The Impact of Historical and Regional Networks on Trade Volumes within the Western Hemisphere: A Gravity Analysis across Sectors

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Prepared for presentation at the Southern Agricultural Economics Association's Annual Meeting, Birmingham, AL, February 4 – 7, 2012.

Abstract: *This paper identifies and analyzes the effects of existing trade networks on bilateral trade volumes in the Western Hemisphere by applying the gravity model of international trade to two data-sets, one encompassing bilateral trade volumes of agricultural products and one encompassing bilateral trade volumes of manufactured goods. The evidence suggests the trade behavior within the Western Hemisphere is highly influenced by relationships resulting from different types of linkages (i.e., networks). These networks are attributed to regionalism (via the enactment of regional trade agreements) and history (via the modern effects of former imperial relationships). Using a data-set encompassing the trade volumes for 32 countries in the Americas and 31 of their global trading partners during the 1990s, this study analyzes the extent of these networks and addresses any differences across sectors.*

Key words: International trade; gravity models; history; regional trade agreements.

JEL classification codes: F1 (International trade), F15 (Economic integration), F54 (Post-colonialism), F55 (International institutional arrangements).

1. Introduction

It can be postulated that the trade behavior in the Western Hemisphere is influenced by relationships, or networks, resulting from different types of linkages based on either regionalism or history.[1] For instance, there are currently numerous regional trading agreements in the Western Hemisphere. Such agreements clearly establish linkages and would in all likelihood influence the trade behavior of member states. The major regional trade agreements are presented with their respective members and years of enactment in Table 1; almost every economy in the hemisphere is participating in some form of an integrated area. Recent data reveal preliminary support for the existence of regional trade relationships.[2] The Caribbean Community and Common Market (CARICOM), the Mercado Comun del Sur (MERCOSUR), and the North American Free Trade Agreement (NAFTA) have all experienced increases in

[1] Podolny and Page (1998) defines a network as "… any collection of actors that pursue repeated, enduring exchange relations with one another…" (p. 59). Rauch (1999, 2001) and Combes, Lafourcade, and Mayer (2005) discuss in great detail the importance of networks for trade. DeGroot et al. (2004) suggests similar frameworks without explicitly using the term 'networks.' They refer to the idea of networks as 'institutions.'

[2] Table presentation is omitted to save space. Data are available upon request.

intra-regional trade during the 1990s. However, intra-regional trade within the Andean Pact increased initially during the nineties, but reached its peak in 1998 with a sharp decline in subsequent years. The members of the Central American Common Market (CACM) exhibit a similar trend, but the peak is reached earlier. Intra-regional trade among the Group of Three has remained low, both before and after the formal enactment in 1995.

Other relationships are the consequences of historical legacies. Almost all economies in the Western Hemisphere are former European colonies. As a lingering effect, there are often neo-colonial trade ties present with large volumes of trade between the former dependency and the former metropolitan ruler in Western Europe. Rauch (1999) suggests that colonial ties often result in lasting trade relationships. A useful way of approaching neo-imperial trade dependency is to consider the percentage of a former dependency's total exports that is shipped to the former ruler.[3] The corresponding trade shares for the Caribbean economies, most of which are former British dependencies, range between 8 % to upwards of 70 % (!) of total exports over the past decades. It is important to note that such trade volumes are not necessarily in response to comparative advantages but are rather the outcomes of deliberately distortive policy.[4] Interestingly, no analogous relationships are present for most former Spanish and Portuguese colonies as imperial export-shares linger in the lower single digits.

While intuitive arguments can made in support of the existence of trade networks in the Americas, observed trade relationships may simply be part of the 'natural' trade and may not represent any true distortions or biases. For instance, countries within a particular region may exhibit higher trade levels internally vis-à-vis external nations due to cultural similarities or

[3] Again, table is omitted to save space. Data are available upon request.

[4] The impact of historical ties is also discussed, in some form, by Anderson and Norheim (1993), Brysk, Parsons, and Sandholtz (2002), Eichengreen and Irwin (1998), Frankel, Stein, and Wei (1997), Hamilton and Winters (1992), Linnemann (1966), Sandberg and Martin (2001), and Sandberg, Seale, and Taylor (2006).

geographic proximity. Similarly, the presumed neo-colonial trade distortion might just be in response to the relative market size of the Western European countries.

This paper attempts to identify and analyze any network effects in the Western Hemisphere by fitting two empirical specifications of the gravity model to data encompassing the bilateral trade volumes of the economies in the Americas. There is no ex-ante reason why historical and regional networks will exert the same effects on the agricultural sector vis-à-vis the manufacturing sector.[5] It is an appealing inquiry to appraise whether such differences are present. This topic is of interest due to plans of further hemispheric integration via the formation of the Free Trade Area of the Americas (FTAA), a pan-continental free trade agreement encompassing most the economies in North, Central, and South America. Developing an understanding of trade behavior within the Americas is therefore a necessary and timely endeavor.

This paper proceeds at follows. The next section briefly introduces the gravity model. Section 3 provides a discussion of the data and Section 4 continues with an empirical discussion. Finally, Section 5 concludes.

