2. The dependent variable is a binary indicator for whether a country-pair belongs to the same trade cluster, as identified by the intramax procedure after the fourth “split”. We use data on the fourth split because the model fit is, on average, 10 percentage points higher compared to estimates based



Figure 2: Trade bloc orientations in 1960.

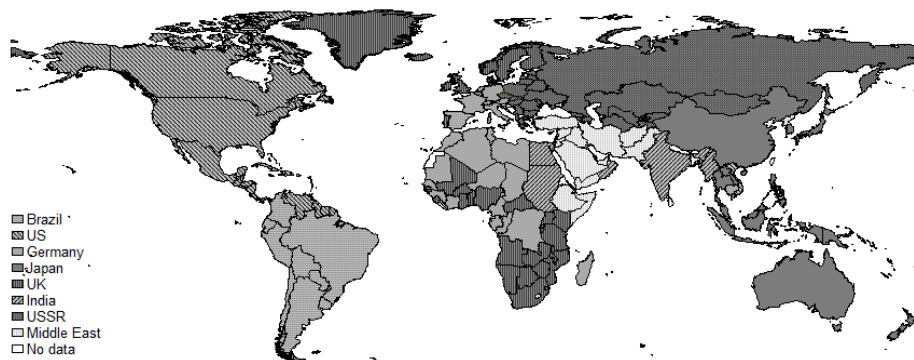


Figure 3: Trade bloc orientations in 1970.

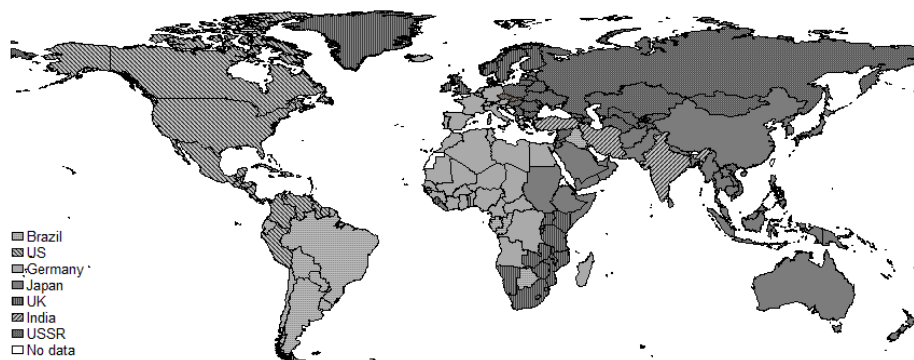


Figure 4: Trade bloc orientations in 1980.

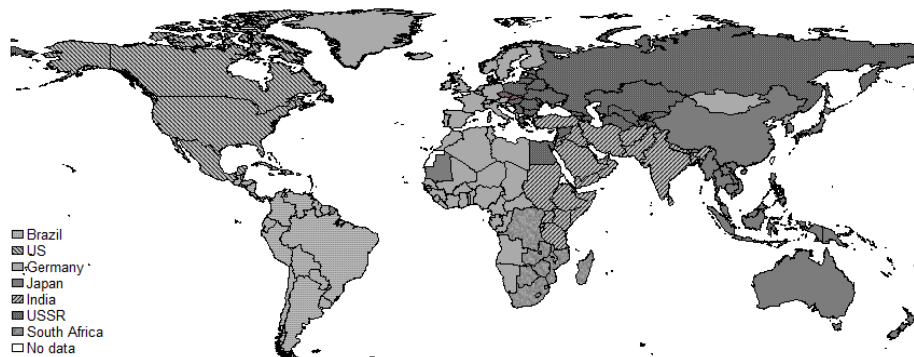


Figure 5: Trade bloc orientations in 1990.

