The effects of exchange rate regime on trade between top 21 trading nations: an aggregate and commodity group analysis

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Abstract

This paper statistically analyzes the effects of exchange rate regime on trade value between the top 21 trading countries for the years 1996 till 2014. It consists of two parts. The first part reviews aggregate trade data between top trading countries. The second part performs analysis and compares the aggregate trade data to the data of the four most frequently traded commodities in order to see if the effect of the exchange rate regime is similar. To carry out this analysis and see effects, an augmented bilateral gravity model of trade is used. Through the use of Ordinary Least Squared regressions, the effect of the exchange rate regime on trade is formulated. The analyzed aggregate trade results showed that trade value is positively affected by a fixed exchange rate regime. Comparing obtained results to the commodity models, it was concluded that the effects shown by the aggregate trade model was significantly different from the four most frequently traded commodity models.

Contents

Introduction

Over the past decades economies around the world have taken on multiple forms of exchange rates. The last century in particular has seen the greatest changes in the exchange rate regimes countries have adopted. In the early 1900s, most developed countries were following the gold standard, which meant that the country's currency had a value directly related to gold and so paper currencies could be converted into a fixed amount of gold. In 1914 just after the difficult and unfamiliar economy which followed World War I, the gold standard collapsed. After the war, in the 1920s, some countries tried to re-introduce the gold standard however the great depression in 1929 forced these countries to scrap these plans. Soon after, economies, especially developed economies, worldwide took on fixed exchange rates when the Bretton Woods system was introduced in July 1944. Countries who agreed to the Bretton Woods system fixed their exchange rate to the American dollar. This system lasted until the early 1970s and since then there has been a trend, between developed economies in particular, towards a floating exchange rate regime (Bordo, 2003).

After this collapse, in 1972, most European countries agreed to keep stable exchange rates by agreeing to preserve exchange rate fluctuations within a 2.25% band. This eventually led to the introduction of the European Monetary System (EMS) in 1979. Although initially no currency was used as an anchor, the Deutsche Mark was one of the strongest and one of the most stable in the world and this strength and stability eventually led to many of the EMS member countries to fix their currencies to the Deutsche Mark (Tavlas, 1990). For example France and the Netherlands fixed their exchange rates (a 2.25% band) to the Deutsche Mark as early as 1971. Eventually, in 1999, the Eurozone was established. Apart from the fact that countries in the Eurozone have a common currency, a different but yet important way of looking at it is that the countries within the Eurozone have fixed exchange rates with respect to each other. Following the 2008 financial crisis as well as the recent European turmoil however, the Eurozone has come under great scrutiny by many economists and politicians. One of the arguments they point out against the Euro is that it gives individual countries no monetary freedom. This, as is the case with Greece, can cause serious turmoil during economic slowdowns. On the other hand, proponents of the Eurozone argue that the common currency area boosts trade between the member countries as well as with the rest of the world (Mursa, 2012). In fact, according to a report published by the European Central Bank, adopting the euro has increased trade by 5% to 10%.

Not only the Eurozone, but also many of the world's largest and most developed economies are concerned about the effects of their exchange rate regimes on trade. Gordon Thiessen, a former Governor of the Bank of Canada, outlined that the Canadian dollar must remain freely floating given the benefits this will have on Canada's trade of primary commodities (Thiessen, 2000). From these given arguments it is clear that the effect of exchange rate regime on trade plays a key role on the decisions countries make regarding their exchange rate policy. In particular, the decisions of those countries which trade the most will be the most important and have the greatest global impact. This paper will therefore address the following question:

'What is the effect of exchange rate regime on the value of trade between the top trading nations?'