2. The Gravity Model of International Trade

The gravity model of international trade enables the researcher to identify whether any distortion, or biases, resulting from proposed network effects are present. The notion of gravity models can be traced to the use of 'social physics' during the late nineteenth century and to the early writings on the economics of location and transportation costs. The basic idea behind the gravity model of international trade is that bilateral trade volumes from one country to another can be explained by: a) factors that capture the potential (or capacity) of a country to export

[5] Trade in agricultural commodities may be more or less susceptible to neo-colonial trade biases or regional preferences relative to trade in manufactured goods and vice versa.

goods and services; b) factors that capture the propensity (or capacity) of a country to import goods and services; and by c) other forces that either attract or inhibit bilateral trade. [6]

Although there were earlier attempts by economists to utilize a similar concept (e.g., Reilly 1929; Zipf 1946), the introduction of the contemporary econometric gravity model is usually attributed to Tinbergen (1962) and Pöyhönen (1963a, 1963b) who independently and concurrently explored similar models.[7] Our gravity model states that

$$\ln X_{ijt} = \beta_0 + \beta_1 \ln\left(\frac{Y_{it}}{N_{it}}\right) + \beta_2 \ln\left(\frac{Y_{jt}}{N_{jt}}\right) + \beta_3 \ln N_{it} + \beta_4 \ln N_{jt} + \beta_5 D_{ij} + \beta_6 \ln Remoteness_{it} + \beta_7 \ln Remoteness_{jt} + \sum_{m=1}^{M} \delta_m W_{mij} + u_{ijt}, \quad (1)$$

where X_{ijt} represents the bilateral exports from country i to country j in time period t, Y_{it} is nominal GDP for country i in time period t, Y_{jt} is nominal GDP for country j in time period t, N_{it} is country i's population in time period t, N_{jt} is country j's population in time period t, and D_{ij} is the bilateral distance in kilometers between the capital of country i and the capital of country j. $Remoteness_{it}$ or the remoteness of the exporter in time period t is defined as

$$Remoteness_{it} = \sum_{j \neq i} \left[D_{ij} \times \left(\frac{Y_{jt}}{Y_{wt}} \right) \right], \quad (2)$$

[6] Sandberg (2010) provides an extensive review of gravity models.

[7] Pulliainen (1963), Linnemann (1966), and Aitken (1973) refine the empirical model while theoretical underpinnings have been provided by, among others, Anderson (1979), Bergstrand (1985, 1989), Helpman and Krugman (1985), and Helpman (1987), and more recently by Deardorff (1998), and Evenett and Keller (2002).

where Y_{wt} is aggregate world GDP in time period *t*, while $Remoteness_{jt}$ represents the remoteness of the importer in time period *t*, and is defined analogously.[8] Since the trading partners' relative shares of global GDP vary from year to year, the calculated remoteness varies from year to year as well. W_{mij}s are *m* binary variables present in a vector **w** corresponding to any qualitative relationships between country *i* and country *j* (i.e., any measurable network effects), and u_{ijt} is a normally distributed error term. One can consequently define the parameters from the model in vector form as **β**, where $\boldsymbol{\beta}' = (\beta_0, ..., \beta_7, \delta_1, ..., \delta_m)$.[9]

The gravity model is commonly augmented with qualitative variables that either increase or reduce trade, which in our case are introduced with vector **w**. In previous research, such variables have included binary variables for assessing the impact of participation in regional trading agreements, of sharing a common commercial language (e.g., linguistic ties), of sharing a common border, and of historical colonial ties.[10] An appealing aspect of using binary variables to capture the network effects of regional trading agreements, linguistic ties, adjacency, and colonial history on bilateral trade is that one is able to assess how trade flows under the presence of such influences differ from presumably 'normal,' or 'baseline,' trade patterns (Hewett 1976; Linnemann 1966; Tinbergen 1962).

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[8] A country that is located relatively remote with respect to its trading partners will trade more extensively with a country located within a particular distance than would an economy that is less remote in the relative sense. Frankel, Stein, and Wei (1997) and Polak (1996) provide intuitive explanations.

[9] It should be noted that our formulation of the model incorporates per-capita income rather than absolute income. Per capita GDPs (Y_{it}/N_{it}, Y_{jt}/N_{jt}) may more accurately capture the trading capacity of the two countries as compared to using absolute GDPs (Y_{it}, Y_{jt}). As Bergstrand (1985, 1989) suggest, GDP per capita of the exporting country can proxy its capital-labor ratio and the GDP per capita of the importing country indicates its ability to absorb imports. Inclusion of per capita incomes becomes particularly appealing when considering that trading partners' populations already capture economies of scale and sheer physical size. Using per capita GDPs rather than absolute GDPs in the estimation also has econometric rationale. As pointed out by Breuss and Egger (1997), aggregate income and population are likely highly correlated in that countries with large populations tend to have larger GDPs, *ceteris paribus*. This would inherently result in multi-collinearity between income and population when estimating the gravity model. Per capita GDP is less likely to be highly correlated with population.

[10] Sandberg (2010) provides a broad inventory of references.

For the purposes of this study, a total of 11 binary variables are included in vector **w** (thus $m = 11$). Table 2 defines these variables. Variable W_1 addresses adjacency and its influence, variables W_2 through W_5 control for historical linkages and cultural similarities due to colonial heritage and sharing a common commercial language, and variables W_6 through W_{10} measures the impact of regional linkages resulting from participation in regional trade agreements (i.e., participation in the Andean Pact, CACM, CARICOM, MERCOSUR, and NAFTA respectively).[11] A final binary variable, W_{11}, controls for the importing country being a member of the European Union. This variable is intended to capture any preferential treatment (e.g., policy distortions) extended by the European Union to goods imported from the economies in the Western Hemisphere.