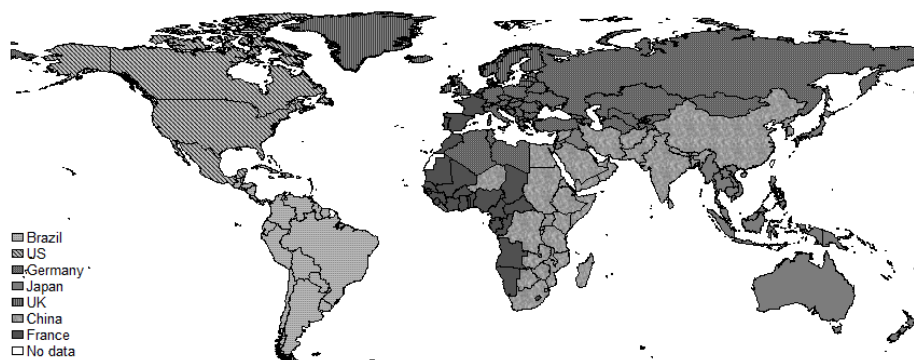


Figure 6: Trade bloc orientations in 2000.

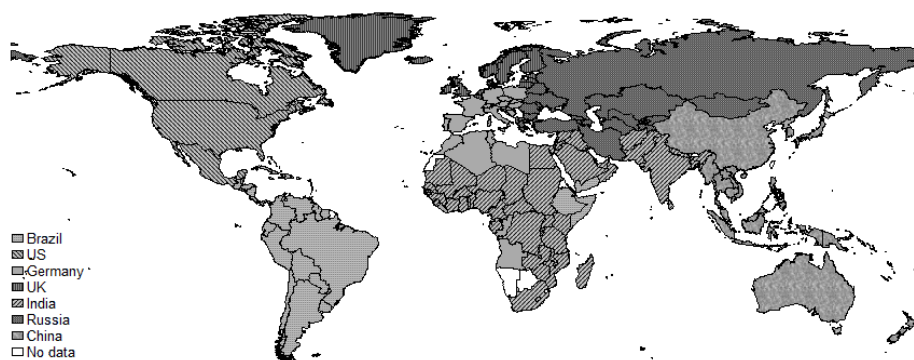


Figure 7: Trade bloc orientations in 2005.

on the third split. However, the results are very similar and available upon request.

In Table 1, model (1) shows the probit estimates for the full sample. The average marginal effects in (2) and marginal effects at the mean in (3) are nearly identical. The average marginal effects for individual years are shown in Table 2.²

	(1)	(2)	(3)
	Probit	AME	MEM
ln Distance	-0.677*** (0.006)	-0.098*** (0.001)	-0.093*** (0.001)
ln GDP	-0.053*** (0.004)	-0.008*** (0.001)	-0.007*** (0.001)
ln Population	0.115*** (0.005)	0.017*** (0.001)	0.016*** (0.001)
Border	-0.195*** (0.024)	-0.025*** (0.003)	-0.023*** (0.002)
Landlocked			
1	-0.036*** (0.009)	-0.005*** (0.001)	-0.005*** (0.001)
2	-0.074*** (0.026)	-0.010*** (0.003)	-0.010*** (0.003)
Islands			
1	0.127*** (0.009)	0.018*** (0.001)	0.017*** (0.001)
2	0.524*** (0.017)	0.093*** (0.004)	0.094*** (0.004)
Language	0.197*** (0.010)	0.030*** (0.002)	0.029*** (0.002)
Colony	0.394*** (0.027)	0.069*** (0.006)	0.070*** (0.006)
Common Colonizer	0.277*** (0.012)	0.045*** (0.002)	0.044*** (0.002)
Same Country	0.200*** (0.033)	0.032*** (0.006)	0.032*** (0.006)
PTA	0.455*** (0.015)	0.083*** (0.003)	0.083*** (0.004)
Constant	4.602*** (0.057)	-	-
Observations		247,650	
Pseudo R^2		0.200	
Log Likelihood		-66,440.88	
χ^2		26,230.13	
% Correctly specified		89.91	
Pearson p-value		0.000	

Notes: Probit estimates in (1), average marginal effects in (2) and marginal effects at the mean in (3). Dependent variable: B_4 . Robust standard errors are in parentheses. Coefficients marked *** are significant at the 1% level, ** 5% and * 10%.