The highly contested ongoing debate regarding the relative advantages and disadvantages of fixed versus floating exchange rates in countries, in particular those who are among the leading traders, shows the social relevance of the topic being discussed in this paper. On top of this, although many academic papers have tackled the same topics in a variety of ways, this paper adds extra value to these existing papers by using data from a unique set of countries (those who trade the most) and a very recent 19 year time period, namely 1996-2014. The existing literature mostly used trade data from either developed countries, developing countries or simply between two specific countries. Also, most of the research focused on a time period around the 1970s, when the Bretton Woods system broke down. There are also a few which focused on the early 1900s, however, no paper has yet looked at the time period used in this paper. In fact, Bailey, M. j., Tavlas, G. S., & Ulan, M. (1986), who used the top 7 largest trading countries, indicated that further research regarding these countries should be carried out. Furthermore, as one of his concluding points, Dell'ariccia (1999) urged the use of a more recent time period to test the the effect of exchange rate volatility on trade. By making use of trade data from the top 21 trading countries and using a very recent time frame, this paper makes use of the suggestions made in the two papers.

Following the introduction, this paper examines the existing literature regarding the research question in the literature review section. Afterwards, the model, in particular the gravity model, variables and the methods used to answer the research question will be discussed in the theoretical framework section. The data collected and the sources used for the data will be carefully evaluated in the data section. In the methodology section the transformation of the data and the statistical tools used will be explained. The final results will be presented and analyzed in the results section and this will be followed by a conclusion where the main findings will be summarized and their implications outlined.

Literature review

Amongst all the research that has been carried out in order to find the effect of exchange rate regime or exchange rate volatility on trade, there is no clear consensus. The paper by Brada & Mendez looks at the effect of exchange rate risk and exchange rate regime on international trade. They focus on bilateral trade and bilateral exchange rates among 30 countries between 1973 and1977. In order to investigate the effects they make use of the augmented gravity model of bilateral trade flows which takes the natural logarithm of the normal gravity model. In this model, Brada & Mendez make use of the logarithm of variables such as GDP, GDP per capita and distance between the two countries. Their model looks similar to the following model:

$$\log(bilateral\ trade) = \text{constant} + \log(GDP_1) + \log(GDP_2) + \log(distance\ between\ countries) + fixed\ dummy$$

Their findings suggest that bilateral trade flows between countries that had a floating exchange rate is significantly higher than those which had fixed exchange rates. They explain this by suggesting that although floating rates does lead to greater uncertainty and hence lower trade between the countries (assuming traders are risk averse), its effects are significantly less than the trade reducing effects of restrictive policies, such as tariffs and quotas, imposed by countries which follow a fixed exchange rate regime. Hence the benefits outweigh the costs (Brada & Mendez, 1988).

Klein and Shambaugh (2006) on the other hand, find significantly contrasting results. Their research is very similar to that of Brada and Mendez in the sense that they use the same methodology and variables however the only difference is that they use far greater number of countries, namely 181, and they make use of data from 1973 to 1999. The results they end up with shows that fixed exchange rates has a positive and significant effect on bilateral trade among developed countries. Hence in this case the costs of floating rates outweigh the benefits. Aristotelous (2001) takes a much narrower approach as his paper looks at trade between only two countries, namely the United States and the UK, between 1889 and 1999. However, he still uses the same augmented gravity model. The results contrasted those of Klein & Shambaugh (2006) and Brada & Mendez (1988), as they showed that neither exchange rate volatility nor exchange rate regime played a significant role in determining the value of trade between the two countries. Similarly, using data from the 7 largest trading OECD countries and the time period 1973-1984, Bailey, Tavlas, and Ulan (1986) find that exchange rate variability does not have a significant effect on the total value of trade.

Franke (1991) looks at the question from an entirely different angle. By focusing solely on exports, he argues that the value of an export strategy depends on exchange rate volatility, just like a financial option agreement. Hence the greater the volatility of exchange rates, the greater the value of exports and the greater the trade. This is backed up to some extent by (Sercu & Vanhulle, 1992) who agree with Franke's literature but also extend it by improving some of the assumptions and also including foreign direct investment (FDI) strategy as an alternative for exporting. With regards to FDI, their results show that when exchange rate rises an export strategy becomes more valuable or appealing than an FDI strategy. Therefore, if one was to see exports as an option and the exchange rate regime representing the price volatility of exports then a country with floating exchange rates should have higher exports as exports become more attractive.