3. Data

Bilateral export data are obtained from the Inter-American Development Bank's DATA Intal CD-ROM Version 4.0 (2003), and the data contain a total of ten annual cross-sections, 1992 through 2001. To capture any sectoral differences, the gravity model is estimated using two different data-sets. The first data-set encompasses trade in agricultural products and primary commodities only; and the second data-set trade in manufactured goods. As a result, there are twenty regressions to be estimated (ten annual cross-sections, two data sets). [12]

A total of 63 countries (or economic units) are included in the data (see Table 3), and the data consist of the economies in the Western Hemisphere plus the majority of the economies of the Organization for Economic Cooperation and Development (OECD), China, India, Israel and

[11] Note that no binary variables are introduced to control for participation in the Group of Three or LAIA due to perfectly collinearity.

[12] The data are disaggregated based on the United Nations Conference on Trade and Development (UNCTAD) nomenclature. Bilateral exports of UNCTAD Category 1 (Food products) and Category 2 (Agricultural raw materials) are combined into a data-set representing agricultural trade. Export data from Category 5 (Manufactured goods) are used for trade in manufactures.

Singapore, South Africa, and others. Since the emphasis is on the trade patterns of the economies in the Western Hemisphere, a particular characteristic of the data-set is its unbalanced nature in favor of the 34 FTAA countries. This implies that the bilateral exports between FTAA members are included, as are the FTAA countries' bilateral exports to and from non-FTAA economic units. However, the bilateral exports between non-FTAA economies are excluded. This feature enables any 'noise' from the global trade environment unrelated to the Western Hemisphere to be removed.

GDP and population data are obtained from the United Nations Common Database. The distance data and information about colonial ties, language, and adjacency are obtained from Mayer and Zignago (2006). Information regarding participation in regional trading agreements is obtained from Frankel, Stein, and Wei (1997).

4. Empirical Results

All estimations for this study are performed using GAUSS econometric software (Aptech Systerms Inc. 2001). Since the data-set encompasses countries of vastly different sizes and subsequently great variations in bilateral trade volumes, heteroskedasticity is present. To correct for the occurrence of heteroskedasticity, White's robust standard errors are estimated. The empirical results are presented in Table 4 and Table 5.[13]

Conforming to *a priori* expectations, per capita incomes and populations exert statistically significant positive effects on international trade flows and the geographic distance a statistically significant negative effect. The results convey that trade in agricultural products is more

[13] Before analyzing the results, it is important to note that the sample contains a number of 'zero observations,' i.e., in some instances the reported bilateral exports are indeed zero. Some country pairings simply do not trade in certain products and the observed bilateral exports in such a case are equal zero resulting in 8% of the data points being zero. These reported 'zero observations' pose an empirical problem as the dependent variable is the natural logarithm of bilateral exports; one cannot take the natural logarithm of zero. Following Boisso and Ferrantino (1997), Eichengreen and Irwin (1998), Head and Ries (1998), Sandberg and Martin (2001), and Sandberg, Seale, and Taylor (2006), a value of one is added to the dependent variable before the natural logarithm is taken.

sensitive to the per capita income of the importer (absorptive capacity) than to that of the exporter (productive capacity). This would indicate that agricultural trade is relatively 'demand driven,' with economic conditions of the importer exerting greater influence vis-à-vis the economic conditions of the exporter. Much of the exports from the region's developing economies, i.e., the Caribbean and Latin America, consist of agricultural products granted favorable treatment by the United States, Canada, and the European Union, via, for example, the General System of Preferences (GSP). These exports (primarily agricultural in nature) enter the North American and European markets with relatively low, if any, import duties. Consequently, the importer's income should exert a greater influence on agricultural trade, as the United States, Canada, and Western Europe have relatively high-income levels relative to the countries in Latin America and the Caribbean. Furthermore, considering the diminished impact of distance on agricultural trade, as these often bulky products are presumably shipped large distances to reach the developed markets, the absorptive capacity of the importer outweighs the resistance provided by geographic location.

Manufactured goods trade in the Americas, conversely, is more sensitive to per capita income of the exporter with statistically higher elasticities observed throughout the sample. These results conform to HO-theory as manufactured goods tend to be more capital-intensive and capital-abundant countries tend to export capital-intensive goods.[14] It logically follows that industrial output has higher distance elasticity, as there are fewer preferential access distortions observed. Manufactured products are therefore more subjected to the gravitational resistance of geography and traditional economic factors, which would be the case for, say, industrial exports

[14] Bergstrand (1985, 1989) suggest that the per-capita income of the exporter serves as a proxy for its capital-labor ratio.

from Chile or Brazil shipped to the United States or Europe. These consignments are not granted the same GSP treatment as primary exports originating in the Caribbean basin.

Statistically significant throughout the sample, the estimated parameters for the population variables, all positive, are greater in magnitude for the exporter than for the importer. This holds for both aggregate trade and manufactured goods trade. The evidence suggests that trade in manufactured goods is more sensitive to the economies of scale of the exporter. For agricultural trade, however, the estimated population parameters are not statistically different across exporters and importers; in fact the estimated parameters fall within the same confidence intervals. Perhaps relative scale economies are less common, or certainly less influential, in the agricultural sector vis-à-vis manufacturing.[15]

The binary network effects of history and regionalism measure how any trade volume deviates from a presumably 'normal,' or baseline, trade behavior; they measure the magnitude of any distortions or biases. For interpretive purposes, it useful to consider the 'average parameter' estimate for any particular variable. The 'average parameter' estimates, $\hat{\bar{\delta}}_m$, as presented in Table 6 and Table 7, are defined the arithmetic mean of the statistically non-zero estimates. The marginal effect of these binary variables is subsequently equal to factor $e^{\hat{\bar{\delta}}_m}$.