Table 1: Probit estimates for full sample, 1950-2005.

We find that whether or not two countries belong to the same trade cluster is very much influenced by distance, both in absolute and relative

²We also estimate the marginal effects at the mean (omitted to save space), which we find to be consistent with the results displayed here. All results are available upon request.

	(1) 1950	(2) 1955	(3) 1960	(4) 1965	(5) 1970	(6) 1975	(7) 1980	(8) 1985	(9) 1990	(10) 1995	(11) 2000	(12) 2005
ln Distance	-0.048*** (0.002)	-0.069*** (0.003)	-0.064*** (0.003)	-0.046*** (0.003)	-0.066*** (0.008***)	0.073*** (0.284)	0.098*** (0.270)	0.099*** (-0.259)	-0.161*** (0.003)	-0.169*** (0.003)	-0.137*** (0.003)	-0.112*** (0.003)
ln GDP	0.025*** (0.002)	0.031*** (0.002)	0.011*** (0.002)	0.016*** (0.002)	0.008*** (-0.006**)	-0.016*** (0.002)	-0.004* (0.009***)	-0.015*** (0.008***)	-0.012*** (0.002)	-0.033*** (0.026***)	-0.045*** (0.055***)	-0.052*** (0.002)
ln Population	-0.011*** (0.002)	-0.014*** (0.002)	-0.003 (0.003)	-0.007*** (0.002)	-0.006** (0.003)	0.031*** (0.045***)	0.009*** (0.019)	0.008*** (0.004)	0.011*** (-0.034***)	0.026*** (-0.052***)	0.055*** (0.002)	0.054*** (-0.018*
Border	-0.020*** (0.004)	-0.032*** (0.006)	-0.012 (0.008)	0.015 (0.011)	0.015 (0.013)	0.045*** (0.016)	0.019 (0.014)	0.004 (0.012)	-0.034*** (0.012)	-0.052*** (0.011)	-0.054*** (0.010)	-0.018* (0.009)
Landlocked												
1	-0.013*** (0.003)	-0.035*** (0.004)	-0.006 (0.004)	-0.002 (0.004)	0.011** (0.005)	0.018*** (0.005)	0.000 (0.004)	-0.033*** (0.004)	-0.005 (0.004)	-0.056*** (0.004)	0.022*** (0.005)	-0.015*** (0.004)
2	-0.028*** (0.005)	-0.063*** (0.007)	-0.028*** (0.009)	-0.003 (0.013)	0.066*** (0.015)	0.011 (0.014)	-0.016 (0.012)	-0.023** (0.011)	-0.019 (0.012)	-0.105*** (0.007)	0.026** (0.013)	-0.011 (0.010)
Islands												
1	0.015*** (0.004)	-0.023*** (0.004)	0.011*** (0.004)	0.006 (0.004)	0.002 (0.005)	0.065*** (0.005)	0.036*** (0.004)	0.000 (0.004)	0.002 (0.004)	-0.016*** (0.004)	0.016*** (0.004)	0.036*** (0.004)
2	0.056*** (0.013)	0.030** (0.012)	0.06*** (0.014)	0.019 (0.012)	0.047*** (0.014)	0.211*** (0.016)	0.08*** (0.011)	0.111*** (0.012)	0.072*** (0.011)	0.033*** (0.010)	0.117*** (0.012)	0.117*** (0.013)
Language	0.044*** (0.005)	0.044*** (0.006)	0.057*** (0.006)	0.111*** (0.007)	0.093*** (0.007)	0.001 (0.005)	0.044*** (0.006)	0.007 (0.005)	-0.001 (0.005)	-0.016*** (0.005)	-0.021*** (0.005)	0.044*** (0.005)
Colony	0.019** (0.010)	0.024* (0.013)	0.046*** (0.015)	0.093*** (0.018)	0.150*** (0.024)	0.071*** (0.023)	0.076*** (0.02)	0.083*** (0.022)	0.032 (0.020)	0.140*** (0.022)	0.104*** (0.024)	0.039** (0.017)
Common Colonizer	-0.006 (0.005)	0.023*** (0.008)	0.020*** (0.007)	0.078*** (0.009)	0.058*** (0.008)	0.072*** (0.009)	0.044*** (0.007)	0.064*** (0.007)	0.036*** (0.007)	0.022*** (0.006)	0.088*** (0.007)	0.001 (0.005)
Same Country	0.010 (0.011)	0.005 (0.013)	0.021 (0.015)	0.026 (0.016)	0.021 (0.019)	0.073*** (0.025)	0.072*** (0.025)	0.091*** (0.028)	0.071** (0.029)	0.134*** (0.039)	0.035 (0.025)	0.073*** (0.025)
PTA	-	-	-0.044*** (0.008)	-0.007 (0.015)	0.101*** (0.033)	0.002 (0.015)	-0.039*** (0.009)	-0.007 (0.008)	-0.023*** (0.008)	0.022*** (0.008)	0.095*** (0.010)	0.022*** (0.007)
Observations	17,556	17,556	17,556	17,556	17,556	20,592	22,350	23,562	23,870	23,870	23,870	21,756
Pseudo R ²	0.270	0.210	0.200	0.200	0.180	0.120	0.180	0.220	0.270	0.330	0.300	0.340
Log Likelihood	-2,260.33	-3,513.69	-3,348.28	-3,670.60	-4,586.73	-6,064.59	-6,134.13	-6,146.91	-7,125.40	-6,837.22	-6,998.72	-5,003.36
χ ²	1,108.54	1,372.59	1,261.66	1,665.44	1,643.93	1,573.99	2,147.03	2,399.62	2,786.53	3,048.38	3,778.43	2,515.66
% Correctly specified	95.62	93.08	93.59	92.82	90.75	89.47	89.69	90.14	87.2	87.51	88.06	90.91
Pearson p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Average marginal effects. Dependent variable: B_4 . Robust standard errors are in parentheses. Coefficients marked * * * are significant at the 1% level, ** 5% and * 10%.