Realizing all of the contrasting results in the literature, Bini-Smaghi (1991) suggests that rather than testing for the impact of exchange rate volatility or exchange rate regime on trade as a whole (bilateral or multilateral), it would be more insightful to segregate total trade into different commodity groups. He argues that the markets in which trade occurs are vastly different and so it is likely that exchange rate volatility will have different effects on each of the sectors. Therefore using aggregate data could lead to a loss of important information, one which many of the previous literature could be suffering from. In his data, the effect of exchange rate risk on intra-European Monetary System manufacturing trade for the period 1976-84 is tested. Maskus (1990) shows supporting evidence for this as he looks at the exchange rate risk on different sectors of the US during 1974-84. He uses 7 sectors, namely agriculture, crude materials, manufactured goods, chemicals, machinery, transport equipment and miscellaneous manufactures. His results show that exchange rate risk reduced trade in agriculture by 6%, the most out of all the 7 sectors. This, he argues is mainly due to the fact that the agricultural sector is highly open to international trade. McCorriston, Sheldon and Cho (2002) also carried out a similar investigation into different sectors using a wider time period, namely 1974-95, and the gravity model to test their hypothesis. Just like Maskus (1990), they find that between the 10 developed countries they tested, agricultural sector trade is affected the most (negatively) by exchange rate uncertainty as compared to other sectors. They compare these results to aggregate trade data for the same time period and countries and point out that the effect of exchange rate uncertainty is much greater on the agricultural sector than the aggregate trade data predicts.

It is very clear from the research that there is wide range of conflicting evidence among economists as to what the effects of exchange rate risk on trade are. It seems that the effects are influenced by factors such as the time period, the countries (whether developed or developing) and whether they use sector trade or aggregate trade statistics. Some, such as Brada & Mendez, show that floating exchange rates fosters trade while others such as Klein & Shambaugh indicate otherwise. Taking note from all existing literature, in particular Klein & Shambaugh (2006), this paper hypothesizes that exchange rate volatility will have a negative impact on a country's trade. In particular the effect on the world's top 21 trading nations as they conduct around 85% of annual trade around the world. The following null and alternative hypothesis are therefore formulated in order to test this hypothesis:

> H_0: The value of aggregate trade among the top 21 trading nations is independent of the bilateral exchange rate regime
> H_A: The value of aggregate trade among the top 21 trading nations is affected by the bilateral exchange rate regime

On top of this, many previous papers, in particular the one by Bini-Smaghi (1991) suggests that it would be of added value to analyze the effect of exchange rate regime on different commodity groups or sectors rather than just aggregate trade. As mentioned above, in this paper it was argued that because each traded market or sector are significantly different, using aggregate trade data could lead to a loss of important information. Furthermore, Maskus (1990) also showed the importance of looking at sector trade rather than just aggregate trade. His main finding showed that the sectors which were open to trade the most were affected by exchange rate risk the most. As well as this, McCorriston, Sheldon and Cho (2002) suggest that aggregate trade statistics underestimate the effect of exchange rate risk on sectors which are highly open to trade, such as the agricultural sector. Based on this academic research this paper makes a second hypothesis regarding sectoral trade:

> H_0: Aggregate trade statistics gives an accurate estimation of the effect of exchange rate risk on trade for the top 4 most traded commodity groups
> H_A: Aggregate trade statistics does not give an accurate estimation of the effect of exchange rate risk on trade for the top 4 most traded commodity groups