There is strong evidence of neo-colonial trade distortions between the former British dependencies in the Western Hemisphere and the U.K. Stronger effects are found for agricultural trade versus trade in manufactured goods. It seems that former British colonies trade with the U.K by quite the large magnitude.[16] The favorable treatment extended by the U.K. to its

[15] Considering the dominance of the agricultural sector in the smaller Caribbean economies, the results are not all that surprising. An island-economy, or microstate, has a natural boundary of how much economies of scale can be realized given its limited physical size and smaller population.

[16] The magnitudes, however, are significantly lower than was found by Sandberg, Seale, and Taylor (2006), who fits a variation of the model to a Caribbean-centered data-set.

former dependencies, relative to other non-European trading partners, seems to greatly impact trade volumes, especially when it comes to agricultural products. One can certainly make the argument that Commonwealth's preferential treatment is counter-productive in that it reinforces the dependence upon agricultural exports. Most of the countries in the Caribbean basin (e.g., former British colonies) are reliant upon primary exports and these preferences quite possibly increase the opportunity cost of structural transformation and industrialization of their economies, particularly when considering the stronger effect observed for agriculture.

The story is quite different when it comes to the former Iberian colonies. The estimates suggest that former Spanish colonies (i.e., most of Central and South America) trade between 1.7 to 2.9 times as much with Spain relative to the baseline trade volume. Spain's neo-colonial influence seems to be marginally stronger for agricultural goods. For the sole former Portuguese colony in the sample (i.e., Brazil) there is no neo-colonial distortion present for manufactured goods trade. A possible explanation for these differences and the particularly strong British linkage could be that England's former colonies gained independence relatively recently while the former Iberian dependencies achieved autonomy centuries ago. It may also be that British trade policy is more specifically targeted toward engaging its former dependencies commercially.[17]

Turning the attention to the effects of regionalism, Table 7 presents the calculated average parameter values and the marginal effects. A striking phenomenon is that smaller economies tend to stick together, with stronger effects observed for CARICOM, CACM, and the Andean Pact than for NAFTA or MERCOSUR. CARICOM, CACM, and the Andean Pact have greater

[17] This evidence supports the postulations provided by Brysk, Parsons, and Sandholz (2002) and Grier (1999) stating the U.K. has maintained, and indeed encouraged, stronger post-colonial trade relationships with its former colonies relative to Spain or Portugal.

influence for agricultural commodities than for manufactured goods trade, thus supporting the idea that many of these economies are highly specialized in, and thereby dependent upon, agricultural exports. By far, CARICOM seems to exert the greatest influence on the trade behavior of its members. Intra-CARICOM trade volumes are significantly biased on a magnitude of 16.64 to 72.3 times that of the models presumed normal patterns. The argument can certainly be made that small island economies are more trade dependent vis-à-vis larger, more self-sufficient, economies.[18]

For both agricultural trade and manufactured goods trade, the NAFTA binary performs poorly; it seems that the gravity variables (i.e., economic circumstances and geographic proximity) already capture the presumed effects of NAFTA. Perhaps the U.S.-Canada- Mexico trade-nexus is strong enough given natural conditions that any statistical effect from the NAFTA agreement disappears? At least that seems to be the case for our data. MERCOSUR exerts a statistically significant effect on agricultural trade, indicating a modest relative distortion of trade patterns. The effect of the Andean Pact, consisting of medium-sized economies, is somewhere in between the ambiguous effects of NAFTA and MERCOSUR and the stronger effects of CARICOM and CACM, thus lending further support to the inverse relationship between the economic size of members and regional dependency.[19]

[18] Statistically significant positive parameters are also found by, among others, Sandberg, Seale, and Taylor (2006) and Thoumi (1989a, 1989b).

[19] It should be noted that using a variation of the gravity model and disaggregated trade data, Vollrath, Hallahan, and Gehlhar (2006) finds that NAFTA has not exerted a statistically significant effect on bilateral trade in agricultural commodities; however, they do find a positive statistically significant effect for processed food products. Furthermore, they also find that MERCOSUR exterts a positive influence on trade patterns with a marginally larger effect observed for processed food products vis-à-vis agricultural commodities. Statistically ambiguous parameters for NAFTA, MERCOSUR and the Andean Pact are obtained by Grant and Lambert (2008) for both agricultural and non-agricultural trade. Soloaga and Winters (2001), however, suggests positive relationships for NAFTA, MERCOSUR, Andean Pact, and CACM aggregate trade data.

5. Concluding Remarks

The evidence suggests that both history and regionalism have significantly shaped the trade behavior of the Western Hemisphere even after controlling for economics and geography. Significant neo-colonial trade distortions are present between the United Kingdom and her former dependencies. The findings suggest that deliberate trade policy on behalf of the U.K. magnify trade volumes. The corresponding effect is significantly lower, however, for former Iberian colonies and the effect diminishes almost entirely for Portugal's relationship vis-à-vis Brazil.

The gravity model reveals that regional linkages, e.g., regional trading agreements, significantly influence trade behavior after controlling for other factors. In particular, the smaller economies in the central region of the hemisphere tend to cooperate more fully than the larger, more self-sufficient, peripheral ones. The evidence supports that the CARICOM and the CACM agreements strongly influence the trade relationships of their respective member states. This is not entirely surprising since smaller economies tend to have a narrower productive base and consequently a larger dependency on trade. For NAFTA and MERCOSUR, on the other hand, the gravity model detects smaller effects on the trade behavior of their members. The effect of the Andean Pact, consisting of medium sized economies, is somewhere in between, thus lending support to an inverse relationship between economic size and regional dependency.