Table 2: Probit estimates for individual years, 1950-2005.

terms, as we expected. Over the entire period (1950-2005) all variables included in the estimations are of significant influence on the probability of two countries belonging to the same trade bloc. The negative sign of distance means that if the physical distance between two countries increases, the probability of being in the same trade bloc declines. Furthermore, Table 1 reports that countries where the average GDP is higher (as a proxy for purchasing power of the—extended—market) have a higher chance of being in a trade cluster. A similar effect can be found for the shared population of the two nations. If the country-pair has a higher average population, which is a proxy for market size in potential customers, the chance of being clustered increases.

With respect to the geographic controls, contiguity (having a common border) is a complicated variable. Instinctively, the chance of sharing a border should increase the chance of being in a cluster (compare Andresen, 2009*a*). However, the nations in our trade blocs are often in a cluster with more than 16 nations, with which they obviously cannot all share a border. This has a negative bearing on the estimated parameter value. The geographical position of countries or the set of countries also has a strong influence on the chance of being in a trade cluster. When one country of the set is completely landlocked, this has a negative effect on the chance of being clustered. Being landlocked means less access to sea ports and hence an increase in transportations costs (compare Frankel et al., 1996). When both countries in the dyad are landlocked, the chance of them being in a trade cluster is even smaller. When a country is an island, or when both countries in a dyad are islands, it positively affects the probability of being in the same trade cluster. This has everything to do with the geographical location of most of the island-nations in our dataset. Nation islands are remote from most other countries and the nations closest to them are other islands (consider, e.g. Caribbean and South-Pacific island groups). If both countries are islands substantially increases the chance of being in the same trade bloc.

