The Determinants of Trade in Goods and Services

Abstract:

This paper examines the determinants of aggregate goods and services trade flows, because these total, and not bilateral, trade flows are most relevant for the gains from trade. Using a panel dataset covering the 1996-2008 period for 179 countries, I find that the determinants of aggregate trade are largely the same as those found, in previous literature, for bilateral trade. The results however differ between goods trade and services trade. Constant factors such as culture and geography, which change little over time have a large effect on a country's trade performance. New to the literature has been the inclusion of a variable on average height, which turned out to have a large, negative and significant effect on trade.

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Introduction

Ever since its introduction in 1962 by Tinbergen, the gravity model has been a huge empirical success. The model describes how trade between any two countries is a function of the product of their respective GDP's and the distance between them. It has later been adapted to include a wide range of variables such as whether countries share a common language and the height of tariff barriers. The average height of these tariffs has dropped tremendously during the past decades; still some countries seem not to have taken advantage of these tariff changes and are still lagging behind concerning their trade performance.

In 2008 Burundi had a trade to GDP ratio of about 56%, with a world average of well over a 100% (WorldBank, 2009). Another small African country did quite a bit better in this respect: Togo had a trade to GDP ratio of over 170%. At the same time, Nepal had a ratio of just over 42%, whilst another Asian developing country, Cambodia, had a ratio of over 153%. Despite the large drop in tariff' heights, Burundi and Nepal lag behind in their trade performance. Many explanations can be given. Two prominent differences between these countries are that two of them are landlocked and are in mountainous regions, whilst the other two have direct sea access, and little elevation. Of course there are many other geographical/institutional/infrastructural/cultural and economic differences, and that is precisely the point. Countries are different in so many ways that their trading performance is not just a function of tariff heights, its GDP and distance to its trading partners, but of many other variables as well.

To investigate which variables are most important to a country's trade performance, it makes little sense to look at the determinants of bilateral trade. In this paper, I therefore propose an adaptation of the gravity model, using unilateral variants of those variables that have been found to influence bilateral trade. These unilateral variants will be country specific, instead of country pair specific. I also introduce a new variable on the average height of a country. Using a panel dataset containing aggregate trade data for 179 countries over the 1996 – 2008 period, I will investigate the influences of these variables on a country's total goods and services trade performance.

This paper will shed some light on why countries trade as much or as little as they do. This is a little researched question in international economics, because most attention is being given to the determinants of bilateral trade flows. However, from a policy perspective, it is not so much important with whom you trade, as how much you trade.

This paper is organized as follows. In section 2, the theoretical background of the gravity model of trade and the empirical literature using this model are being discussed. In section 3, the dataset is being discussed, with a thorough discussion of the variables used and possible problems arising from the dataset. In section 4, the results are being discussed for both the influence of the variables on goods trade and on services trade, together with some notes on these results. Finally section 5 gives the conclusions of this paper.

2 Theoretical part

2.1 Theoretical literature overview and background.

This paper uses an adapted version of the gravity model for bilateral trade, a model pioneered by Tinbergen (1962) and Linneman (1966). This model bears a close resemblance to Newton's law of universal gravitation that describes the gravitational pull between two forces as the product of their masses divided by the distance between them. Though the model is very intuitive and has always proven very useful at predicting bilateral trade flows, its theoretical foundations have long been subject of discussion. In this section the theoretical background of the gravity model in its simplest form will be discussed, after this the model will be extended to include border effects with the help of country fixed effects, as were first introduced by Harrigan (1996) and Hummels (1999). The background provided here is based on Feenstra (2002) and his 1987 textbook (Feenstra, 1987).

In order to construct the basic version of the gravity equation for international trade (1.5), one needs to make a number of simplifying assumptions to accompany the model, of which the most important ones are listed below.

- Countries are specialized in producing different varieties of a final product
- Perfect competition and free trade (no tariffs or trade costs and identical prices)
- Demand in all countries is identical and homothetic
- Trade is balanced

Given these assumptions, all countries will consume all goods in proportion to their respective GDP's. To show this intuitive result formally, I construct a multi country framework with ij=1,……C countries and k=1,…..N products. Furthermore I denote the production of country i of good k by y_k^i and set all prices equal to unity.

This way country i's GDP becomes: $Y^i = \sum_{k=1}^{N} y_k^i$ (1.1)

and the world GDP becomes: $Y^w = \sum_{i=1}^{C} Y^i$ (1.2)

Given that trade is balanced a country j's share of world expenditure, s^j, is also country j's share of world GDP. Thus $s^j = Y^j/Y^w$. Then given our assumptions, the exports of country i to country j of product k can be defined as:

$$X_k^{ij} = s^j y_k^i \quad (1.3)$$

When considering all varieties/goods equation 1.3 becomes:

$$X^{ij} = \sum_k X_k^{ij} = s^j \sum_k y_k^i = s^j Y^i = \frac{Y^i Y^j}{Y^w} = s^j s^i Y^w = X^{ji} \quad (1.4)$$

Adding X^{ij} to X^{ji} to obtain the total amount bilateral trade between i and j:

$$X^{ij} + X^{ji} = \left(\frac{2}{Y^w}\right) Y^i Y^j \quad (1.5)$$

Equation 1.5 gives the gravity model in its simplest form in which bilateral trade between country i and j is directly proportional to the product of their GDP's. Below, the model will be extended to include distance and country fixed effects. This will result in differing prices between countries. To find the consumption, and thus trade patterns one needs a specific utility function. In this case the well-known CES specification appears to be the best candidate. I let c_k^{ij} denote the exports from country i to country j of good k. Given the assumption of more goods than factors, and thus complete specialization, c_k^{ij} will also be country j's consumption of good k. Furthermore let there be i=1,……C countries and k=1,…..N^i products. This way country j's utility functions can be described as follows:

$$U^j = \sum_{i=1}^{c} \sum_{k=1}^{N^i} \left(c_k^{ij}\right)^{(\sigma-1)/\sigma} \qquad (1.6)$$

To simplify 1.6 I shall assume 'iceberg' transport costs as first coined by Samuelson (1952). This way the price paid by consumers in country j for country i's export good will be higher than that paid for the same good in country i. This is due to the fact that part of the shipment, T, "melts" along the way, so that only 1-T of the original shipment arrives at its destination. With equal transport costs for all goods, demand for country i's goods in country j will be equal for all varieties. This way equation 1.6 simplifies to:

$$U^j = \sum_{i=1}^{c} N^i (c^{ij})^{(\sigma-1)/\sigma} \qquad (1.7)$$

To solve for the demand for country i's export goods in country j, we need to optimize equation 1.7 subject to the budget constraint:

$$Y^j = \sum_{i=1}^{c} N^i p^{ij} c^{ij} \qquad (1.8)$$

Doing so leads to:

$$c^{ij} = (p^{ij}/P^j)^{-\sigma}(Y^j/P^j) \qquad (1.9)$$

Where P^j stands for:

$$P^j = \left(\sum_{i=1}^{c} N^i (p^{ij})^{1-\sigma}\right)^{1/(1-\sigma)} \qquad (1.10)$$

Total exports of country i to country j are given by:

$$X^{ij} = N^i p^{ij} c^{ij} \qquad (1.11)$$

Plugging equation 1.9 and 1.10 back into 1.11 lead to the total amount of exports from country i to country j:

$$X^{ij} = N^i Y^j \left(\frac{p^{ij}}{P^j}\right)^{1-\sigma} \qquad (1.12)$$

However, the difference between prices may not accurately reflect the true effects of crossing borders. Therefore an alternative approach can be used in which the factor T, the proportion of goods that 'melts' during transport, is estimated using the distance between the trading partners, d, and other border effects, τ, as in (1.13).

$$lnT^{ij} = \tau^{ij} + \rho \ln d^{ij} + \varepsilon_{ij} \qquad (1.13)$$

Anderson and Van Wincoop (2001) used the market clearing conditions to obtain a linear set of equations from which the parameter values can be obtained.

Given iceberg transport costs the output of firms is larger than the amount of goods received by consumers, as can be seen below:

$$y^i = \sum_{j=1}^{C} c^{ij}\, T^{ij} \qquad (1.14)$$

Given that transport costs from country i to country j equal those from j to i, an implicit solution to 1.14 would be

$$\tilde{p}^i \equiv (s^i/N^i)^{1/(1-\sigma)} / \tilde{P}^i \qquad (1.15)$$

When solved, the price indexes become:

$$\left(\tilde{P}^j\right)^{1-\sigma} = \sum_{i=1}^{C} s^i \left(T^{ij}/\tilde{P}^i\right)^{1-\sigma} \qquad (1.16)$$

Substituting (1.16) back into (1.12) we obtain:

$$X^{ij} = s^i Y^j \left(\frac{T^{ij}}{\tilde{P}^i P^j}\right)^{1-\sigma} = \left(\frac{Y^i Y^j}{Y^w}\right)\left(\frac{T^{ij}}{\tilde{P}^i \tilde{P}^j}\right)^{1-\sigma} \qquad (1.17)$$

In (1.17) bilateral trade between i and j depends on the product of their GDP's, transport costs and on the "multilateral resistance indexes" (Anderson and Van Wincoop, 2001). When taking the GDP terms from right to left, taking logs and replacing the transport costs by (1.13), (1.17) can be rewritten, leaving the constant Y^w out, to:

$$\ln\left(\frac{X^{ij}}{Y^i Y^j}\right) = \rho(1-\sigma) ln d^{ij} + (1-\sigma) t^{ij} + ln\left(\tilde{P}^i\right)^{\sigma-1} + ln\left(\tilde{P}^j\right)^{\sigma-1} + (1-\sigma)\varepsilon_{ij} \qquad (1.18)$$

We now have an equation in which the total amount of bilateral trade between i and j as a fraction of the product of their GDP's depends on distance, all other factors influencing transport costs and the multilateral resistance terms.

With transport costs equal in both directions, we can use (1.16) to solve the multilateral resistance terms. The transport costs can be calculated using (1.13) and the estimated values and this equation using (1.18). To do this however one needs to be precise regarding the form of the $(1-\sigma)t^{IJ}$ part of (1.18). Anderson and Van Wincoop (2001) used the term $(1-\delta)^{ij}$ that takes the value of unity for trade between two countries. When replacing $(1-\sigma)t^{IJ}$ by $\gamma(1-\delta)^{ij}$ and $\rho(1-\sigma)$ by α, we obtain:

$$\ln\left(\frac{X^{ij}}{Y^i Y^j}\right) = \alpha ln d^{ij} + \gamma(1-\delta)^{ij} + ln\left(\tilde{P}^i\right)^{\sigma-1} + ln\left(\tilde{P}^j\right)^{\sigma-1} + (1-\sigma)\varepsilon_{ij} \qquad (1.19)$$

However, one still needs to calculate the unobserved multilateral resistance terms/price indexes. The approach taken in this paper does so by the use of country fixed effects. This approach does not calculate the price indexes, it estimates them as the coefficients on country/region fixed effects. We let δ^{j}_{1} be a dummy variable that is 1 if country i is the exporter and we let δ^{j}_{2} be a dummy variable that takes the value of 1 if country j is the importer. The gravity equation of (1.19) becomes:

$$\ln\left(\frac{X^{ij}}{Y^{i}Y^{j}}\right) = \alpha lnd^{ij} + \gamma(1-\delta)^{ij} + \beta_1^i\delta_1^i + \beta_2^j\delta_2^j + (1-\sigma)\varepsilon_{ij} \qquad (1.20)$$

Where coefficients on the country fixed effects, i.e. the betas, are $ln\left(\tilde{P}^{i}\right)^{\sigma-1}$.

According to Feenstra (2002), both methods give consistent estimates of the average border effect. The use of the explicit multilateral resistance term will give more efficient estimates of the average border effects, but the associated computational difficulties make a compelling case for the use of the country fixed effects method. According to Feenstra (2002), "the fixed effects method produces consistent estimates of the *average* border effect across countries, and is easy to implement, so it might be considered to be the preferred empirical method".

Anderson offers a different foundation for the gravity model. This foundation is based on "the properties of expenditure systems with a maintained hypothesis of homothetic preferences across regions'' (Anderson, 1979). He uses what is known as the 'Armington assumption', that products are differentiated by country of origin. With this approach the gravity model, according to Anderson, can be used for countries with similar structures for the traded-goods preference, taxes and transport costs. Bergstrand (1985), derives a gravity equation in a multiplicative form under 6 assumptions, including assumptions such as "perfect substitutability of goods internationally in production and consumption, perfect commodity arbitrage, zero tariffs, and zero transport costs". Bergstrand (1985) later admits that some of these assumptions are "restrictive", and proposes to use a generalized gravity equation. This equation is dubbed 'general' "because it treats exporter and importer incomes as exogenous yet imposes no restrictions on parameter values other than being identical across all country pairings" (Bergstrand, 1985). Using this model he validates previous findings with respect to the refutability of some assumptions; no perfect substitutability and imperfect commodity arbitrage. With respect to differing prices between countries due to border effects he proposes to use the GDP deflator as a variable on these price differences.