In the context of a future FTAA, historical linkages need to be considered when considering hemispheric integration. The economies in the Caribbean basin are rather unique in that they are highly dependent upon exports to the United Kingdom for economic subsistence. Given the shorter geographic distance and consequently lower transportation costs, the North American markets could, through more accommodating trade policy, be attractive substitute

destinations for Caribbean and Latin American exports. In particular, the industrial economies of the United States and Canada have presumably similar consumption patterns and demand structures as the U.K. and the rest of the European Union. However, the danger is that such a drastic change in trade patterns would be dominated by trade diversion rather than trade creation.

Taking into account regional tendencies and the presence of neo-colonial trade distortions and regional preferences, hemispheric integration will be a complicated process. As the polarization of the United States and Brazil increases, both taking on the dominant roles in the northern and southern cones, respectively, a viable option may be to look at the central region as a stepping-stone to achieve wider integration. This can be realized by intensifying and expanding the trade relationships of the meridian economies with their northern and southern counterparts. Via the deepening of regional cooperation of the central region while at the same time escalating trade with, within, and among the extremities, wider integration could be achieved.

Table 1. Current regional trading agreements in the Western Hemisphere

Name of agreement	Year enacted	Current members
Andean Community (or Andean Pact)	1969	Bolivia, Colombia, Ecuador, Peru, and Venezuela
Caribbean Community and Common Market (CARICOM)	1973	Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago
Central American Common Market (CACM)	1959	Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua
Group of Three	1995	Colombia, Mexico, and Venezuela
Latin American Free Trade Association (LAFTA)/Latin American Integration Association (LAIA)[a]	1960	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay, and Venezuela
Mercado Comun del Sur (MERCOSUR)	1991	Argentina, Brazil, Paraguay, and Uruguay
North American Free Trade Agreement (NAFTA)	1994	Canada, Mexico, the United States

Frankel, Stein, and Wei (1997), Caribbean Community Secretariat (2001). a) The name Latin American Free Trade Association (LAFTA) applies before 1980; the name Latin American Integration Association (LAIA) applies after 1980.

Table 2. Dummy variables in vector **w**

Variable	Variable name	Variable definition
Contingency/Adjacency:		
W_1	Common border	Equal to 1 if the two trading partners are contingent, i.e., they share a common border, 0 otherwise.
Culture and historical linkages:		
W_2	Common language	Equal to 1 if the two trading partners share a common commercial language, 0 otherwise.
W_3	Colonial linkage: U.K.	Equal to 1 if one of the trading partners is the U.K. and the other a former British colony in the Western Hemisphere, 0 otherwise. (Note that neither the United States nor Canada are considered former colonies in this context).
W_4	Colonial linkage: Spain	Equal to 1 if one of the trading partners is Spain and the other a former Spanish colony in the Western Hemisphere, 0 otherwise.
W_5	Colonial linkage: Portugal	Equal to 1 if one of the trading partners is Portugal and the other a former Portuguese colony in the Western Hemisphere, 0 otherwise.
Regional trade agreements:		
W_6	NAFTA	Equal to 1 if both trading partners are members of NAFTA, 0 otherwise.
W_7	CARICOM	Equal to 1 if both trading partners are members of CARICOM, 0 otherwise.
W_8	MERCOSUR	Equal to 1 if both trading partners are members of MERCOSUR, 0 otherwise.
W_9	Andean Pact	Equal to 1 if both trading partners are members of the Andean Pact, 0 otherwise.
W_{10}	CACM	Equal to 1 if both trading partners are members of CACM, 0 otherwise.
Effects of the European Union being the importer:		
W_{11}	EU Importer	Equal to 1 if the importing country is a member of the European Union, 0 otherwise.

Table 3. Countries included in the study

Country	
Antigua and Barbuda	Iceland
Argentina	India
Australia	Ireland
Austria	Israel
The Bahamas	Italy
Barbados	Jamaica
Belgium-Luxembourg	Japan
Belize	Mexico
Bolivia	The Netherlands
Brazil	New Zeeland
Canada	Nicaragua
Chile	Panama
China	Paraguay
Colombia	Peru
Costa Rica	Poland
Czech Republic	Portugal
Denmark	Singapore
Dominica	Slovak Republic
Dominican Republic	South Africa
Ecuador	South Korea
El Salvador	St Kitts and Nevis
Finland	St Lucia
France	St Vincent and the Grenadines
Germany	Sweden
Greece	Switzerland
Grenada	Trinidad and Tobago
Guatemala	Turkey
Guyana	United Kingdom
Haiti	Uruguay
Honduras	United States
Hong Kong	Venezuela
Hungary	

Table 4. Agricultural trade (UNCTAD categories 1 & 2)