With respect to cultural and historical variables we found the following. Shared language (as a proxy for shared culture) has a positive effect on the chance of being in a shared cluster, confirming the literature discussed. When one of the two countries has been a colony of the other country in the past (such as Senegal being colonized by France, Angola by Belgium, and India by the United Kingdom), this is reflected in a positive effect on the chance of sharing a trade cluster. Similar effects are found for two countries in a dyad that share the same former colonizer (such as Senegal and Nigeria do with respect to France, and India and Myanmar (Burma) with respect to the UK). Not unexpectedly, having a shared history, i.e. two countries that used to be one nation state (such as the Czech Republic and Slovakia or nations that used to constitute Yugoslavia), has direct positive effects on being in the same trade cluster. The effect of sharing a preferential trade

agreement is positive on being in a shared trade cluster. These results are in line with the expectations from the literature review.

In Table 2, running AME estimates for similar variable on trade cluster, but on 5 year periods, similar effects can be distinguished. The effect for distance follows the two arguments as discussed in the literature. One can see that over time first (till 1975) distance has less impact on clustering, and from 1990 onwards there is an increase in the distance effect again. First, maybe due to globalization forces, proximity became less important, later on the effect of need for personal information exchange might have made proximity more important for countries to be in the same trade cluster. For the average GDP, we find first that a higher average GDP has a lower chance of getting two nations in the same cluster, while after 1975 the sign changes and the higher average GDP increases the chance of being in the same cluster. This might be explained by the changing “North-South” orientation of trade (more market extension than cheap imports) (Poon and Pandit, 1996). Similar effects are found for the average population. Until 1965, the average lower population size led to clustering of two nations, while afterwards higher average population leads to a higher probability of clustering. This might also be explained by market orientation of trade (Glenn, 2008; Poon and Pandit, 1996).

With respect to the geographical control variables, we find the following. When there is a significant border effect on clustering, its effect is negative. As explained before, this has to do with the number of countries in a trade bloc that do not share a border due to their geographic layout. Over time, one can see that the border effect is rather small, if significant at all. Being landlocked does have similar effects for the shorter periods as for the whole time-span. Especially when both countries are landlocked, we find a negative effect on being in the same cluster, due to increases in transportation costs. The effect of one country being an island on being in the same trade cluster is not very often significant in the short time studies. When significant, the effect can be both positive and negative. This unclear evidence might be influenced by the fact that many islands were colonies in the past and trade flows of the islands with other countries were mostly determined by who was colonizing them (Glenn, 2008). When investigating the effect of both countries being islands and the effect on being in the same trade clusters, there is clear evidence that this positively affects the probability of being in the same cluster.

As for the cultural and historical variables, for most time-periods conclusive evidence is found to confirm the outcomes from Table 1. With a few (mostly not significant) exceptions, sharing a language has a positive effect on the chance of two countries being in the same cluster. Colonial ties with one of the countries does keep a positive effect on the chance of being in the same cluster, even though the intramax results indicate that colonial ties get weaker and/or become less important over time (compare Head et al.,

2010). The colonial effect might be overtaken by shared language, shared background and institutional similarities (compare Glenn, 2008; Andresen, 2009*b*), but history does not change, so the effect might be indirectly found back in colonial ties. The results for common colonizer are similar to the long time-span estimations. The effect of two countries being one country in the past does not get significant until after 1970. Also, the results for PTAs are in line with the long-term estimations from Table 1. Having a preferential trade agreement—regional or otherwise—in common increases the chance of being in the same trade cluster.

5 Discussion and conclusion

This paper investigated the variables that influence the probability of countries being in a trade bloc. We show how trade blocs have developed throughout 1950-2005 and determine how a number of factors—geographical, political, historical and cultural—contribute to these changes in global trade. Distance—geodesic, cultural and cognitive—matter.