Deardorff (1995) uses the two extreme cases of the Heckscher-Ohlin trade model to derive a gravity type model of bilateral trade. Later Bergstrand (1989), shows that when incorporating "factor-endowment variables in the spirit of Heckscher-Ohlin and taste variables in the spirit of Linder", a gravity model including per capita incomes can be derived, from a monopolistic competition model, with product differentiation between *firms*. Using a Heckscher-Ohlin-Chamberlin-Linder model, he shows that the exporter's capital-labor ratio and the importers GDP per capita both enter a generalized gravity equation. He argues that exporters' per capita income can be interpreted as a proxy for the country's capital-labor ratio, whilst changes in the GDP per capita reflect changes in taste preferences.

2.2 Empirical literature overview

Gravity model and the influences of distance and GDP

The first use of a gravity model for international trade was by Jan Tinbergen in his 1962 book 'Shaping the World Economy: Suggestions for an International Economic Policy.'

Since then, many authors have researched and confirmed the effects of GDP and distance on bilateral trade. A few of these papers have been very influential, starting with McCallum (1995), who estimates the effect of borders on trade, based on data on interprovincial trade within Canada and data on trade between Canadian provinces and U.S. states. He uses a very simple gravity model that regresses the log of trade on the log of provinces' or states' income, the log of distance between them, and a dummy variable that takes the value of 1 for inter-provincial trade and 0 otherwise.
He finds a huge effect on trade caused by the existence of the border between Canada and the U.S.. Various specifications all point out that trade with the United States would be around 22 times higher when there would not be a border. This effect is especially large given the similarity of the two countries and the relative bureaucratical ease of crossing this border. It shows the relative importance of borders, as compared to distance.

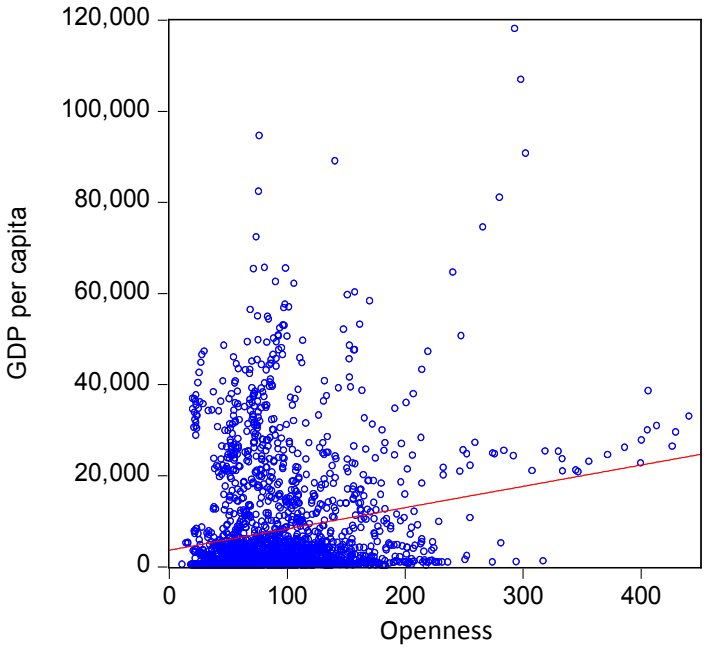
Also Wolf (2000) finds a large and significant home bias for trade within U.S. states compared to inter-state trade of about factor 3. Though this effect is quite large, it is much smaller than home bias found by McCallum (1995). The sources of this home bias on the state level are unknown. Due to the excellent legal framework for inter-state trade and the institutional and cultural similarities between states one would not suspect a large bias. One possible explanation is given; the difference in long-distance finished goods trade and short-distance intermediate goods trade in local production clusters. The latter could explain the relatively large amount of intra-state trade.

Anderson & Van Wincoop (2003) criticize McCallum and Wolf and argue that their results are partly due to omitted variable bias. According to the authors, McCallum and Wolf fail to incorporate the multilateral resistance term and their models therefore have no theoretical justification. Failing to incorporate the average trade barrier into the model leads to an overestimation of bilateral trade for close trading partners. In order to get unbiased results one needs to use a general equilibrium model before and after the removal of the trade barrier because this way one can adjust for the effect on the average trade barrier. Nonetheless their results indicate that national borders reduce bilateral trade by 20 to 50%. These estimates are much smaller than those in previous research, such as McCallum (1995). Next to the above mentioned bias, the authors contribute this to the fact that "they (ed. McCallum & Wolf) considered the effect of the border on the ratio of national to international trade and this border effect is inherently large for small countries" (Anderson & Van Wincoop, 2003).

Being a large economy has been found to negatively impact a country's trade performance. Though being big is not necessarily a bad thing, it hampers trade due to its effect on specialization. Larger countries, or countries with larger populations have, ceteris paribus, more

opportunities for specialization and are less dependent on imports. This effect has been found and confirmed by authors such as Rodrik (1998), Frankel and Rose (2000), Wei (2000), and Jansen & Nordås, (2004).

Fig 1. The relationship between GDP per capita and Openness



Source: Own calculations, with data of the IMF (2010 & 2010a), the World Bank (2009) and the WTO (2010).

In another paper, Anderson and Marcouillier (2000) argue that higher GDP per capita decreases the share of imports in the total expenditure, when including institutional variables. Their results contrast with earlier work by Frankel, Stein and Wei (1996) who find a positive relationship between GDP per capita and the share of imports in total expenditures, as in figure 1. According to the authors, Anderson and Marcouillier's result can be attributed to the inclusion of institutional quality factors; they argue that failure to do so leads to a bias due to incorrectly omitted variables. Due to the positive correlation between GDP per capita and institutional quality, failure to include the latter as a separate variable leads one to falsely attribute the effect of the latter onto the former. Other authors such as Hunter and Markusen (1988) have also argued that higher GDP per capita decreases the share of imports in total expenditures. They argue that economies become more non-tradable services orientated, which will lead to a decrease of imports as percentage of disposable income.

The Influence of national languages and religion

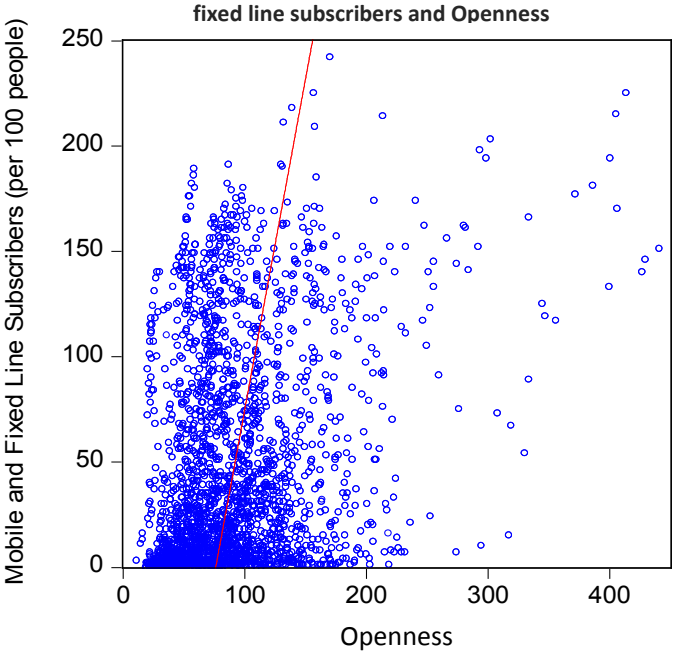
National languages pose an intuitive barrier to trade through their effect on transaction costs. The literature indicates that countries that share a common language, ceteris paribus, have higher bilateral trade levels (Anderson and Marcouillier, 2000; Francois and Manchin, 2007; Linders, 2004; Jansen & Nordas, 2004; Limao & Venables, 2001), the effect on aggregate trade remains little researched. Countries sharing a common religion tend to trade more with each other (Linders, 2004), though the effects are only small. Whether there is a religion that fosters trade most remains unclear, although some empirical research has been conducted (Helble, 2007). I will include dummies for Christian and Muslim countries to look for the effects of religion on trading.

The influence of infrastructure

Infrastructure matters, that is the consensus emerging from the literature. With infrastructure I mean physical infrastructure, as compared to for example social infrastructure. Physical infrastructure can relate to the quality and density of the road network, but also of the rail or air transport network. Furthermore it encompasses the quality of ports and the telecommunications network. In their influential paper, Limao & Venables (2001) find that source and destination country infrastructure influences transport costs. The authors use a measure of infrastructural quality including variables also used in this paper; an unweighted average a country's road density, percentage of roads paved, railway density and the quality of the communications network. Using this measure they find that own country infrastructure improvements from the median to the 25th percentile, increase the volume of trade by 8 percentage points, whilst the increase in the volume of trade is 2 percentage points for a similar improvement in transit country infrastructure, and 11 percentage points if both the home and the transit country simultaneously improve their infrastructure from the median to the 25th percentile (Limao and Venables, 2001).

Jansen & Nordås (2004) use the percentage of roads paved and a combination of indicators on telecommunications, the quality of ports, airport and railways together in an index as an independent variable in a gravity style setup. Because of the high correlation between these variables they use principal components to obtain uncorrelated indexes. Their results clearly indicate that better infrastructure enhances trade performance, as in figure 4. The dependent variable in their model was 'openness', the total volume of trade as a percentage of GDP.

Fig 2. The relationship between the number of mobile and fixed line subscribers and Openness

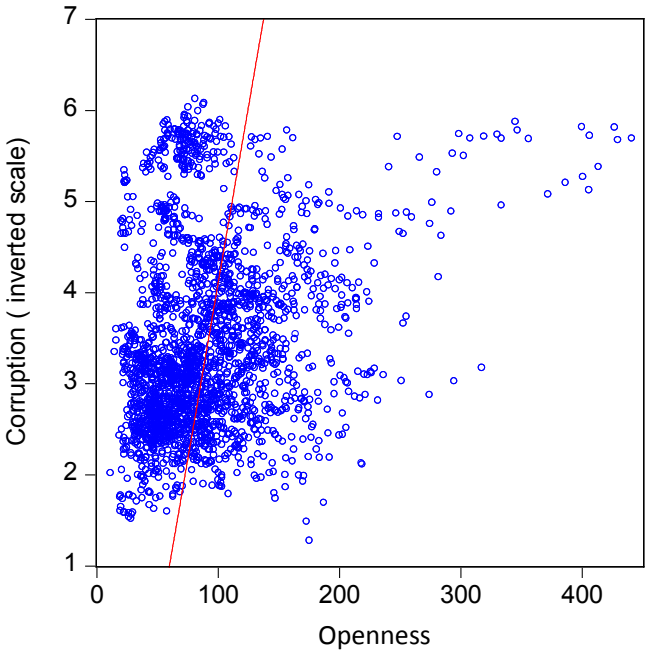


Source: Own calculations, with data of the IMF (2010), the World Bank (2009) and the WTO (2010).

The influence of institutional quality, currency unions and regional trade agreements

The influence of institutions has been one of the most researched topics with the use of the gravity model. Institutions in the context of this paper refer to the way processes are organized in a country. They can relate to the governmental process, the degree of democracy, or to the rule of law, the degree to which all citizens obey legal rules, legal certainty and the extent of corruption. In the Western Hemisphere, institutions such as democracy and good legal institutions are considered common-place. However, this is often not the case outside the Western Hemisphere, and even between developed countries differences exist and persist. The effect of "good" institutions seems to be that they foster trade as in figure 5 (Kepler & Manchin, 2007; Linders, Slangen, De Groot and Beugelsdijk, 2005; Wei, 2000), and that papers ignoring "the security of exchange suffer from an important omitted variables bias" (Anderson & Marcouiliier, 2000). Other authors indicate that differing institutions themselves can be a source of trade (Levchenko, 2004), whilst others argue that institutional distance decreases bilateral trade (Linders et al., 2005).

Fig 3. The relationship between Corruption and Openness



Source: Own calculations, with data from Kaufmann, Kraay, & Mastrzuzzi (2009), the IMF (2010), the World Bank (2009) and the WTO (2010).

An important cross-border institution is that of the currency union. Recent literature has found significant effects on bilateral trade levels. Rose and Van Wincoop (2002) find that being in a currency union increases bilateral trade by up to 400%. This is not due to omitted variable bias or reverse causality, however, given derivative markets and the subsequent possibilities for hedging against exchange rate fluctuations, the impact seems rather large. Frankel and Rose (2000) find similar high estimates. One explanation given by Rose and Van Wincoop (2002) is through the effect on multilateral resistance. Entering a currency union decreases this multilateral resistance factor and therefore trade with close partners in the union will likely increase by less than the afore mentioned 400%. In fact the results show us that for a sample of possible currency unions, the increase in trade between member countries is more likely between 20 and 70%, and the welfare gains between 1 and 21.3% (if the whole world adopts one common currency). Frankel and Rose (2000) also find no evidence of trade diversion, i.e. trade with non-union trading partners also increases due to the currency union. Therefore the gains are often substantial and it seems likely that the gains of a currency union outweigh the cost of forgoing an independent monetary policy.