Dependent variable: ln(exports of agricultural products from country *i* to country *j* in U.S. dollars)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Constant	-25.782***	-30.393***	-34.232***	-35.091***	-34.532***	-44.085***	-35.200***	-33.148***	-33.426***	-44.625***
	(3.928)	(3.864)	(3.486)	(3.613)	(3.650)	(3.964)	(3.661)	(3.543)	(3.188)	(3.982)
GDP per capita exporter	1.208***	1.191***	1.131***	1.137***	1.075***	1.236***	1.094***	1.117***	1.010***	1.141***
	(0.054)	(0.055)	(0.049)	(0.053)	(0.052)	(0.062)	(0.053)	(0.055)	(0.046)	(0.061)
GDP per capita importer	1.098***	1.088***	1.003***	1.055***	0.980***	1.083***	1.033***	0.965***	0.982***	1.088***
	(0.064)	(0.063)	(0.055)	(0.052)	(0.052)	(0.063)	(0.060)	(0.052)	(0.049)	(0.063)
Population exporter	0.724***	0.761***	0.956***	0.961***	0.982***	1.117***	1.033***	1.014***	0.945***	1.067***
	(0.037)	(0.037)	(0.034)	(0.031)	(0.036)	(0.039)	(0.036)	(0.034)	(0.029)	(0.039)
Population importer	0.882***	0.870***	0.880***	0.926***	0.932***	1.031***	0.981***	0.873***	0.864***	0.975***
	(0.044)	(0.043)	(0.024)	(0.026)	(0.030)	(0.032)	(0.030)	(0.025)	(0.025)	(0.033)
Distance[a]	-1.074***	-1.097***	-1.275***	-1.229***	-1.457***	-1.465***	-1.437***	-1.108***	-1.265***	-1.523***
	(0.129)	(0.129)	(0.078)	(0.084)	(0.094)	(0.101)	(0.088)	(0.091)	(0.079)	(0.113)
Remoteness exporter[b]	1.694***	1.626***	1.754***	1.838***	1.934***	2.242***	2.037***	2.362***	2.009***	2.668***
	(0.256)	(0.261)	(0.230)	(0.236)	(0.239)	(0.255)	(0.233)	(0.219)	(0.210)	(0.259)
Remoteness importer[b]	-1.265***	-0.693**	-0.468*	-0.664**	-0.500*	-0.452	-0.818***	-1.434***	-0.648***	-0.453
	(0.310)	(0.312)	(0.278)	(0.289)	(0.277)	(0.306)	(0.283)	(0.300)	(0.239)	(0.283)
Common border[c]	1.068***	0.911***	0.414*	0.308	-0.050	0.256	0.007	0.352	0.291	0.021
	(0.259)	(0.248)	(0.216)	(0.199)	(0.246)	(0.236)	(0.229)	(0.224)	(0.201)	(0.249)
Common language[d]	0.519***	0.460**	0.497***	0.721***	0.329*	0.647***	0.462***	0.827***	0.562***	0.438**
	(0.229)	(0.233)	(0.146)	(0.152)	(0.172)	(0.181)	(0.172)	(0.152)	(0.138)	(0.179)
Colonial linkage: U.K.[e]	--	--	2.981***	2.724***	2.921***	2.832***	2.594***	1.632***	2.064***	2.133***
	--	--	(0.298)	(0.278)	(0.388)	(0.377)	(0.394)	(0.393)	(0.370)	(0.558)
Colonial linkage: Spain[f]	0.353	0.430	0.716***	0.781***	0.895***	0.916***	1.107***	0.588**	0.814***	1.060***
	(0.294)	(0.299)	(0.253)	(0.249)	(0.245)	(0.276)	(0.283)	(0.246)	(0.216)	(0.239)
Colonial linkage: Portugal[g]	0.719***	1.051***	0.935***	0.905***	1.004*	0.678	1.026***	0.767	1.268***	1.597***
	(0.252)	(0.229)	(0.236)	(0.205)	(0.541)	(0.531)	(0.310)	(0.640)	(0.397)	(0.336)
NAFTA[h]	--	--	0.476	0.684	0.770	-0.402	0.058	0.265	0.321	-0.193
	--	--	(0.470)	(0.544)	(0.474)	(0.570)	(0.527)	(0.540)	(0.481)	(0.543)

Table 4. Continued

Dependent variable: ln(exports of agricultural products from country *i* to country *j* in U.S. dollars)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
CARICOM[h]	--	--	3.543***	3.178***	2.560***	3.732***	3.608***	3.402***	3.095***	3.221***
	--	--	(0.284)	(0.319)	(0.393)	(0.412)	(0.346)	(0.377)	(0.345)	(0.361)
MERCOSUR[h]	0.659*	0.733*	0.765*	1.055**	0.990**	0.856*	1.311***	1.566***	1.185**	1.257**
	(0.384)	(0.441)	(0.459)	(0.459)	(0.487)	(0.518)	(0.475)	(0.466)	(0.467)	(0.492)
Andean Pact[h]	0.423	0.821*	0.885***	1.156***	0.799	1.051***	1.478***	1.639***	1.441***	1.749***
	(0.475)	(0.464)	(0.326)	(0.303)	(0.521)	(0.320)	(0.310)	(0.301)	(0.259)	(0.335)
CACM[h]	2.672***	2.808***	2.520***	2.756***	2.434***	2.902***	2.804***	3.070***	2.663***	2.770***
	(0.333)	(0.296)	(0.258)	(0.242)	(0.264)	(0.305)	(0.264)	(0.275)	(0.246)	(0.281)
EU importer[k]	-0.055	0.438*	0.264	0.156	0.323	0.467**	0.122	0.381**	0.327*	0.402**
	(0.246)	(0.228)	(0.205)	(0.214)	(0.202)	(0.225)	(0.214)	(0.169)	(0.174)	(0.176)
R-squared	0.527	0.532	0.614	0.614	0.593	0.559	0.556	0.587	0.613	0.593
F-statistic	90.451	94.355	158.614	163.346	141.800	145.987	142.120	147.587	176.116	149.810
N	1233	1263	1815	1869	1769	2091	2061	1883	2021	1867