Summarizing: Distance between countries reduces the likelihood that they belong to the same trade bloc. At the same time, countries do not have to be strict neighbors in order to belong to the same trade cluster. However, the negative distance coefficient makes clear that even though countries do not have to be strict neighbors, they are only likely to belong to the same trade cluster if the distance between them is not too large. The likelihood that countries belong to the same trade cluster decreases as their access to sea ports becomes more challenging, while island nations tend to cluster together, since their distance to other trade partners is often relatively large. Common language facilitates trade. Countries that used to be colonial dependencies are more likely to trade with their colonizers than with other countries. Unsurprisingly, countries that used to be colonial dependencies of the same colonizer are more likely to trade with each other than with other countries. Countries that used to belong to a larger predecessor tend to continue belonging to the same trade cluster. Preferential trade agreements stimulate trade cluster formation. However, visual inspection shows strong evidence that these efforts are mainly successful at a regional level.

Our main contribution is that we significantly expanded upon previous datasets (compare Poon and Pandit, 1996; Poon, 1997*a,b*; Poon et al., 2000). We also provide a more in-depth analysis of the factors—geographic, political, historical and cultural—that may explain trade bloc formation over time. Our study adds to the counter-triad argument in the international business literature. The clustering of countries due to trade flows is geographically fascinating, since trade depends strongly on (geodesic and relative) distance. However, this study only addresses trade flows, while ignoring the role of FDI. This is left for future research. Furthermore, adding GIS

data on specific transaction costs (tariffs, complicated transportation) could refine and improve the isolation variable a great deal. Similar, adding country information on sectoral distribution of the countries industry and firm population level (number of MNE's and/or SME's, etc.), as well as more sophisticated variables on culture (e.g. religious beliefs, political system, corruption levels, just to name a few) may provide interesting complements to our current results.

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Appendix

Afghanistan, Albania, Algeria, American Samoa, Angola, Antigua & Barbuda, Argentina, Armenia, Aruba, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belgium-Luxembourg, Belize, Benin, Bermuda, Bhutan, Bolivia, Bosnia & Herzegovina, Botswana, Brazil, Brunei, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Cayman Islands, Central African Republic, Chad, Chile, China, Colombia, Comoros, Costa Rica, Croatia, Cuba, Cyprus, Czech Republic, Czechoslovakia, D.R. Congo, Denmark, Djibouti, Dominica, Dominican Republic, East Germany, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Faeroe Islands, Falkland Islands, Fiji, Finland, France, French Guiana, French Polynesia, Gabon, Gambia, Georgia, Germany, Ghana, Gibraltar, Greece, Greenland, Grenada, Guadeloupe, Guam, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Ivory Coast, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kiribati, Kuwait, Kyrgyzstan, Laos, Latvia, Lebanon, Lesotho, Liberia, Libya, Lithuania, Luxembourg, Macao, Macedonia, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Marshall Islands, Martinique, Mauritania, Mauritius, Mexico, Micronesia, Moldova, Mongolia, Montserrat, Morocco, Mozambique, Myanmar, Namibia, Nauru, Nepal, Netherlands Antilles, Netherlands, New Caledonia, New Zealand, Nicaragua, Niger, Nigeria, North Korea, Norway, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Republic of Congo, Reunion, Romania, Russia, Rwanda, Samoa, Sao Tome & Principe, Saudi Arabia, Senegal, Serbia & Montenegro, Seychelles, Sierra Leone, Singapore, Slovak Republic, Slovenia, Solomon Islands, Somalia, South Africa, South Korea, Spain, Sri Lanka, St. Helena, St. Kitts & Nevis, St. Lucia, St. Pierre-Miquelon, St. Vincent & Grenadines, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syria, Tajikistan, Tanzania, Thailand, Togo, Tonga, Trinidad & Tobago, Tunisia, Turkey, Turkmenistan, Tuvalu, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, USSR, Uzbekistan, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.