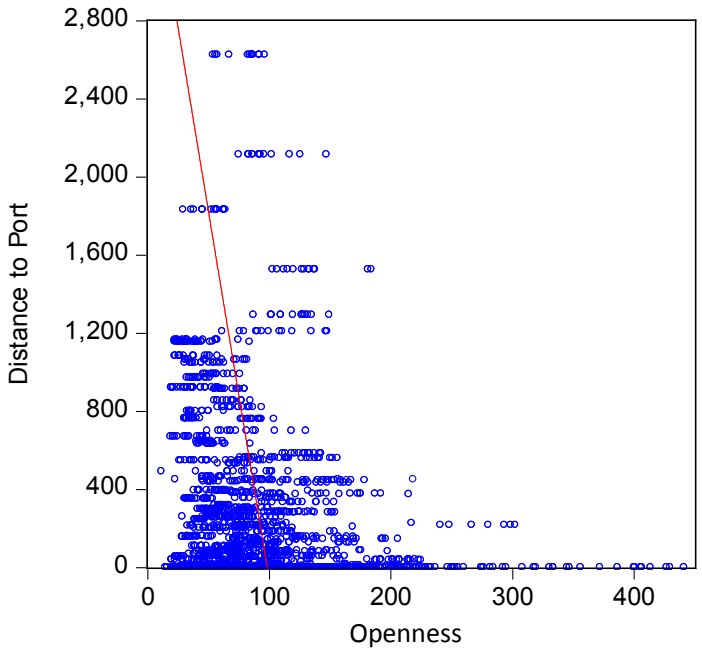
Frankel, Stein and Wei (1996) find that the world is regionalizing with many RTA's in recent years. Regional trade agreements are an exemption to the MFN principle of the GATT (WTO). However they only allow Free Trade Agreements and officially prohibit Preferential Trade Agreements. Frankel et al. find that these Free Trade agreements "represent an excessive degree of regionalization of world trade". This goes for FTA for entire continents but also to a lesser degree for sub-continental regions. Within the latter category Preferential Trade Agreements can be welfare improving under certain circumstances. It has to be noted that this analysis does not consider political economic motives. For example RTA's may be stepping stones to worldwide trade liberalization.

In this paper I will not include a dummy variable on Regional Trade Agreements. Virtually all countries in the world are part of at least one RTA, the inclusion of a dummy variable would therefore make little sense, and qualifying the world's Regional Trade Agreements is beyond the scope of this paper.

The influence of geography

Probably the best researched effect of geography on trade is that of being landlocked. An influential paper has been written by Limao & Venables (2001). In their paper they examine the influence of being landlocked on transport costs and on bilateral trade flows. They find that being landlocked increases transport costs by about 50%. Given the high elasticity of trade with respect to transport costs, -2.5, found by the authors, being landlocked is an important barrier to trade.

Fig 4. The relationship between Distance to Port and Openness



Source: Own calculations, with data of the IMF (2010), the World Bank (2009) and the WTO (2010).

Similar results with respect to the sign of the landlocked dummy have been obtained by Jansen & Nordås (2004); Dollar & Kraay (2003) & Francois & Manchin (2007). Countries can be landlocked in more than one way, for example they can be double landlocked (having to cross two countries to get to sea), but they can also be very close to sea such as Swaziland (147km) or very far from sea such as the Kyrgyz Republic (2115km). The effect on trade of the distance to port (figure 2), combined with the landlocked dummy, has only been researched by Limao & Venables (2001), who suggest that even when including distance to port, which is generally higher for landlocked countries, the dummy on being landlocked keeps a positive and significant effect on transport costs.

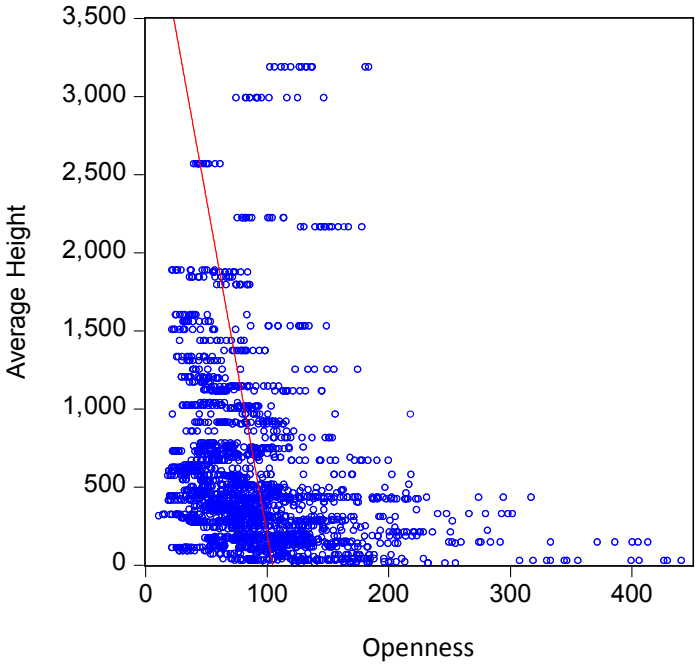
However there is more to geography than being landlocked or not. Similar to being landlocked, a country can be 'sealocked', as islands are. Though these countries have direct access to sea, they have no possibilities for overland trade. This implies that multi-modal transport is always needed; furthermore for short distances sea transport may not be the most efficient way of transport. Several authors have included 'island-dummies' in their researches and they have consistently found negative estimates (Limao & Venables, 2001; Jansen & Nordås, 2004).

Another geographical factor influencing trade is latitude. With the overwhelming majority of rich countries being in the temperate zones, the major markets are concentrated away from the equator. The closer a country is to the equator, the less it will trade, ceteris paribus. This is exactly the result that Jansen & Nordås (2004) obtained.

Geography within a country can also influence trade. Mountain ranges can negatively impact trade through their effect on transport costs, as in figure 3. It is not hard to see how the Himalaya mountains might impede Nepal's export ambitions. However I have not been able to find relevant articles in which this connection has been researched.

The evidence on the effect of geographic size on trade is conflicting after controlling for the size of the economy, the GDP.

Fig 5. The relationship between Average Height and Openness



Source: Own calcula**tions, with data of the IMF (2010),** the World Bank (2009) **and the WTO (2010).**

3 Data & Methodology

3.1 Descriptive statistics

The sample used in this paper includes 179 countries, for the full list see appendix 1. To avoid sample selection bias I have taken the full sample of countries but excluded several due to data limitations. These countries are: Andorra, Antigua and Barbuda, East Timor, Kosovo, Liechtenstein, Marshall Islands, Nauru, Palau, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, San Marino, Serbia & Montenegro, Taiwan, Tuvalu, Vatican City. However I have included Hong-Kong & Macao though they are not sovereign states.

The time span used in this paper is 1996-2008. I have chosen this time span because of data availability, and specifically the availability of the Kaufmann, Kraay, & Mastrzuzzi (2009) indicators on institutional quality.

Table 1. Descriptive Statistics

Variable	Minimum	Maximum	Mean	Standard deviation
Road density, per km2	0.0100 (Sudan)	19.310 (Macao)	0.6877	1.3885
% Roads paved	1.0000 (Chad)	100.00 (Austria)	48.707	33.057
Mobile+Fixed lines subscriptions per 100 people	0.0000 (Central African Rep)	242.00 U.A.E.	47.359	51.030
Voice and Accountability	1.1475 (North Korea)	5.3256 (Denmark)	3.3802	0.9970
Political Stability	0.2231 (Somalia)	5.1832 (Iceland)	3.3788	0.9950
Government Effectiveness	0.9892 (Somalia)	6.1359 (Switzerland)	3.4423	1.0130
Regulatory Quality	3.4262 (Liberia)	6.9132 (Brunei)	3.4262	1.0038
Rule of Law	0.8143 (Somalia)	5.6161 (Iceland)	3.3912	0.9958
Control of Corruption	1.2773 (Congo, Rep)	6.1245 (Iceland)	3.4319	1.0116
Latitude, in degrees	-41.280 (New-Zealand)	64.110 (Iceland)	18.682	24.456
Distance from 49st degree lt	0.1400 (France)	90.280 (New-Zealand)	31.578	22.805
Country size, km2	29.00 (Macao)	17098242 (Russia)	74129	1982240
Distance to port, km	0.000 (Algeria)	2625.0 (Kazakhstan)	264.83	415.27
Average height, meters	9.45 (Bahamas)	3185.92 (Tajikistan)	574.28	542.64
GDP, billions, current USD, (t-1)	0.00007 (Sao Tome& Principe)	14.011 (U.S.A.)	0.2031	0.9039
GDP per capita, current USD, (t-1)	69.314 (Liberia)	106831 (Luxembourg)	7337.9	11870

These figures have been calculated using all countries in all time periods and therefore consist of 2327 observations per variable.

The data on institutional quality have been configured by Kaufmann to have an average of 0 with a standard deviation of 1. However observations were both positive and negative, and I will not be using the full sample of Kaufmann. Due to these omissions the standard deviation is sometimes a bit higher and sometimes a bit lower than 1. With respect to the mean, one can see that it is slightly below 3.5 whilst in the original sample it was 0. I have rescaled the institutional quality variables by adding 3.5 points to every observation in order to make them all positive, which allows me to take their logarithms.

3.2 Contribution to the literature

The literature has so far mainly focused on the determinants of bilateral trade. Though the theoretical foundations of the gravity model of international trade have been validated several times in the past decennia, the economic relevance of the determinants of bilateral trade flows may not be that big. One would expect a country interested in trading to be more concerned with its total trading performance than with its trading performance with specific partner countries. Following the paper by Jansen and Nordås (2004), I will use the gravity equation to calculate the determinants of trade between the home country and the rest of the world as a partner country. This paper aims to validate previous findings, with respect to both bilateral and aggregate trade, and also aims to add to the literature by including a variable on average height. The variables used in this paper are the equivalents of those used in standard bilateral trading models, but are specifically chosen for this setup with trade between one country and the rest of the world. Some of these variables are specifically aimed at correctly measuring the impact of being landlocked, such as the distance to port and the average height of a country.

3.3 Equation

$$
\begin{aligned}
Trade_{i,t} = {} & \beta_0 + \beta_1 GDP_{i,(t-1)} + \beta_2 GDP\ per\ capita_{i,(t-1)} + \beta_3 GDP\ rest\ of\ World_{i,(t-1)} \\
& + \beta_4 Christian_{i,t} + \beta_5 Muslim_{i,t} + \beta_6 English_{i,t} \\
& + \beta_7 Other\ World\ language_{i,t} + \beta_8 Former\ Colony_{i,t} \\
& + \beta_9 Percentage\ Roads\ paved_{i,t} + \beta_{10} Road\ Density_{i,t} \\
& + \beta_{11} Mobile\ and\ Fixed\ Line\ Subscribers_{i,t} + \beta_{12} Corruption_{i,t} \\
& + \beta_{13} Government\ Effectiveness_{i,t} + \beta_{14} Political\ Stability_{i,t} \\
& + \beta_{15} Regulatory\ Quality_{i,t} + \beta_{16} Rule\ of\ Law_{i,t} \\
& + \beta_{17} Voice\ \&\ Accountability_{i,t} + \beta_{18} Currency\ Union_{i,t} + \beta_{19} Africa_{i,t} \\
& + \beta_{20} Asia_{i,t} + \beta_{21} Middle\ \&\ South\ America_{i,t} + \beta_{22} Island_{i,t} \\
& + \beta_{23} Landlocked_{i,t} + \beta_{24} Country\ Size_{i,t} + \beta_{25} Average\ height_{i,t} \\
& + \beta_{26} Distance\ to\ Port_{i,t} + \beta_{27} Distance\ from\ 49th\ degree_{i,t} + \varepsilon_{i,t}
\end{aligned}
$$

This equation has been chosen because all variables have either been found in the literature to affect bilateral trading or there is a theoretical foundation for their inclusion. I will go into more detail on the chosen variables below.

I will estimate this equation with the ordinary least squares (OLS) method with the inclusion of time fixed effects. This approach is similar to the one taken by Jansen and Nordås (2004).

3.4 Variable description

3.4.1 Economic Variables

Gross Domestic Product (GDP)

This variable gives a country's nominal GDP in current prices. The variable was chosen in this form because the independent variable is measured in nominal, current prices, as well. A lag of 1 period (year) is introduced to deal with the problem of endogeneity.

- **Included because/prediction:** According to the gravity model a higher GDP in the home country will increase the volume of trade.
- **Expected sign: +**
- **Source:** World Bank (2009) & International Monetary Fund (2010a).