White's robust standard errors in parenthesis. All continuous variables are measured in natural logarithms. *) Statistically significant at the 10 % level. **) Statistically significant at the 5 % level. ***) Statistically significant at the 1 % level. a) Bilateral distance in kilometers between the capitals of trading partners. b) *Remoteness* $i_t = \sum_{j \neq i} \left[d_{ij} \times \left(\frac{Y_{jt}}{Y_{wt}} \right) \right]$. Binary variables: c) Equal to 1 if the two trading partners are contingent, i.e., they share a common border, 0 otherwise. d) Equal to 1 if the two trading partners share a common commercial language, 0 otherwise. e) Equal to 1 if one of the trading partners is the U.K. and the other a former British colony in the Western Hemisphere, 0 otherwise. (Note that the United States and Canada are not considered former colonies). f) Equal to 1 if one of the trading partners is Spain and the other a former Spanish colony in the Western Hemisphere, 0 otherwise. g) Equal to 1 if one of the trading partners is Portugal and the other a former Portuguese colony in the Western Hemisphere, 0 otherwise. h) Integration/regional dummies: Equal to 1 if both trading partners are members a specific trading agreement, (NAFTA, CARICOM, MERCOSUR, Andean Pact, or CACM respectively), 0 otherwise. k) Equal to 1 if the importing country is a member of the European Union, 0 otherwise.

Table 5. Manufactured goods trade (UNCTAD category 5)

Dependent variable: ln(exports of manufactured goods from country *i* to country *j* in U.S. dollars)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Constant	-37.932***	-36.450***	-35.183***	-38.082***	-38.651***	-44.027***	-39.035***	-38.983***	-36.060***	-48.715***
	(3.483)	(3.536)	(3.032)	(3.058)	(3.057)	(3.460)	(3.142)	(3.442)	(2.738)	(3.502)
GDP per capita exporter	1.714***	1.779***	1.600***	1.625***	1.651***	1.773***	1.724***	1.766***	1.634***	1.824***
	(0.049)	(0.048)	(0.044)	(0.042)	(0.042)	(0.050)	(0.048)	(0.050)	(0.040)	(0.053)
GDP per capita importer	0.881***	0.870***	0.867***	0.860***	0.849***	0.991***	0.938***	0.889***	0.889***	0.898***
	(0.054)	(0.055)	(0.046)	(0.044)	(0.045)	(0.052)	(0.051)	(0.051)	(0.046)	(0.055)
Population exporter	1.211***	1.247**	1.299***	1.299***	1.324***	1.461***	1.443***	1.450***	1.366***	1.509***
	(0.033)	(0.033)	(0.026)	(0.024)	(0.026)	(0.033)	(0.030)	(0.032)	(0.024)	(0.034)
Population importer	0.751***	0.741***	0.945***	0.976***	0.945***	0.989***	0.946***	0.924***	0.894***	0.966***
	(0.038)	(0.038)	(0.023)	(0.023)	(0.025)	(0.026)	(0.025)	(0.024)	(0.022)	(0.030)
Distance[a]	-1.308***	-1.340***	-1.629***	-1.669***	-1.671***	-1.870***	-1.683***	-1.578***	-1.559***	-1.679***
	(0.103)	(0.101)	(0.073)	(0.076)	(0.073)	(0.087)	(0.085)	(0.088)	(0.072)	(0.102)
Remoteness exporter[b]	0.482**	-0.002	-0.049	0.047	0.093	0.420**	0.698***	1.013***	0.802***	1.658***
	(0.227)	(0.223)	(0.192)	(0.179)	(0.174)	(0.198)	(0.186)	(0.196)	(0.182)	(0.235)
Remoteness importer[b]	0.679**	0.920***	0.809***	0.999***	1.007***	0.885***	0.092	-0.298	-0.082	0.017
	(0.296)	(0.303)	(0.258)	(0.260)	(0.261)	(0.294)	(0.271)	(0.296)	(0.226)	(0.277)
Common border[c]	0.551**	0.835***	0.201	-0.096	-0.225	-0.497	-0.360	-0.039	0.124	-0.105
	(0.236)	(0.224)	(0.200)	(0.217)	(0.205)	(0.316)	(0.316)	(0.212)	(0.186)	(0.220)
Common language[d]	1.052***	1.080***	0.615***	0.726***	0.697***	0.800***	0.758***	0.824***	0.661***	0.721***
	(0.182)	(0.174)	(0.123)	(0.117)	(0.120)	(0.131)	(0.130)	(0.128)	(0.117)	(0.147)
Colonial linkage: U.K.[e]	--	--	1.224***	1.236***	0.953***	0.909**	1.048***	0.959**	0.993***	1.986***
	--	--	(0.321)	(0.284)	(0.334)	(0.365)	(0.329)	(0.418)	(0.366)	(0.656)
Colonial linkage: Spain[f]	-0.004	-0.034	0.650***	0.606**	0.561**	0.817***	0.520***	0.453**	0.641***	0.712***
	(0.249)	(0.217)	(0.180)	(0.240)	(0.269)	(0.296)	(0.197)	(0.201)	(0.192)	(0.202)
Colonial linkage: Portugal[g]	-0.198	-0.068	0.224	-0.080	-0.187	0.079	0.123	0.292	0.490	0.338*
	(0.895)	(0.770)	(0.805)	(0.656)	(0.388)	(0.390)	(0.174)	(0.292)	(0.353)	(0.185)
NAFTA[h]	--	--	-0.270	0.139	0.423	-0.328	-0.190	-0.318	-0.189	-0.727
	--	--	(0.543)	(0.725)	(0.711)	(0.786)	(0.717)	(0.716)	(0.664)	(0.698)

Table 5. Continued.