Theoretical Framework

Even though many papers find contrasting results regarding the effect of exchange rate risk or exchange rate regime on trade, the majority of these papers use the gravity model to test this effect. The model states that trade flow between two nations depends positively on the economic size of each country and negatively on the distance between the two countries. It was introduced by Jan Tinbergen in 1962. The augmented version of this model, which simply takes the natural logarithm of all the variables, has been specified and developed by many more scholars since then. Anderson (1979), one of the scholars who has greatly contributed to this field, stated that in order to use the augmented gravity model and achieve reliable and accurate results, the countries used need to be similar. This paper uses top 20 trading nations, 15 of which are OECD countries. Although there are some differences between these countries, their main similarity is that all of them focus on trading as one of their main source of income. Due to this, it is assumed that overall they are all relatively homogeneous and therefore the gravity model is appropriate to investigate the research question of this paper. The basic gravity equation, as first introduced by Jan Tinbergen, is written as

$$T_{iz,\ t} = \frac{(Y_{i,\ t})^{\beta}\ (Y_{z,\ t})^{\alpha}}{(D_{iz})^{\gamma}}$$

Where $T_{iz, t}$ represents the value of trade flow from country i to country z at time t, Y_i and Y_z are the nominal GDPs of country i and country z respectively at time t. D_{iz} is the distance between country i and z and β, α, and γ are fixed parameters. For the purpose of this paper the natural logarithm of this equation needs to be taken. After doing so, the equation looks as follows

$$\log(T_{iz,\ t}) = G + \beta\log(Y_{i,\ t}) + \alpha\log(Y_{z,\ t}) - \gamma\log(D_{iz}) + \varepsilon_{iz,\ t}$$

Where G is a constant and $\varepsilon_{iz, t}$ represents the error term at time t. However, the constant does not have to be in the model as its inclusion depends whether it is significantly important or not. On top of these variables, the equation used in this paper will also include various other control variables. Using the augmented gravity model stated above, Baier and Bergstrand (2007) investigated weather free trade agreements really have an effect on total value of trade between two nations. They used 96 different countries and they found that free trade agreements doubles the two members' bilateral trade after about 10 years. The main explanation for this they argue is that free trade reduces transaction costs such as tariffs and hence increases trade. Similarly, Aristotelous (2001) justified his reason to use a free trade variable as part of his gravity model by suggesting that free trade should reduce costs of trade between countries. In theory all of this is very much plausible, after all free trade areas are set up to foster trade. Hence the model in this paper will also include a dummy for free trade, $FT_{iz,\,t}$. This dummy variable takes the value of 1 if there is a free trade agreement between country i and z at time t and 0 otherwise. In table 1, all of the variables used, including free trade and their expected effects on total trade will be summarized.

As Dell'Arricia (1999) states, countries with larger economies trade more and they are also more specialized. This specialization is represented by income or GDP per capita. He therefore states that economies with higher GDP per capita can be expected to trade more. Anderson (1979) and Aristotelous (2001) also use similar reasoning to state that higher GDP per capita should lead to higher levels of trade between two countries. This evidence therefore justifies the use of GDP per capita of country i and country z at time t as a variable in this paper's gravity model.

Rose (2004) and Dell'Arricia (1999) both state the importance of having the same language or culture on total trade values between countries. Firstly, Dell'Arricia states that having the same language should cut transaction costs significantly as no expenses would be made on translations and hence foster trade between two countries. Similarly, Rose also mentions the reduction in transaction costs as well as a possibly increasing contact between trading countries due to a common language. In order to incorporate this in the paper's model, a dummy variable with a value 1 representing a common language and 0 showing no common language is added. There have also been papers which included a dummy variable showing weather a country has historically been colonized by the other or not. They argued that the country which is colonizing usually left behind many of their cultural habits and this should lead to an increase in trade between the nations. However, for the time period and the countries used in this paper, this variable would not be of any added value since none of the countries were colonized in the recent past and so it is unlikely that colonization will significantly affect the total value of trade.