Gross Domestic Product, per Capita (GDPPC)

This variable gives a country's nominal GDP in current prices per capita. This variable controls for indirect influences of the level of development on the volume of trade. A lag of 1 period (year) is introduced to deal with the problem of endogeneity.

- **Included because/prediction:** A higher GDP per capita is expected to increase the volume of trade because there are barriers to trade that are very indirect and cannot easily be measured but are related to the level of development. However some authors suggest that more developed economies tend to produce more non-tradable services, decreasing trade.
- **Expected sign: +/-**
- **Source:** World Bank (2009) & International Monetary Fund (2010a).

Rest of the World, Gross Domestic Product (RoWGDP)

This variable gives the nominal GDP in current prices of the partner country, which in this set-up is always the rest of the world. The variable is obtained by summing up all GDP values for 1 year and then subtracting the home country's GDP. A lag of 1 period (year) is introduced to deal with the problem of endogeneity.

- **Included because/prediction:** According to the gravity model a higher GDP in the partner country will increase the volume of trade of the home country.
- **Expected sign: +**
- **Source:** World Bank (2009) & International Monetary Fund (2010a).

3.4.2 Cultural Variables

Former Colony (FC)

This dummy variable takes the value 1 if the country has been colonized in the past for a period longer than 30 years and has only gained independence less than 100 years before the beginning

of the dataset, i.e. after 1896. Furthermore only colonies from Western European powers are considered and the former Soviet satellite states are not included.

- **Included because:** Being a former colony has often been found to influence bilateral trade.
- **Prediction**: On the one hand one would expect these countries to trade more, because they are more familiar with Western institutions and habits, furthermore many of them still have close ties with at least one developed European country. On the other hand, depending on the type of colony, much of the mineral resources of these countries may have been appropriated in the past, colonial borders might have raised ethnic tension and countries may be reluctant to trade with their former colonizers.
- **Expected sign: +/-**
- **Source:** U.S. Central Intelligence Agency (2010) & own research

English Language (Eng)

This dummy variable takes the value 1 if the country has the English language as an official language, and 0 otherwise.

- **Included because/prediction:** Sharing a common language has been found to influence bilateral trade, English is the most widely spoken language and is therefore expected to have a positive effect on trade.
- **Expected sign: +**
- **Source:** U.S. Central Intelligence Agency (2010) & own research

Other World language (OthWL)

Other world languages are defined as languages that are official in at least 3 countries and are spoken, as a first language, by at least 200 million people worldwide, with the exception of the English language. These other world languages are: French, Spanish, Portuguese, Russian and Arabic.

- **Included because/prediction:** Sharing a common language has been found to influence bilateral trade. Speaking a World language decreases transaction costs for trading with a considerable part of the world. Lower transaction costs are expected to increase trade. However, if the knowledge of these world languages comes at the cost of less knowledge of the English language, the net effect could be non-positive.
- **Expected sign: +/-**
- **Source:** U.S. Central Intelligence Agency (2010) & own research

Christianity (Chr) and Islam (Mus)

These dummy variables take the value of 1 if the country predominantly favors 1 of the 2 religions, and 0 otherwise. Christians include Jews, Protestants, Catholics and all other believers in the bible or the Torah. Muslims include Shiites and Sunnis.

- **Included because:** Culture can be an important determinant of trading patterns, and sharing a common religion has been found to influence bilateral trade.

- **Prediction:** These variables are included to describe the culture of the countries; however there is no strong prediction for followers of one religion to trade more than others. Muslims have historically been traders, whilst the today's large economies are predominantly Christian.
- **Expected sign: +/-**
- **Source:** U.S. Central Intelligence Agency (2010) & own research

3.4.3 Infrastructural Variables

Percentage Roads Paved (PRP)

This variable gives the percentage of all roads in a country that are paved, and is defined as: "those roads that are surfaced with crushed stone (macadam) and hydrocarbon binder or bituminized agents, with concrete, or with cobblestones, as a percentage of all the country's roads, measured in length" (World Bank, 2008).

- **Included because/prediction**: A higher percentage of paved roads signals better road (maintenance) quality. It is therefore expected that a higher percentage of roads paved decreases transport costs and time and will therefore increase trade.
- **Expected sign: +**
- **Source:** World Bank (2009).

Mobile and Fixed Line Subscribers (MFS)

This variable measures the amount of mobile and fixed line subscribers per 100 people. It gives a good measure of the access to communications technology.

- **Included because/prediction:** Better access to communications infrastructure is expected to decrease transaction costs and thus increase trade.
- **Expected sign: +**
- **Source:** World Bank (2009).

Road Density (RD)

This variable measures the density of the road network. The road density is calculated by taking the length of roads in km per 100sq km.

- **Prediction:** Having a denser road network is expected to decrease transport time and costs and therefore increase trade.
- **Expected sign: +**
- **Source:** World Bank (2009).

3.4.4 Institutional Variables

Voice and Accountability (VA)

This variable measures "the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media" (Kaufmann, Kraay, & Mastrzuzzi, 2009).

- **Included because/prediction:** More accountability leads politicians to listen better to their people and embark on projects on their behalf. This will improve the business climate and thus trade.
- **Expected sign: +**
- **Source:** Kaufmann, Kraay, & Mastrzuzzi (2009).

Political Stability and the Absence of Violence (PS)

This variable measures "the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism" (Kaufmann, Kraay, & Mastrzuzzi, 2009).

- **Included because/prediction:** More political stability decreases risk and will therefore increase trade.
- **Expected sign: +**
- **Source:** Kaufmann, Kraay, & Mastrzuzzi (2009).

Government Effectiveness (GE)

This variable measures "the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies" (Kaufmann, Kraay, & Mastrzuzzi, 2009).

- **Included because/prediction:** Higher quality of pubic and civil services will decrease costs and therefore promote trade.
- **Expected sign: +**
- **Source:** Kaufmann, Kraay, & Mastrzuzzi (2009).

Regulatory Quality (RQ)

This variable measures "the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development" (Kaufmann, Kraay, & Mastrzuzzi, 2009).

- **Included because/prediction:** Better private sector development enhances trade.
- **Expected sign: +**
- **Source:** Kaufmann, Kraay, & Mastrzuzzi (2009).

Rule of Law (ROL)

This variable measures "the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence" (Kaufmann, Kraay, & Mastrzuzzi, 2009).

- **Included because/prediction:** A better rule of law decreases risk and uncertainty and will therefore enhance trade.
- **Expected sign: +**
- **Source:** Kaufmann, Kraay, & Mastrzuzzi (2009).

Control of Corruption (COR)

This variable measures “the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests” (Kaufmann, Kraay, & Mastrzuzzi, 2009).

- **Included because/prediction:** Less corruption decreases transaction costs and uncertainty, this will enhance trade.
- **Expected sign: +**
- **Source:** Kaufmann, Kraay, & Mastrzuzzi (2009).

Currency Union (CU)

This dummy variable takes the value 1 if the country is part of a currency union, and 0 otherwise. Only currency unions with at least 3 country members in the sample are included in this paper. The currencies included are the euro, the dollar, the CFA franc, the East Caribbean dollar and the South African rand.

- **Included because/prediction:** Being member of a currency union has been found to have a positive effect on bilateral trade, using the gravity model. Previous literature has also indicated a positive effect on total trade. Lower transaction costs could boost trade, whilst the loss of dependent policy might decrease trade.
- **Expected sign: +/-**
- **Source:** Own research

3.4.5 Geographical Variables

Latitude, from 49th degree (D49)

This variable gives the absolute difference in degrees latitude between a country’s capital and the 49th degree latitude on the Northern Hemisphere. Data have been obtained by the use of Google Earth and may include a very small, but insignificant, measurement error. The 49th degree latitude on the Northern Hemisphere is more or less the latitude of Vancouver-Paris and thus constitutes a geographical proximity to large markets of the Western world.

- **Included because/prediction:** It is expected that being further away from the major markets in the world will increase transaction costs and therefore reduce the amount of trade.
- **Expected sign: -**
- **Source:** own research

Country Size (M2)

This variable gives the absolute size of a country in square kilometers. This measure includes all land area, inland water bodies and may include coastal waters, but always excludes territorial waters.

- **Included because/prediction:** It is expected that larger countries will relatively trade less, compared to their GDP, than smaller countries. Because larger countries have more

- possibilities for domestic production they will be less likely, ceteris paribus, to import than smaller countries.
- **Expected sign: -**
- **Source:** United Nations (2008).

Island (ISL)

This dummy variable takes the value of 1 when the country is not attached to any of the large land-masses, and 0 otherwise.

- **Included because/prediction:** It is expected that being an island increases transport costs, because multi-modal transport is always necessary for international trade. Furthermore the small hinterland and therefore little sea traffic will increase transport costs. These higher transport costs are likely to reduce the amount of trade.
- **Expected sign: -**
- **Source:** own research

Land-locked (LL)

This dummy variable takes the value of 1 when the country is land-locked, and 0 otherwise.

- **Included because/prediction:** Due to the administrative barriers of crossing borders, it is expected that being land-locked increases transaction costs and will therefore reduce trade. Due to the inclusion of the distance to sea as a separate variable, any decrease in trade due to the land-locked dummy is solely due to administrative barriers.
- **Expected sign: -**
- **Source:** own research

Distance to Port (DTP)

This variable gives the straight line distance of a country's capital city to the nearest sea-port that has liner service and that is used for importing/exporting goods from/to this country.

- **Included because/prediction:** It is expected that being further away from a sea port increases transport costs, and therefore decreases the amount of trade.
- **Expected sign: -**
- **Source:** own research

Average Height (AH)

This variable gives the mean elevation level of a country in meters.

- **Included because/prediction:** It is expected that having a higher mean elevation level as a country will increase transport time and therefore transport costs. Due to these higher transport costs it is expected that, ceteris paribus, these countries trade less than those with lower mean elevation levels.
- **Expected sign: -**
- **Source:** Gallup, Mellinger and Sachs (2001) & own research.

Africa (AF), Asia (AS) and Middle and South America (MSA)

These dummies indicate whether a country is on one of these three continents. The Middle East, including Turkey is included in the Asia dummy.

- **Included because:** There are many regional factors that can influence trade, and therefore need to be controlled for.
- **Expected sign:** +/-
- **Source:** own research.

3.4.6 Dependent Variables

Goods Imports

The volume of goods imports of a country from all other countries in the world. This includes the costs of transport, known as: 'cost, insurance, freight'.

- **Source:** International Monetary Fund (2010); World Trade Organization (2010) & World Bank (2009)

Goods Exports

The volume of goods exports of a country to all other countries in the world. This is measured on a 'free on board' basis and therefore does not include 'cost, insurance and freight'.

- **Source:** International Monetary Fund (2010); World Trade Organization (2010) & World Bank (2009)

Service Imports

The volume of commercial services imports of a country from all other countries in the world.

- **Source:** International Monetary Fund (2010); World Trade Organization (2010) & World Bank (2009)

Service Exports

The volume of commercial services exports of a country from all other countries in the world.

- **Source:** International Monetary Fund (2010); World Trade Organization (2010) & World Bank (2009)

3.5 Correlation Matrices

Cultural Variables & Infrastructural Variables

Table 2. Correlation matrix; cultural & infrastructural variables

	FC	En	Oth Wl	Chr	Mus	MFS	PRP	RD
FC	-	0,432	0.167	-0.170	0.167	-0.380	-0.395	-0.020
En	0,432	-	-0.520	0.215	-0.214	-0.030	-0.098	0.058
Oth Wl	0,167	-0.520	-	-0.139	0.304	-0.200	-0.201	-0.167
Chr	- 0,170	0,215	-0.139	-	-0.805	0.253	-0.032	0.030
Mus	0.167	-0.214	0.304	-0.805	-	-0.255	-0.006	-0.169
MFS	- 0.380	-0.030	-0.200	0.253	-0.255	-	0.544	0.412
PRP	-0.395	-0.098	-0.201	-0.032	-0.006	0.544	-	0.395
RD	-0.020	0.058	-0.167	0.030	-0.169	0.412	0.395	-

One can observe a rather high correlation of 0.463 between the dummy variable on former colonies (FC) and the dummy variable on world languages (WL). This is a result that was to be expected due to the nature of colonization. However given that this correlation is far from perfect the two do not always coincide, which allows me to test their individual significance in determining the amount of trade of a country. Furthermore, all three infrastructural variables seem to be positively correlated, this needs to be taken into account when including them together into one equation.

Institutional Variables

Table 3. Correlation Matrix, institutional variables

	V&A	PS	GE	RQ	ROL	COR
V&A	-	0,711	0,797	0,813	0,798	0,767
PS	0,711	-	0,751	0,702	0,805	0,754
GE	0,797	0,751	-	0,918	0,943	0,945
RQ	0,813	0,702	0,918	-	0,886	0,866
ROL	0,798	0,805	0,943	0,886	-	0,946
COR	0,767	0,754	0,945	0,866	0,946	-

Though the level of correlation varies between the various combinations it becomes clear that these different measures of institutional quality are highly correlated. This needs to be taken into account when measuring their impact on trade using OLS.