Dependent variable: ln(exports of manufactured goods from country *i* to country *j* in U.S. dollars)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
CARICOM[h]	--	--	3.482***	2.969***	2.924***	3.059***	3.033***	2.884***	2.704***	2.843***
	--	--	(0.296)	(0.325)	(0.323)	(0.337)	(0.325)	(0.335)	(0.332)	(0.432)
MERCOSUR[h]	0.331	0.098	0.091	0.073	0.305	0.161	0.412	0.395	0.391	0.671
	(0.459)	(0.439)	(0.400)	(0.395)	(0.417)	(0.496)	(0.444)	(0.455)	(0.406)	(0.438)
Andean Pact[h]	0.658***	0.767***	0.693**	0.483*	0.945***	0.916***	1.028***	1.109***	1.167***	1.262***
	(0.206)	(0.192)	(0.273)	(0.292)	(0.213)	(0.241)	(0.235)	(0.227)	(0.224)	(0.178)
CACM[h]	2.715***	2.403***	2.326***	2.269***	2.381***	2.488***	2.598***	2.502***	2.283***	2.292***
	(0.256)	(0.260)	(0.237)	(0.222)	(0.225)	(0.257)	(0.255)	(0.247)	(0.219)	(0.242)
EU importer[k]	-0.234	-0.196	-0.508***	-0.544***	-0.236	-0.752***	-0.883***	-1.017***	-1.057***	-0.980***
	(0.220)	(0.219)	(0.187)	(0.178)	(0.185)	(0.206)	(0.173)	(0.181)	(0.161)	(0.196)
R-squared	0.703	0.718	0.739	0.754	0.745	0.700	0.714	0.726	0.751	0.724
F-statistic	210.910	229.334	316.234	345.714	316.047	296.491	310.168	296.182	366.507	289.738
N	1350	1364	2025	2051	1963	2308	2250	2033	2204	2006

White's robust standard errors in parenthesis. All continuous variables are measured in natural logarithms. *) Statistically significant at the 10 % level. **) Statistically significant at the 5 % level. ***) Statistically significant at the 1 % level. a) Bilateral distance in kilometers between the capitals of trading partners. b) *Remoteness* $i_t = \sum_{j \neq i} \left[d_{ij} \times \left(\frac{Y_{jt}}{Y_{wt}} \right) \right]$. Binary variables: c) Equal to 1 if the two trading partners are contingent, i.e., they share a common border, 0 otherwise. d) Equal to 1 if the two trading partners share a common commercial language, 0 otherwise. e) Equal to 1 if one of the trading partners is the U.K. and the other a former British colony in the Western Hemisphere, 0 otherwise. (Note that the United States and Canada are not considered former colonies). f) Equal to 1 if one of the trading partners is Spain and the other a former Spanish colony in the Western Hemisphere, 0 otherwise. g) Equal to 1 if one of the trading partners is Portugal and the other a former Portuguese colony in the Western Hemisphere, 0 otherwise. h) Integration/regional dummies: Equal to 1 if both trading partners are members a specific trading agreement, (NAFTA, CARICOM, MERCOSUR, Andean Pact, or CACM respectively), 0 otherwise. k) Equal to 1 if the importing country is a member of the European Union, 0 otherwise.

Table 6. Effects of binary variables, historical networks

	Average parameter [a]	Marginal effect [b]
Agricultural trade		
U.K. colony	2.485	12.003
Spain colony	0.860	2.362
Portugal colony	1.063	2.895
Manufactured goods trade		
U.K. colony	1.164	3.201
Spain colony	0.620	1.859
Portugal colony	0.338	1.402

a) 'Average Parameter' is calculated as $\frac{\sum_{n} \hat{\delta}_m}{n}$, where *m* indicates a given binary variable (e.g., colonial linkages for the U.K., Spain, and Portugal) and *n* is the number of years for which parameter estimates statistically different from zero were found. '0' indicates that no values were statistically different from zero. b) Marginal Effects are calculated as ($e^{\hat{\bar{\delta}}_m}$), where $\hat{\bar{\delta}}_m$ equals the 'Average parameter' estimate for binary variable *m*. Baseline/reference observation: where all 11 binary variables in vector **w** are jointly equal to 0.

Table 7. Effects of binary variables, regional networks

	Average parameter[a]	Marginal effect [b]
Agricultural trade		
NAFTA	0	1.000
CARICOM	3.292	26.907
MERCOSUR	1.038	2.823
Andean Pact	1.144	3.140
CACM	2.740	15.485
Manufactured goods trade		
NAFTA	0	1.000
CARICOM	2.987	19.831
MERCOSUR	0	1.000
Andean Pact	0.903	2.466
CACM	2.426	11.310

a) 'Average Parameter' is calculated as $\frac{\sum_{n} \hat{\delta}_m}{n}$, where *m* indicates a given binary variable, (e.g., NAFTA, CARICOM, MERCOSUR, Andean Pact, or the CACM) and *n* is the number of years for which parameter estimates statistically different from zero was found. '0' indicates that no values were statistically different from zero. b) Marginal Effects are calculated as ($e^{\hat{\bar{\delta}}_m}$), where $\hat{\bar{\delta}}_m$ equals the 'Average parameter' estimate for binary variable *m*. Baseline/reference observation: where all 11 binary variables in vector **w** are jointly equal to 0.

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