Table A1: Countries in the dataset.

Afghanistan-India, AFTA (ASEAN FTA), Albania-Bosnia and Herzegovina, Albania-Bulgaria, Albania-Croatia, Albania-Macedonia, Albania-Moldova, Albania-Romania, Albania-Serbia Montenegro, Andean Community (Cartanega), Arab Maghreb Union (AMU), Armenia-Canada, Armenia-Cyprus, Armenia-Estonia, Armenia-Georgia, Armenia-Iran, Armenia-Kazakhstan, Armenia-Kyrgyz Republic, Armenia-Moldova, Armenia-Russia, Armenia-Switzerland, Armenia-Turkmenistan, Armenia-Ukraine, ASEAN-China, Asia Pacific Trade Agreement (APTA), Association of Caribbean States (ACS), Australia-New Zealand (ANZCERTA), Australia-Papua New Guinea (PATCRA), Australia-Singapore, Australia-Thailand, Azerbaijan-Georgia, Azerbaijan-Ukraine, Baltic Free Trade Area (BAFTA), Belarus-Ukraine, Bhutan-India, Bolivia-Chile, Bolivia-Mexico, Bosnia and Herzegovina-Bulgaria, Bosnia and Herzegovina-Croatia, Bosnia and Herzegovina-Macedonia, Bosnia and Herzegovina-Moldova, Bosnia and Herzegovina-Romania, Bosnia and Herzegovina-Slovenia, Bosnia and Herzegovina-Turkey, Bosnia Herzegovina and Serbia Montenegro, Bosnia Herzegovina-Romania, Bulgaria-Estonia, Bulgaria-Israel, Bulgaria-Latvia, Bulgaria-Lithuania, Bulgaria-Macedonia, Bulgaria-Moldova, Bulgaria-Serbia Montenegro, Bulgaria-Turkey, Canada-Chile, Canada-Costa Rica, Canada-Israel, Canada-United States (CUSFTA) (followed by NAFTA), Caribbean Community (CARICOM), CARICOM-Colombia, CARICOM-Costa Rica, CARICOM-Cuba, CARICOM-Dominican Republic, CARICOM-Venezuela, Central America-Mexico, Central American Common Market (CACM), Central European Free Trade Agreement (CEFTA), Chile-China, Chile-Colombia, Chile-Costa Rica, Chile-El Salvador, Chile-Guatemala, Chile-Honduras, Chile-Mexico, Chile-South Korea, Chile-Venezuela, China-Hong Kong, China-Macao, Colombia-Mexico-Venezuela, Common Economic Zone (CEZ), Common Market for Eastern and Southern Africa (COMESA), Commonwealth of Independent States (CIS), Community of Sahel-Sharan States (CEN-SAD), Costa Rica-Mexico, Costa Rica-Panama, Costa Rica-Panama, Croatia-Macedonia, Croatia-Moldova, Croatia-Serbia and Montenegro, Croatia-Slovenia, Croatia-Turkey, Czech Republic-Estonia, Czech Republic-Israel, Czech Republic-Latvia, Czech Republic-Lithuania, Czech Republic-Slovakia, Czech Republic-Turkey, Dominican Republic-Panama, East African Community (EAC), EC-Algeria, EC-Chile, EC-Croatia, EC-Cyprus, EC-Egypt, EC-Estonia, EC-Faroe Islands, EC-Iceland, EC-Israel, EC-Jordan, EC-Lebanon, EC-Macedonia, EC-Mexico, EC-Morocco, EC-Norway, EC-Overseas Countries and Territories, EC-Russia, EC-South Africa, EC-Switzerland-Liechtenstein, EC-Syria, EC-Tunisia, EC-Turkey, Economic and Monetary Community of Central Africa (CEMAC) (preceded by ECCAS), Economic Community of Central African States (ECCAS) (followed by CEMAC), Economic Community of West