Geographical Variables

Table 4. Correlation matrix, geographical variables

	Dist 49	Size	ISL	LL	DTP	AH	AF	AS	MSA
Dist 49	-	0,091	0,235	-0,264	-0,256	-0,438	0	-0,217	0
Size	0,091	-	-0,097	-0,070	0,118	0,071	-0,058	-0,011	-0,019
ISL	0,235	-0,097	-	-0,247	-0,293	-0,267	-0,160	-0,091	0,184
LL	-0,264	-0,070	-0,247	-	0,692	0,410	0,139	-0,002	-0,156
DTP	-0,256	0,118	-0,293	0,692	-	0,456	0,097	0,204	-0,184
AH	-0,438	0,071	-0,267	0,410	0,456	-	0,041	0,180	-0,072
AF	0	-0,058	-0,160	0,139	0,097	0,041	-	-0,371	-0,293
AS	-0,217	-0,011	-0,091	-0,002	0,204	0,180	-0,371	-	-0,265
MSA	0	-0,019	0,184	-0,156	-0,184	-0,072	-0,293	-0,265	-

The correlation matrix above indicates some possible multicollinearity problems with regard to the joint inclusion of these variables in OLS. The largest correlation is found between being landlocked (LL) and the distance to the nearest port (DTP). I suspect a separate impact from both variables and therefore aim to include both variables together. Furthermore there is a positive correlation between the average height of a country (AH) and being landlocked (LL).

There are more variables that are correlated, however, they are between categories. I will highlight those variables that from a theoretical point of view are likely to be correlated.

Cross Category Correlations

Table 5. Correlation matrix, cross category correlations

	MFS	PRP	RD	INS	D49	AF	AS	MSA
GDPPC	0.762	0.486	0.351	0.734	0.371	-0.326	-0.023	-0.130
Size	0.043	- 0.067	-0.123	0.029	-0.023	-0.058	-0.012	-0.019

Country size and road density are negatively correlated, which is an intuitive result. Furthermore a country's GDP per capita is correlated with the quality of its institutions and infrastructure, as well as its latitude. Furthermore African and Middle/South American countries are generally less developed. These correlations are highly intuitive and their effects on the standard errors need to be taken into account. The variables are however far from perfect collinearity and I therefore expect this to be a minor problem. To make sure, I will calculate the Variance Inflation Factor later and confirm that multicollinearity is not an issue here.

4 Results

4.1 The goods trade model

Table 6. Results, dependent variable: goods trade

	1	2	3	4	5	6	7
C	- 85.2720***	- 85.8881***	- 85.2973***	- 92.3734***	- 94.0172***	- 89.1590***	- 92.7665***
GDP(t-1)	0.85741***	0.85285***	0.91499***	0.83885***	0.89268***	0.86430***	0.87198***
GDPPC(t-1)	0.10116***	0.10737***		0.10900***	0.07014***	0.09635***	0.09343***
RoWGDP(t-1)	2.61519***	2.63169***	2.60264***	2.84207***	2.88608***	2.73452***	2.84509***
Chr	0.10124**	0.06685	0.15479***	0.08711**	- 0.08560**	0.08516*	
Mus	- 0.13395***	- 0.15125***	-0.07190*	- 0.12686***	- 0.16954***	- 0.14222***	
Eng	0.27800***	0.23496***	0.25559***	0.26260***	0.28117***	0.27372***	0.31462***
Oth WL	- 0.01960	- 0.02571	- 0.01464	- 0.00827	- 0.00378		
FC	- 0.02839		- 0.01369	- 0.00328	0.01697		- 0.02623
PRP	0.02094***	0.02101***	0.01858***	0.02080***	0.00082	0.02043***	0.01594***
RD	- 0.04229***	- 0.04296***	- 0.08411***		- 0.06163***	- 0.04569***	- 0.0336**
MFS	0.00733***	0.00731***	0.00916***	0.00724***	0.00869***	0.00749***	0.00807***
COR	0.14510						
GE	0.21623	0.04202	0.19526***	0.00054	- 0.00345		
PS	0.05818					- 0.02166	
ROL	- 0.56316***						
RQ	0.21181***						0.05312
VA	- 0.14171**						
CU	- 0.03668	-0.05359**	- 0.02111	- 0.04467*	- 0.04873*	- 0.04420*	- 0.02902
Africa	0.01453	0.02582	- 0.04789	0.03049	- 0.20268***	0.00153	- 0.08559*
Asia	0.32187***	0.30002***	0.28192***	0.32656***		0.30353***	0.16304***
MSA	- 0.20591***	- 0.17221***	- 0.19885***	- 0.16851***	- 0.28184***	- 0.18640***	- 0.18759***
Island	- 0.41057***	- 0.39896***	- 0.42589***	- 0.44409***	- 0.46481***	- 0.43954***	- 0.43024***
Landlocked	- 0.06237*	- 0.14155***		- 0.06425**		- 0.05836**	
Size	- 0.00011		- 0.04088***	0.02672***	- 0.02323*	- 0.00203	- 0.00427
AH	- 0.11669***	- 0.13204***	- 0.12752***	- 0.11237***	- 0.10863***	- 0.11619***	- 0.10518***
DTP	- 0.03079***		- 0.03822***	- 0.03029***	- 0.03231***	- 0.03023***	- 0.03396***
D49	- 0.12320***	- 0.10549***	- 0.12159***	- 0.11570***	- 0.08657***	- 0.12337***	- 0.10470***
R^2	0.95687	0.95563	0.95562	0.95604	0.95496	0.95620	0.95523
N° of obs	2327	2327	2327	2327	2327	2327	2327

Note: all non-dummy variables are in logarithmic form. Time fixed effects, dummies, have been included in the regression. *, **, * indicates significance at the 1%, 5% and 10% level respectively.**

I have added time-fixed effects to the model and then tested the null hypothesis of redundancy of the time-fixed effects. This test gave the following statistics:

Table 7. Test: redundant fixed effects

Redundant Fixed Effects Tests
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	2.195962	(12,2288)	0.0099
Period Chi-square	26.647562	12	0.0087

The test clearly shows that we can reject the null-hypothesis of redundancy at normal confidence levels. Given these results, the remaining equations have been estimated including time fixed effects.

Given the high levels of correlation found in tables 2-5, the model also exhibits multicollinearity. This multicollinearity is largely caused by the institutional variables, therefore I have not included them together after the first equation. The results in table 6 give us important insights. The most important insight is that, in general, the determinants of bilateral trade flows are also important for total trade flows. The estimated log-log model makes it easy to interpret these results. I will discuss the results for each variable in turn, linking them to the predictions made earlier and if possible to previous research.

Economic variables

With respect to the coefficient on GDP, one can say that it is as expected. It retains its significance at the 1% level in all set-ups of the model and has a coefficient that is consistently around 0.86. This means that for a 1% increase in GDP a country's goods trade will increase by around 0.86%, thus leading to a decreasing share of goods trade in a country's GDP. This is in line with previous research, that large economies have more room for specialization and are thus less dependent on imports (Frankel & Rose, 2000; Wei, 2000).

An increase in the standard of living in a country, the GDP per capita, will lead to an increase in the volume of goods trade. However the increase in the volume of trade is only about one tenth of the increase in living standards. What is shows us however, is that more developed countries trade more goods, ceteris paribus, than less developed countries. This is probably due to the increasing opportunities for specialization in the modern world, due to an ever increasing array of goods. This is in line with Frankel, Stein and Wei (1996), but contradicts Anderson and Marcouillier (2002) and Hunter and Markusen (1998). Differences could be due to the differences between the dependent variables used. In this paper, I use total goods trade and services trade independently, whilst in the latter two papers, only aggregated imports were used.

The third result with respect to GDP, is that a one percent increase in the GDP of the partner country, which in this set-up is the rest of the World, leads to an about twice as large percentage increase in the volume of goods traded by a country. This result, together with the first result on own country GDP, confirms the gravity equation (eq. 1.5) which says that the amount of trade is directly proportional to the product of the countries' GDP's.

Cultural variables

The dummy variables on Christianity (Chr) and Islam (Mus) come up significant in most set-ups of the model. The dummy variable on Islam is consistently negative and significant at the 1% level. Though Muslims historically used to be traders, the negative sign on the coefficient might be due to the fact that their pride in their religion and culture may have brought some of them to feel little sympathy for the large economies of the Western world, hindering trade.
Christian countries on the other hand tend to, ceteris paribus, trade more than Islamic countries, or than those countries with other, non-Christian, majorities. This could be attributed to good relations between fellow Christian countries. Though the same can be said for Islamic countries, the difference is that most of the world's large economies, and thus traders, are Christian countries. Good relations with large economies will likely increase one's trade performance. The dummy variables on religion are correlated with the continent dummies. Due to the definition of the religion dummies, virtually only Asian countries are neither Christian nor Muslim. As can be seen in equation 5 of table 6, the dummy on Christianity takes a negative sign when excluding the Asia dummy. Because many Asian countries are non-Christian/Muslim, the explanatory power from the Asia dummy transfers to the baseline of the religion dummies, making the average trading performance of the non-Christian/Muslim countries considerably higher. This leads to the negative sign on the Christian dummy in this set-up.

The dummy variable on former colonies (FC) consistently comes out negative in the model, except when excluding the Asia dummy. It however fails to be significant in every set-up of the model. It seems that, contrary to bilateral trade flows (Francois & Manchin, 2007; Frankel & Rose, 2002; Linders, 2004; Linders, Slangen, de Groot & Beugelsdijk, 2005), being a former colony does not impact aggregate goods trade.

Finally, the dummy variable on the English language has a positive and significant impact on total goods trade, with a coefficient of around 0.25. This means that countries who have English as an official language trade on average trade, ceteris paribus, almost 30% more goods than countries who do not have the English language as an official language. This effect is in line with previous research that found a positive effect of the English language on trade such as Ku & Zussman (2010), Melitz (2008), and completely in line with Wei (2000), who finds a positive effect of English on openness but a negative effect on openness of French and Spanish. The dummy variable on other world languages (OthWL) fails to come up significant in every set-up of the model but is consistently negative. Though insignificant, its negative sign could be attributed to the fact that easier trading with same language countries comes at the cost of trade with different language countries. The markets in which these other world languages trade are, contrary to the English markets, not large enough to offset this negative effect. This is contrary to previous literature, such as Melitz (2008), and due to the use of aggregate goods trade as a dependent variable, rather than bilateral trade.

Infrastructural variables

The coefficients on the variables of the percentage of roads paved (PRP) and of the number of mobile and fixed line subscribers (MFS), consistently come up both positive and significant. The two are correlated with a coefficient of about 0.544. Still it appears they have an individual impact and this impact is significant, despite the presence of multicollinearity. In the variable description, a connection is described between these variables and transaction costs. The variable on mobile and

fixed lines (MFS) influences transactions costs through vocal connectivity whilst a higher percentage of paved roads (PRP) influences transport, and thus transaction costs, through its effect on physical connectivity. Because of these differences it should come as no surprise that the two variables have an individual impact. Previous research by Jansen & Nordås (2004) and Limao & Venables (2001) confirms this positive relation between the quality of the road, the telecommunications network and trade. The same cannot be said about the influence of road density (RD) on goods trade. In every set-up of the model the coefficient came up significant and negative. This result seems highly counterintuitive at first sight. Closer inspection of the data and the results however gives a possible explanation. The variables on roads paved (RD) and the size of a country (M2) are negatively correlated, and measure both sides of the same coin. When excluding the road density variable in set-up 4 of table 6, the size of a country (M2) has an even more positive impact on trade. This could be due to the large distances within a country, which might often make it preferable to trade with other countries, because they are so much closer that administrative barriers cannot offset this difference. When rerunning the regressions using goods imports and exports separately as the dependent variable, it turns out that higher road densities decrease imports and have no significant effect on exports. Road density could be interpreted as a more 'real' determinant of a country's size; distance can be bridged by a large amount of roads. The denser the road network, the easier it is to reach any other place within the country, thus making it easier to trade within a country. A less dense roads network implies the easiest reachable market is more often abroad, increasing the amount of imports of countries with less dense road networks.

Institutional variables

As can be seen from the table 6 in paragraph 3.5 , the variables on institutional quality are all highly correlated with one another. This leads to multicollinearity problems when estimating their impact, on trade, together with one another. As can be seen from the first two set-ups, 4 out of 6 variables have a positive sign, and only three are significant. These differing signs are counter-intuitive but easily explained given their correlation. When only including 1 of these variables the sign of the coefficient becomes both positive and negative but is insignificant, with only one exception. Only when excluding the variable on the GDP per capita (GDPPC), the coefficient on the institutional variable becomes significant with the expected positive sign. This is due to the high correlation of 0,7343 between these two variables. When disaggregating the data into import and export flows, it turns out that the quality of institutions has a positive effect on imports and a negative effect on exports, when holding constant for GDP per capita. For a given economy, worse institutions hamper an efficient conduct of business thus decreasing efficiency and innovation and therefore increasing goods prices, which in turn will lead to lower exports. This inefficiency also makes import goods more attractive, due to their relatively low prices, wider product range and good quality, thus increasing imports. In these disaggregated set-ups, the institutional variables always came up significant at the 1% level with consistent signs. Previous literature always found a positive relationship between the quality of institutions and openness (Jansen & Nordås, 2004; Levchenko, 2004; Linders, 2004). Furthermore good institutions may be good for openness because of the smaller "institutional distance" (Linders, et al., 2005) with the large Western economies who have a relatively high level of institutional quality.