African States (ECOWAS), Economic Cooperation Organization (ECO), EFTA, EFTA-Bulgaria, EFTA-Chile, EFTA-Croatia, EFTA-Czech Republic, EFTA-Estonia, EFTA-Hungary, EFTA-Israel, EFTA-Jordan, EFTA-Latvia, EFTA-Lithuania, EFTA-Macedonia, EFTA-Mexico, EFTA-Morocco, EFTA-Poland, EFTA-Romania, EFTA-Singapore, EFTA-Slovakia, EFTA-Slovenia, EFTA-Tunisia, EFTA-Turkey, Egypt-Jordan, Egypt-Turkey, El Salvador-Mexico, El Salvador-Panama, Estonia-Faroe Islands, Estonia-Hungary, Estonia-Slovakia, Estonia-Slovenia, Estonia-Turkey, Estonia-Ukraine, Eurasian Economic Community (EAEC), European Community (EC), European Economic Area (EEA), Faroe Islands - Norway, Faroe Islands - Switzerland, Faroe Islands-Iceland, Faroe Islands-Poland, Georgia-Kazakhstan, Georgia-Russia, Georgia-Turkmenistan, Georgia-Ukraine, Guatemala-Mexico, Guatemala-Panama, Gulf Cooperation Council (GCC), Honduras-Mexico, Honduras-Panama, Hungary-Israel, Hungary-Turkey, India-Nepal, India-Singapore, India-Sri Lanka, Israel-Mexico, Israel-Poland, Israel-Romania, Israel-Slovakia, Israel-Slovenia, Israel-Turkey, Japan-Malaysia, Japan-Mexico, Japan-Singapore, Jordan-Singapore, Kazakhstan-Kyrgyz Republic, Kazakhstan-Ukraine, Kyrgyz Republic-Moldova, Kyrgyz Republic-Russia, Kyrgyz Republic-Ukraine, Kyrgyz Republic-Uzbekistan, Laos-Thailand, Latin American Integration Association (LAIA), Latvia-Poland, Latvia-Slovakia, Latvia-Slovenia, Latvia-Turkey, Lithuania-Poland, Lithuania-Slovakia, Lithuania-Slovenia, Lithuania-Turkey, Macedonia-Moldova, Macedonia-Romania, Macedonia-Slovenia, Macedonia-Turkey, Macedonia-Ukraine, Melanesian Spearhead Group (MSG), Mercado Comn del Sur (MERCOSUR), MERCOSUR-Bolivia, MERCOSUR-Chile, MERCOSUR-Colombia-Ecuador, MERCOSUR-Peru, MERCOSUR-SACU, Mexico-Caribbean, Mexico-Northern Triangle, Mexico-Uruguay, Moldova-Romania, Moldova-Serbia and Montenegro, Moldova-Ukraine, Morocco-Turkey, New Zealand-Singapore, New Zealand-Thailand, North American Free Trade Agreement (NAFTA) (preceded by CUSFTA), Northern Triangle, Organization of Eastern Caribbean States (OECS), Pacific Island Countries Trade Agreement (PICTA), Pakistan-Sri Lanka, Pan-Arab Free Trade Area (PAFTA), Poland-Turkey, Romania-Serbia and Montenegro, Romania-Turkey, Russia-Ukraine, Singapore-South Korea, Slovakia-Turkey, Slovenia-Turkey, South Asian FTA (SAFTA) (preceded by SAPTA), South Asian PTA (SAPTA) (followed by SAFTA), South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA) (followed by PACER), Southern African Customs Union (SACU), Southern African Development Community (SADC), Syria-Turkey, Tajikistan-Ukraine, Tunisia-Turkey, Turkmenistan-Ukraine, Ukraine-Uzbekistan, US-Australia, US-Bahrain, US-Chile, US-Israel, US-Jordan, US-Morocco, US-Singapore, West African Economic and Monetary Union (WAEMU).

Table A2: Preferential trade agreements in the dataset.