Surprisingly, the coefficient on the dummy variable on currency unions (CU), consistently comes up negative and is significant in most set-ups of the model. Other authors (Frankel & Rose, 2000) found that increases in bilateral trade due to the forming of a currency union did not lower bilateral trade levels with non-members. So far, the results in this paper indicate differently. When a country is included in a currency union, its total goods trade decreases by about 3-5%. One possible explanation is that the decrease in transaction costs between member states cannot make up for the loss of independent monetary policy. Another reason could lie in the nature of the relationship between countries that form a monetary union. To make a monetary union work, the union's economies have to be similar and experience similar shocks, otherwise monetary policy would become very inefficient. Due to their similarities these countries will already be likely to have little Heckscher-Ohlin trade, forming a currency union will not boost this type of trade, making the loss of independent monetary policy more important.

Geographical variables

First of all the coefficients on the dummy variables on Asia and Middle-and South America come up significant, at the 1% level, in every set-up. The coefficient on the Middle-and South America dummy is negative, whilst the coefficient on the Asia dummy is always positive, for both exports and imports. A possible reason could be the generally lower values of institutional and infrastructural quality in Middle-and South America. Though these factors are being controlled for in every set-up, the continent dummies might still say something about a neighbor's or transit country's infrastructure or institutional quality. Transport costs are generally lowest for trade with those countries that are nearest, if this advantage is being undone due to these worse values for institutional and infrastructural or geographical quality, these countries will, ceteris paribus, trade less. Apart from their direct effects on trade, these continental dummies have been included to control for regional factors. The Africa dummy is only significant when excluding the Asia dummy (making average trade higher) or when excluding the religion dummies. It seems that Africa's bad trading performance can largely be attributed to the large amount of Muslim countries, however politically incorrect this observation may be.
When replacing the dummy on Christianity by the dummy on Asian religions, the latter always came up negative. This shows that the good performance regarding aggregate goods trade by Asian countries should not solely be attributed to their religion (though its negative impact is far less than that of Islam), but mainly to other regional factors.

The coefficient on the dummy on being a landlocked country comes up negative and significant, in accordance with previous research (Jansen & Nordås, 2004; Dollar & Kraay, 2003 & Francois & Manchin, 2007). When including the landlocked dummy together with the variable on the distance to port (DTP), the landlocked dummy becomes less significant. Given their high correlation but joint significance, this is a very important insight. In the literature being land-locked is often seen as a discrete variable. The observation that the distance to port (DTP) also explains the amount of goods traded, independently and next to the land-locked variable indicates a more continuous distribution of "landlockedness", with landlocked countries varying wildly in their disadvantage. This should be noted and should be taken into consideration when helping landlocked countries to overcome the associated disadvantages. This result is in line with Limao & Venables (2001) who find that overland transport distance has a significant effect on transport costs, even after including a dummy on being

landlocked and vice versa.

The coefficient on the island dummy is, in line with previous research (Limao & Venables, 2001; Jansen & Nordås, 2004), negative and significant. The coefficient is much larger than the coefficient on the landlocked dummy. This indicates that the negative effects of having no neighbors, but direct sea-access is larger than that of having neighbors but no sea-access. Because there are no landlocked islands, these effects will always mitigate one another.

At first sight the size of a country does not significantly seem to influence the volume of goods trade. The coefficient on the variable comes up significant in three regression set-ups, but does so at the 1% level. Signs however differ between set-ups. In set-up number 4, it has a negative sign. This is due to the exclusion of the GDP per capita variable, and the negative correlation between country size and GDP per capita. More interesting is the positive sign in the 5th set-up of the model. When excluding the road density variable, the coefficient on country size becomes positive and significant. It has been argued in the literature that a larger country leaves more space for specialization within a country, thus decreasing trade. In the modern economy, the amount of specialization within in a country is no longer strongly connected to the size of a country, but to the size of a country's GDP. However, when disaggregating the goods trade data to import and export flows and rerunning the regressions, the results show that larger countries export *more*, probably due to more ample/cheaper production space, and import *less*, due to more domestic production. The increase in exports and decrease in imports does not necessarily mean that these countries automatically have a trade surplus. As we will see in the services trade model, larger countries tend to, ceteris paribus, export less services. Taken together, these results are in line with Frankel and Rose (2000).

An important geographical variable for the volume of trade is the average height (AH) of a country. The regression results suggest that a 1% increase in the average height leads, ceteris paribus, to a decrease in trade of about 0.1%. Given the high correlation of 0.41 between the landlocked dummy and average height, this is a second disadvantage for most landlocked countries, such as Bhutan, that should be taken into consideration by policy makers. No previous literature on this particular variable could be found, perhaps because its effect is so bluntly obvious. However, quantifying the effect shows a large coefficient, with far reaching consequences.

Finally the coefficient on the variable on the distance from the 49st degree latitude comes up significant with a negative sign. Being further away from the European, and American markets decreases the amount of goods traded by a country. In line with theory and empirical research, distance has an negative impact on trade. Similar to Limao & Venables (2001) both overland and sea distance have distinct effects from total distance, making them more efficient predictors of trade flows. Previous literature also found effects of latitude on trading (Jansen & Nordås, 2004; Dollar and Kraay, 2003).

4.2 The services trade model

Table 8. Results, dependent variable: services trade

	1	2	3	4	5	6	7
C	- 70.0756***	- 71.2802***	- 83.4223***	- 76.2436***	- 86.1130***	- 80.0866***	- 84.4664***
GDP(t-1)	0.87510***	0.87746***	0.90003***	0.89463***	0.90205***	0.90511***	0.89691***
GDPPC(t-1)	0.06429***	0.06752***	0.07093***	0.03806**	0.09463***	0.04218**	0.08488***
RoWGDP(t-1)	2.31805***	2.35000***	2.73947***	2.50791***	2.81733***	2.62691***	2.76007***
Chr	- 0.20059***	- 0.22105***	- 0.19457***	- 0.21049***	- 0.22011***	- 0.18254***	- 0.26138***
Mus	- 0.27759***	- 0.25352***	- 0.28006***	- 0.24723***	- 0.25960***	- 0.23577***	- 0.27705***
Eng	0.10192***	0.05948*	0.12545***	0.08471**	0.09255***	0.09095***	0.12526***
Oth WL	- 0.04176	- 0.05768*	- 0.08317***	- 0.11710***	- 0.10194***	- 0.12642***	
FC	0.00703	- 0.07822**	0.00075	0.02421	- 0.07743**	0.06603**	- 0.06210*
PRP	0.00187	0.00420	0.00350	- 0.00064	0.00549	0.00039	0.00727*
RD	- 0.12973***	- 0.11224***	- 0.11852***	- 0.12457***	- 0.09418***	- 0.12684***	- 0.10353***
MFS	0.00575***	0.00664***	0.00613***	0.00544***	0.00630***	0.00463**	0.00698***
COR	- 0.54515***	- 0.53924***	0.24974***				
GE	0.56248***	0.59109***		0.61276***			
PS	- 0.12724**	- 0.10833**			0.12129***		
ROL	0.19343	0.17449				0.47288***	
RQ	0.36997***	0.32544***					
VA	0.10719	0.10844					0.39041***
CU	0.08872***	0.10268***	0.11731***	0.10938***	0.12927***	0.12648***	0.10107***
AF	0.00148	- 0.09345**	- 0.04961	0.09392***	- 0.11818**		- 0.12470***
AS	- 0.01772	- 0.11859**	- 0.05291		- 0.13904***		- 0.09069*
MSA	- 0.25995***	- 0.38979***	- 0.24841***		- 0.36720***		- 0.41565***
ISL	0.09144***	0.08057**	0.06165*	0.08555**	0.05476	0.05133	0.02737
LL	- 0.18387***	- 0.14880***	- 0.18323***	- 0.20311***	- 0.15187***	- 0.19660***	- 0.13919***
M2	- 0.12427***	- 0.12220***	- 0.12881***	- 0.13035***	- 0.12284***	- 0.13013***	- 0.12635***
AH	- 0.07100***	- 0.08795***	- 0.07132***	- 0.06433***	- 0.08257***	- 0.06152***	- 0.08055***
DTP	0.00128	0.00951*	0.00260	0.00404	0.00994*	0.00200	0.01164***
D49	- 0.11208***		- 0.10292***	- 0.14238***		- 0.14224***	
R^2	0.95587	0.95471	0.95350	0.95380	0.95239	0.95326	0.95320
N° of obs	2168	2168	2168	2168	2168	2168	2168

Note: All non-dummy variables are in logarithmic form. Time fixed effects, dummies, have been included in the regression. *, **, * indicates significance at the 1%, 5% and 10% level respectively.**

As with the goods trade model I have added time-fixed effects to the model and then tested the null hypothesis that the time-fixed effects are redundant. This test gave the following statistics.

Table 9. Redundant fixed effects test, services trade

Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	3.689476	(12,2128)	0.0000
Period Chi-square	44.643117	12	0.0000

The test clearly shows that we can reject the null-hypothesis of redundancy. Given these results, the model has been estimated including time fixed effects.

The most important insight is that, in general, the determinants of bilateral trade flows are also important for total services trade flows. The estimated log-log model makes it easy to interpret these results. I will discuss the results for each variable in turn, linking them to the predictions made earlier and to previous research.

Economic variables

The coefficients on GDP, GDP per capita and rest of the world's GDP, are very similar to those in the goods trade set-up. A 1% increase in GDP (GDP) increases trade in services, ceteris paribus, by about 0.9%, thus decreasing the share of services trade in GDP.

As with goods trade, GDP per capita (GDPPC) has a positive influence on the amount of services trade, making richer countries, ceteris paribus, trade more services than less developed countries. This contradicts Anderson & Marcouillier (2002) who assume that as countries become wealthier, the share of non-traded services in expenditure rises. The positive sign found in this paper could, according to Anderson & Marcouillier (2002), be attributed to "correlation between GDP per capita and the omitted variables". They find correlation coefficient between GDP per capita and the tariff ratio is of -.62. When they drop the tariff ratio from the regression, part of its effect on trade is misread as a positive effect of higher income per capita (Anderson & Marcouillier, 2002).

Once again, the coefficient on the GDP of the rest of the world (RowGDP) is highly significant and positive, with an estimate of about 2.5. This could partly be due to the increased interconnectivity of world economies over the years and the coinciding growth of the world's economy. Furthermore, the economies of the rest of the world have not only grown, but their citizens have also become richer. Therefore this variable could also absorb some of the explanatory power of the not-included variable on the rest of the world's GDP per capita. As in the goods trade model, the results here confirm the gravity model that trade between two countries is directly proportional to the product of their GDP's.

Cultural variables

The coefficients on the Christianity and Islam dummies are consistently negative and significant in this set-up of the model. Due to the construction of these variables, this means that Christian and Muslim countries trade less services, ceteris paribus, than countries with an Asian religion such as

Buddhism, or Hinduism. The results also show that this effect is strongest for Muslim countries, for which the negative coefficient of about 0.25 indicates that Muslim countries trade about exp(-0.25), or 22% percent less than countries with Asian religions. Contrary to the goods trade set-up, the coefficient on the Asia dummy is not significant in this set-up. This suggests that the relatively large amount of services trade is really attributable to the Asian religions, rather than continental factors. In the literature a positive effect of sharing a religion on bilateral trade is found (Linders, 2000), and Helble (2007), also finds a positive effect of Asian religions on trade.

The coefficient on the English language dummy is consistently positive and significant with an estimate of about 0.1. This would indicate that English speaking countries trade, ceteris paribus, more services than countries who do not have English as an official language. The coefficient is much smaller than in the goods trade set-up. Language barriers might be of a different type for services trade than for goods trade. Though English is used in many parts of the world as a lingua franca, it might be less useful as a lingua franca when considering services trade. The English speaking community however is large enough for the English language dummy to have a positive and significant effect.

The coefficient on other world languages dummy (OthWL) is consistently negative and significant in most set-ups, with an estimate of about -0.1. This result suggests that countries who have French, Spanish, Russian or Arabic as an official language trade, ceteris paribus, less services than those countries who do not have one of these languages as an official language. This variable failed to be significant in the goods trade model. This difference could be attributed to the fact that when trading goods, language is used to set-up the transaction, but when trading services, language is also part of the service provided. Basic knowledge of another language will no longer suffice. Citizens of countries that have a world language as an official language generally put less effort into learning another language. Due to the relatively large market for say television shows, radio and music in countries that speak world languages, less music and/or television shows are imported from English speaking countries. Besides this direct effect on services trade, people will have more difficulties learning a second or third language because they never come into contact with different languages. This, amongst other reasons, could lead to less foreign language education in countries who speak world languages, leading to less services trade with countries speaking these foreign languages.

The coefficient on the former colony dummy (FC), is both negative and positive as well as being significant and insignificant between the different set-ups of the model. Its sign and significance depend on the inclusion of the continental dummies and the distance from the 49th degree latitude variable (D49). Due to these facts, little can be said of the influence of being a former colony on the amount of services trade. Coupled with the insignificance of the former colony (FC) variable in the goods trade set-up, it seems that contrary to bilateral trade flows (Francois & Manchin, 2007; Frankel & Rose, 2002; Linders, 2004; Linders, Slangen, de Groot & Beugelsdijk, 2005), being a former colony does not influence aggregate trade flows.

Infrastructural variables

The coefficient on the variable on the percentage roads paved (PRP) is positive but economically and statistically insignificant. The coefficient has an estimate of about 0.004, implying that a change from 1% of roads paved to 100% paved would, ceteris paribus, raise services trade by 0.4%, had the

coefficient been significant. Thus, the percentage roads paved, a proxy for the quality of the roads network does not seem to influence the amount of services in a statistically or economically significant way. Because a higher percentage of roads paved did increase goods trade, a small increase in services trade was expected due to an increase in transport services trade.

Similarly to in the goods trade set-up, the coefficient on the density of the road network (RD) is significant and negative. The road density is positively correlated with GDP per capita (table 5) and negatively correlated with the size of a country. Though both variables are also included in the model and significant, the coefficient on the variable of the road density remains negative and significant. This has to do, just as for goods trade, with the 'real' size of a country. A high road density makes it easy to transport goods and travel inside a country. A low road density makes it harder to transport goods within and out of a country. Given the higher transport costs for goods due to lower road densities, it makes sense to switch to a less transport intensive form of trading, which is services trade. Therefore countries that are hard to cross will trade relatively much services and countries with a high road density, which makes it easy to travel, will prefer to use their advantage in trading goods within or out of the country.

The coefficient on the variable on the number of mobile and fixed lines per 1000 people (MFS) is consistently positive and significant. A 100% increase in the number of mobile and fixed lines, something that has occurred in virtually every country over the past decade, will increase the amount of services traded by about 0.6%. This seems like an economically insignificant coefficient and small compared to the increased ease of doing business. This can partly be attributed to the fact that the increase in the developed countries has only been a maximum of about 200% because people were already well connected before the rise of mobile phones. For less developed countries, that have/had virtually no fixed lines, the increase in the number of mobile and fixed line subscribers has been in the range of 700%-5000%. Such increases of several thousand percents will have an economically significant impact on trade. For example, in the Republic of the Congo, the number of mobile and fixed lines per 100 people has increased from 1 to 51 in 12 years, thus an increase of 5100%. This increase would, ceteris paribus, have lead to an increase in services trade of about 25%, surely this is economically significant!

Institutional variables

As can be seen from the correlation matrix in table 4, in paragraph 3.5, the variables on institutional quality are all highly correlated with one another. This leads to multicollinearity problems when estimating their impact, on trade, together with one another. When only including 1 of the institutional variables, next to the dummy variable on currency unions, the coefficient on institutional quality becomes positive and significant with an estimate between 0.12 and 0.61. This indicates that institutional quality is an important determinant for the amount of services trade, much more so than for goods trade. The significance of the coefficient on the institutional variables is insensitive to the inclusion of the GDP per capita (GDPPC) variable, whilst this was not the case in the goods trade model. This could be due to the fact that trade in services is generally more complicated and therefore requires better institutions. In the article by Anderson and Marcouillier (2002), the inclusion of a variable on institutional quality made the variable on GDP per capita insignificant. In this model the two are individually and jointly significant.

The coefficient on the dummy variable on currency unions (CU) is positive and significant in all set-ups. This is different from the goods trade model. Being a member of a currency union would lead, ceteris paribus, to about a 10% increase in services trade. Countries forming a currency union should have similar types of economies, to avoid inefficient monetary policy. The positive effect of the currency union dummy on bilateral has been found in many empirical papers such as Frankel & Rose (2000), Rose & van Wincoop (2002) & Glick and Rose (2001). The results in this paper support the proposition that being part of a currency union will also boost total services trade.

Geographical variables

The continental dummies (AF, AS and MSA) consistently have a negative coefficient. The results indicate that the negative effect is highest in Middle and South America (MSA) and then in Asia (AS) and in Africa (AF). For Middle and South America (MSA), this result is the same as in the goods trade model. For Asia this result is very different, its coefficient was positive in the goods trade model but negative in the services trade model. Asia, and especially countries such as China and Vietnam, are often seen as the world's workshop, indicating high goods trade. This focus on manufacturing could have its effect on services trade. As we saw earlier, countries in which a majority is following an Asian religion tend to trade more services than countries not following Asian religions. Therefore, the negative effect of the Asia dummy is mitigated for many Asian countries by the positive effect of the Asian religion dummy. Part of the high services trade of Asian countries could be attributed to the popularity of Buddhist/Hindu countries with tourists.

The coefficient on the variable of the size of a country (M2) is consistently negative and significant, with an estimate of around -0.125. The larger a country, the less services it will trade, ceteris paribus. When looking into the possible reasons for this negative coefficient, one should take into account that travel and transport services trade accounts for over half of all commercial services trade (WTO, 2010). With respect to the former, citizens of large countries will be less inclined to travel abroad, decreasing travel imports. One could object though that large countries will also attract more tourists, offsetting the afore mentioned decrease in imports by an increase in travel exports. In the goods trade model it was found that size negatively impacts trade. A decrease in goods trade will also decrease demand for goods transport, thus decreasing the level of services trade. More internal transport of goods will not offset this decrease because intra-national trade is not international trade.

The coefficient on the dummy variable on islands (ISL) comes up with a positive coefficient, and is significant in 4 out of 7 set-ups. The sign differs from the goods trade set-up, in which it was negative. Island countries thus trade less goods, but more services. In the goods trade set-up, the negative sign was primarily due to a decrease in goods exports; in the services model, the positive sign is primarily due to the increase in services exports. A large part of these services will have to do with the transport services (container handling, etc) of import goods, and another part of these service exports will constitute of travel services. Island countries tend to, ceteris paribus, attract more tourists, due to the perceived ''relaxed'' atmosphere, proximity of beaches etc. This could explain part of the positive sign of the coefficient on island countries. Because trade in services is generally much smaller than trade in goods, this accounts for the generally negative coefficient of the island dummy found in previous research such as Jansen & Nordås (2004).

The negative sign on the coefficient on landlocked countries (LL) is unchanged with respect to the sign in the goods trade model. The two signs are connected. Less goods trade will lead to less trade in transport services. Furthermore, landlocked countries are seldom transit countries, resulting in little transport services trade from this source. Finally landlocked countries are often less popular with tourists than coastal countries, due to the lack of beaches and generally more extreme climates. These three factors contribute to the negative sign on the coefficient on landlocked countries and a estimate of about -0.15 which is smaller than that in the goods trade model of about -0.07. The decrease in services trade (unrelated to the low goods trade) with respect to tourism, can account for this difference in the estimate of the coefficient. Because the literature in this field makes no distinction between goods and services trade, little is known about the exact relationship between being landlocked and services trade.

The variable on the average height of a country (AH) consistently comes up negative and significant at the 1% level. Higher countries tend to trade less goods (table 6) and will therefore also trade less transport services. Furthermore higher countries tend to be colder and will therefore attract less tourism, decreasing tourism services exports.

The coefficient on the distance to port variable (DTP) is positive but only significant in 3 out of 7 set-ups, in which the variable on the distance from the 49th degree latitude had been left out. The further the capital of a country is from sea, controlling for being landlocked, the higher the amount of services would be, ceteris paribus. A possible explanation could be the higher export of transport services, because import/export goods have to be transported over longer distances to the capital by domestic transport companies. However, the significance of the coefficient is unsure, contrary to in the goods trade model. Intuitively being further away from sea will always influence goods trade more than it will influence services trade. In the literature, Limao & Venables (2001) have only found an effect of distance to port on transport costs. However, transport costs hardly seem important for services trade.

Finally, the coefficient on the variable on the distance from the 49th degree latitude (D49) has a negative sign and is significant at the 1% level in all set-ups in which it is used. The closer a country is to the 49th degree latitude, the closer it is to the large economies of the Americas, Europe and Japan. The effect could give an indication of a neighboring country's wealth. This is not fully captured by the GDP per capita (GDPPC) variable. Wealthier neighbors mean, ceteris paribus, more trade.

4.3 Notes on the results

The imports part of the dependent variable on aggregate goods trade is measured on a cost, insurance & freight base (c.i.f.). This implies that when higher transport costs decrease the volume of trade they simultaneously increase the value, on a c.i.f. basis, of these goods. This effect somewhat mitigates the effects of transport costs on trade. Taking this effect into account one can say that were goods imports also reported on a free on board (f.o.b.) basis, the coefficients on the infrastructural and geographical variables, whose effects are through transport costs, would be larger.

4.3.1 The variance inflation factor

From the correlation matrices (table 2, 3, 4 & 5) it can be seen that there exist concerns about multicollinearity. However these pair wise correlations do not necessarily give the best view on the extent of the possible multicollinearity. I therefore use the method of the VIF or variance inflation factor to detect the presence of multicollinearity. The VIF is calculated by regressing an independent variable on all other independent variables, taking the R^2 of these regressions and dividing 1 by 1 minus the R^2, or $1/(1-R^2)$. The largest of these values gives an indication of the severity of the multicollinearity. This process is explained in more detail in Applied Linear and Statistical Models, 2004, by Neter, Kutner, Nachtsheim and Wasserman. They propose a cut-off value of 10, above which serious multicollinearity exists that influences the standard error of the variable. Furthermore, the average of VIF values gives an indication on the extent of the difference between the given coefficients and the true coefficients in the absence of multicollinearity.

Table 10. The Variance Inflation Factor

Variable	VIF (Variance Inflation Factor)	VIF (1 Institutional variable per equation)
GDP(t-1)	11,24708	**10,37269**
GDPPC(t-1)	8,787732	8,279379
RoWGDP(t-1)	77,79679	**76,58727**
Chr	6,414656	6,245628
Mus	4,141799	4,003523
Eng	2,581365	2,547654
Oth WL	2,481574	2,415231
FC	3,430944	3,357282
PRP	1,291037	1,263568
RD	5,651538	5,576094
MFS	1,630502	1,596748
COR	11,03180	3,264539
GE	16,01255	3,788338
PS	3,504996	1,983808
ROL	13,74646	3,243015
RQ	6,407094	2,255951
VA	4,939906	2,514749
CU	1,385692	1,359095
AF	5,028840	4,873722
AS	4,292251	4,005881
MSA	2,468106	2,424166
ISL	1,934135	1,864847
LL	1,802620	1,770287
M2	9,831102	**9,642272**
AH	1,880746	1,827085
DTP	2,415908	2,392797
D49	3,180560	3,155500
Average	**7,974733**	**6,393004**

Note: All non-dummy variables are in logarithmic form. Time fixed effects, dummies, have been included in the regression.

From these results, it can be seen that when all the variables on institutional quality are included together, serious multicollinearity will influence the standard deviations. When only using 1 variable on institutional quality, in this case corruption, the VIF decreases and the variable on GDP, GDP(t-1) has a VIF value of 10.37269. This is above the cut-off value of 10, and mainly due to the correlation with the size of the country (M2), without which the VIF drops to 2.83262. However when rerunning the regressions without the M2 variable, all significant coefficients remain significant with the same sign, some insignificant variables have their coefficients change sign, but keep their insignificance. The variable on the rest of the world's GDP also has a very high VIF of over 76, however when dropping the variable on the rest of the world's GDP, the same story holds as when dropping the variable on country size (M2), i.e. signs may change, but only of insignificant variables that remain insignificant. Thus, when estimating a model with just 1 variable on institutional quality, multicollinearity will exist but its influence will not be too large. Furthermore the average VIF of 6.393004 indicates that the standardized regression coefficients of the equations will not be too far from their true coefficients, i.e. signs will not change.

4.3.2 Missing values handling

As with most empirical researches, it was quite hard to find good data. For many variables, data were missing for at least some years for some countries. In handling these missing observations I have been as consistent as possible, without implementing a too uniform regime.

With respect to the dependent and economic variables, these data were often incomplete when using only one source. I have therefore supplemented these data with data from other sources. All sources used are given in the variable description. When filling the gaps, I have not used the absolute values provided by other sources, but instead calculated the year on year changes in the donor source and used this to calculate the missing values using the original non-missing data. With respect to GDP data for example I have used the growth rates provided by the IMF to calculate missing values for the GDP data provided by the World Bank.

The cultural variables have all been constructed by myself and therefore did not contain any missing values.

The data for infrastructural variables were often incomplete. When only 1 observation was available for a country, I have removed the country from the sample. When more than 1 observation was available, I have calculated the missing values using a logarithmic function, for the variables on road density and on percentage of roads paved. This seemed appropriate because it will be increasingly harder to increase these numbers. For the number of mobile and fixed lines per 100 people, few values were missing. These few values were calculated by linear inter/extrapolation.

The data on the variables on institutional quality were complete, with the exception of the years 1997, 1999 and 2001. These values were obtained by linear interpolation. The data on currency unions were constructed by myself and therefore did not contain any missing values.

The continental dummies and the dummies on island and landlocked countries were constructed by myself and therefore did not contain any missing values.

The data on country size come from the demographic yearbook of the CIA, and did not contain any missing values.

The data on average height contained some missing observations, mainly for small island countries. I have calculated the average height of these missing observations by taking 15% of the highest peak as the average height. This seemed to be a fairly consistent estimator for those island countries that did not have missing values.

The data on the distance to port and the distance from the 49th degree latitude were constructed by myself and therefore did not contain any missing values.

Due to the way that the missing values have been handled, no serious adverse effects should be present in the results.

5 Conclusions

Using an adapted version of the gravity model, this paper tests the determinants of aggregate trade. It presents two set-ups, one in which total trade in goods is the dependent variable, and one in which total services trade serves as the dependent variable. In both these set-ups, economic variables are used, together with cultural, institutional, infrastructural and geographical variables. Using a panel data set covering 179 countries over 13 periods (1996-2008), all independent variables in the model are found to have a significant influence on either goods or services trade, or both.

With respect to goods trade, the largest type of trade, many of the determinants of bilateral trade are found to also have an impact on a country's total trade performance. The share trade in GDP decreases as economies grow, but countries with wealthier citizens trade more. Island and landlocked countries trade less goods, as do countries that are further away from sea. Good institutions have a positive effect on exports, but a negative effect on imports, which lead to a insignificant coefficient when concerning total goods trade. Furthermore, infrastructure matters; a higher percentage of roads paved increases trade, as does a larger telecommunications network. Differing from the literature on bilateral trade is that former colonies do not trade more or less than non-former colonies, and only having the English language, as an official language, seems to have a positive and significant impact on a country's goods-trading performance. Being a member of a currency union does not seem to boost goods trade, to the contrary. Islam has a negative effect on a country's trading performance whilst Christianity has a positive effect. Countries that are further away from the Western world's markets typically trade less. Middle and South American countries, ceteris paribus, trade less goods, whilst Asian countries typically trade more goods. New to the literature has been the inclusion of a variable on the average height of a country. As expected, more elevated countries tend to, ceteris paribus, trade less goods, as do, geographically, larger countries.

With respect to services trade, the picture is largely the same. However, notable differences exist. The coefficient on the island dummy consistently turned up positive, as did the coefficient on the currency union dummy. The quality of institutions has a large and positive effect on the amount of services imports and exports. The distance to port has no separate effect on services trade after controlling for being landlocked. Different from the goods trade model, Asian religions have the largest positive effect on trade, though the impact of Christianity is less negative than that of Islam. Contrary to the goods trade model, Asian countries, ceteris paribus, trade less services, as do African and Middle and South American countries. Finally, the impact of non-English world languages is significant and negative, when concerning trade in services, whilst the English language has a positive effect on services trade.

Given these results, one can conclude that the determinants of bilateral trade often, but not always coincide with those of aggregate trade. Many variables influence how much a country trades. The dimension of influence of these variables, and whether they have a positive or negative effect, can differ between goods and services trade, as it can differ between exports and imports. Every country is different and needs to find its own comparative advantage. The large influence of geography and culture, factors that cannot (easily) be changed, should not be underestimated. Countries pursuing an increase in trading should take the results of this paper into account when deciding on their strategy.

References:

Anderson, J. E., & Van Wincoop, E. (2003). Gravity with Gravitas: A Solution to the Border Puzzle. *American Economic Review*, *93*(1), 170-192.

Anderson, J. E., & Marcouillier, D. (2000). Insecurity and the Pattern of Trade: an Empirical Investigation. *The Review of Economics and Statistics*, *84*(2), 342-352.

Bergstrand, J. (1985). The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence. *The Review of Economics and Statistics*, *67*(3), 474-8.

Bergstrand, J. (1989). The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade. *The Review of Economics and Statistics*, *71*(1), 143-153.

Deardorff, A. (1995). *Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?* (NBER Working Papers 5377). National Bureau of Economic Research.

Dollar, D. Kraay, A. (2003). Institutions, Trade, and Growth. *Journal of Monetary Economics*. 50(1), 133-162.

Feenstra, R. C. (1987). *Empirical Methods for International Trade*. Cambridge, MA: The MIT Press.

Feenstra, R. C. (2002). Border Effects and the Gravity Equation: Consistent Methods for Estimation. *Scottish Journal of Political Economy, 49*(5), 491-506.

Frankel, J., Rose, A. (2000). *Estimating the Effect of Currency Unions on Trade and Output* (NBER Working Paper 7857). National Bureau of Economic Research.

Frankel, J., Rose, A., Wei, S. (1996). Regional Trading Arrangements: Natural or Supernatural. *American Economic Review*. 86(2), 52-56.

Francois, J., & Manchin, M. (2007). *Institutions, Infrastructure and Trade* (Policy Research Working Paper Series 4152). The World Bank.

Gallup, J.L., A.D. Mellinger, and J.D. Sachs. (2001). *Geography Datasets.* [Data file]. Retrieved from http://www.cid.harvard.edu/ciddata/geographydata.htm

Glick, R., Rose, A. K. (2001). *Does a Currency Union Affect Trade? The Time Series Evidence* (Working Paper 8396). National Bureau of Economic Research.

Harrigan, J. (1996). Openness to Trade in Manufactures in the OECD. *Journal of International Economics, 40*(1996), 23-39.

Helble, M. (2007). Is God good for Trade? *Kyklos*, *60*(3), 385-413.

Hummels, David. (1999*). Toward a Geography of Trade Costs* (GTAP Working Papers 1162). Center for Global Trade Analysis, Department of Agricultural Economics, Purdue University.

Hunter, L. Markusen, J. (1988). Per-Capita Income As a Determinant of Trade. In R. C. Feenstra (Ed.), *Empirical Methods for International Trade* (pp.89-109). Cambridge, MA: The MIT Press.

International Monetary Fund. (2010). *Direction of Trade Statistics.* [Data file]. Retrieved from http://www2.imfstatistics.org/DOT/

International Monetary Fund. (2010a). *World Economic Outlook.* [Data file]. Retrieved from http://www.imf.org/external/pubs/ft/weo/2010/02/weodata/index.aspx

Jansen, M., & Nordas, H. (2004*). Institutions, Trade Policy and Trade Flows* (CEPR Discussion Papers 4418). C.E.P.R. Discussion Papers.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2009). *Governance matters VIII : aggregate and individual governance indicators 1996-2008* (Policy Research Working Paper Series 4978). The World Bank.

Ku, H., Zussmann, A. (2010). Lingua franca: The Role of English in International Trade. *Journal of Economic Behavior & Organization. 75*(2), 250-260.

Levchenko, A. (2007). Institutional Quality and International Trade. *Review of Economic Studies, 74*(3), 791-819.

Limao, N., & Venables, A. J. (2001). Infrastructure, Geographical Disadvantage, Transport Costs, and Trade. *The World Bank Economic Review, 15*, 451-479.

Linders, G. (2004). The Effect of Domestic Institutions on International Trade Flows: A sectoral analysis. European Regional Science Association. Retrieved from http://ideas.repec.org/p/wiw/wiwrsa/ersa04p357.html

Linders, G., Slangen, A., de Groot, H., & Beugelsdijk, S. (2005). *Cultural and Institutional Determinants of Bilateral Trade Flows* (Tinbergen Institute Discussion Papers 05-074/3). Tinbergen Institute.

Linnemann, H. (1966). *An Econometric Study of International Trade Flows*. Amsterdam.

McCallum, J. (1995). National Borders Matter: Canada and U.S. Regional Trade Patterns. *American Economic Reviews, 85*(3), 615-623.

Melitz, J. (2008). Language and Foreign Trade. *European Economic Review, 52*(4), 667-699.

Neter, J., Kutner, M., Wasserman, W., & Nachtsheim, C. (1996). *Applied linear statistical models.* Columbus, OH: McGraw Hill/Irwin.

Rodrik, D. (1998). *Trade Policy and Economic Performance in Sub-Saharan Africa* (NBER Working Papers 1776). C.E.P.R. Discussion Papers.

Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions Rule: The Primacy of Institutions over Geography and Integration in Economic Development. *Journal of Economic Growth, 9*(2), 131-165.

Rose, A. K., van Wincoop, E. (2002). An Estimate of the Effect of Common Currencies on Trade and Income. *The Quarterly Journal of Economics, 117*(2), 437-466.

Tinbergen, J. (1962). *Shaping the World Economy: Suggestions for an International Economic Policy*. New York: The Twentieth Century Fund.

United Nations. (2008). *Demographic Yearbook* [online]. Retrieved from http://unstats.un.org/unsd/demographic/products/dyb/dyb2008.htm

U.S. Central Intelligence Agency. (2010). *World Factbook* [online]. Retrieved from https://www.cia.gov/library/publications/the-world-factbook/fields/2098.html?countryName=American%20Samoa&countryCode=aq&regionCOde=a u&#aq

Wei, S. (2000). *Natural Openness and Good Government* (NBER Working Papers 7765). National Bureau of Economic Research.

Wolf, H. C. (2000). Intranational Home Bias in Trade. *Review of Economics and Statistics* 82(4), 555–563.

World Bank. (2009). *World Development Indicators, 2009*. [Data file]. Retrieved from http://www.worldbank.org

World Trade Organization. (2010). *International Trade Statistics, 2010.* [Data file]. Retrieved from http://stat.wto.org/Home/WSDBHome.aspx?Language

Appendix 1.

List of the 179 countries included in the sample.

Afghanistan	Albania	Algeria
Angola	Argentina	Armenia
Australia	Austria	Azerbaijan
Bahamas, the	Bahrain	Bangladesh
Barbados	Belarus	Belgium
Belize	Benin	Bhutan
Bolivia	Bosnia and Herzegovina	Botswana
Brazil	Brunei Darussalam	Bulgaria
Burkina Faso	Burundi	Cambodia
Cameroon	Canada	Cape Verde
Central African Republic	Chad	Chile
China	China, Hong-Kong	China, Macao
Colombia	Comoros	Congo, Dem. Rep.
Congo, Rep.	Costa Rica	Cote d'Ivoire
Croatia	Cuba	Cyprus
Czech Republic	Denmark	Djibouti
Dominica	Dominican Republic	Ecuador
Egypt, Arab Rep.	El Salvador	Equatorial Guinea
Eritrea	Estonia	Ethiopia
Fiji	Finland	France
Gabon	Gambia, The	Georgia
Germany	Ghana	Greece
Grenada	Guatemala	Guinea
Guinea-Bissau	Guyana	Haiti
Honduras	Hungary	Iceland
India	Indonesia	Iran, Islamic Rep.
Iraq	Ireland	Israel
Italy	Jamaica	Japan
Jordan	Kazakhstan	Kenya
Korea, Dem Rep.	Korea, Rep.	Kuwait
Kyrgyz Republic	Lao PDR	Latvia
Lebanon	Lesotho	Liberia
Libya	Lithuania	Luxembourg
Macedonia, FYR	Madagascar	Malawi
Malaysia	Mali	Malta
Mauritania	Mauritius	Mexico
Micronesia, Fed. Sts.	Moldova	Mongolia
Morocco	Mozambique	Myanmar
Namibia	Nepal	Netherlands, The

New Zealand
Nicaragua
Niger
Nigeria
Norway
Oman
Pakistan
Palestinian Territories
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Portugal
Qatar
Romania
Russian Federation
Rwanda
Samoa
Sao Tome & Principe
St. Vincent & the Grenadines
Saudi Arabia
Senegal
Seychelles
Sierra Leone
Singapore
Slovak Republic
Slovenia
Solomon Islands
Somalia
South Africa
Spain
Sri Lanka
Sudan
Suriname
Swaziland
Sweden
Switzerland
Syrian Arab Rep.
Tajikistan
Tanzania
Thailand
Togo
Tonga
Trinidad and Tobago
Tunisia
Turkey
Turkmenistan
Uganda
Ukraine
U.A.E.
United Kingdom
United States
Uruguay
Uzbekistan
Vanuatu
Venezuela, RB
Vietnam
Yemen, Rep.
Zambia
Zimbabwe