Another unique variable Klein and Shimbaugh (2006) use is weather either trading country is an island or not. Their explanation for doing so can be found in the paper by Raballand (2003) where the effects of a country being an island or landlocked on trade is investigated. A total of 4500 observations using 46 different nations are made. The findings show that being landlocked would reduce trade by 65%. Similarly, being an island also significantly increases the total value of trade a country trades. Since none of the countries in the dataset used here are landlocked, it is not possible to use this as a dummy variable. However, not all the countries are islands (eg Germany and France). Just like Klein and Shimbaugh, this paper therefore also uses an island dummy where the variable shows 1 when either or both of the two countries are islands and 0 when neither of the countries are islands.

Finally, to address the question of this paper, namely what is the effect of exchange rate regime on the value of trade among the top trading nations, a dummy variable for fixed exchange rates will be incorporated. The variable will have a value of 1 if the two trading countries, i and z at time t, have fixed exchange rates and 0 otherwise. It has to be noted that in this paper a broad definition of fixed exchange rates is put into use: not only direct pegs but also indirect pegs via a third country's currency are considered to be fixed exchange rates. For example, if the Netherlands were to fix its currency to the dollar and the UK also fixed their currency to the dollar, then the currencies of the UK and the Netherlands would also be seen as fixed. Furthermore, countries in a monetary union are also considered to have fixed exchange rates between them.

With many of the possible variables needed for the model considered and evaluated, the final mathematical model used to answer the research question is as follows:

$$\log(T_{iz,t}) = \alpha_0 + \alpha_1 \log(Y_{i,t}) + \alpha_2 \log(Y_{z,t}) + \alpha_3 \log(y_{i,t}) + \alpha_4 \log(y_{z,t}) + \alpha_5 \log(D_{iz,t}) + \alpha_6 FI_{iz,t} + \alpha_7 FT_{iz,t} + \alpha_8 LN_{iz} + \alpha_9 IS_{iz}$$

The variable $\log(T_{iz,t})$ is the log of aggregate trade (imports + exports) between country i and country z at time t. In the second part of the paper it will represent the log of the specific commodity traded. α_0 is the constant. The independent variables and their expected signs are summarized in table 1.

Table 1: a summary of all the independent variables used and the expected sign of their coefficients

Variable	**Variable Description**	**Coefficient**	**Predicted sign of coefficient**
$\log(Y_{i,t})$	Natural logarithm of country i's nominal GDP at time t	α_1	+
$\log(Y_{z,t})$	Natural logarithm of country z's nominal GDP at time t	α_2	+
$\log(y_{i,t})$	Natural logarithm of country i's GDP per capita at time t	α_3	+
$\log(y_{z,t})$	Natural logarithm of country z's GDP per capita at time t	α_4	+
$\log(D_{iz,t})$	Natural logarithm of the distance between country i and z at time t	α_5	-
$FI_{iz,t}$	A dummy variable for fixed exchange rates between country i and z at time t	α_6	+
$FT_{iz,t}$	A dummy variable for free trade between country i and z at time t	α_7	+
LN_{iz}	A dummy variable for language between country i and z	α_8	+
IS_{iz}	A dummy variable indicating whether country i or z or both are islands	α_9	+

Although there might be some multicollinearity in the regression, this is only a problem for an OLS regression if there is perfect multicollinearity. Therefore, unless the results show that there is perfect multicollinearity, some multicollinearity should not have a significant impact on the results.

Data

To conduct the study, this paper used the top 21 trading countries in the world. The data regarding which countries trade the most was obtained from the The World Factbook of the CIA. This website collects data and intelligence from 267 world entities to be used by US policy makers and it is coordinated throughout the US intelligence community. Within these 21 countries Hong Kong is also included. Since Hong Kong is not a purely independent country, it means that the list of 21 countries contains 20 independent countries and 1 country which is under the principle of a 'one country, two systems'. Due to the reasons mentioned in the sections above as well as the availability of time and accurate and reliable data, the time period between 1996 and 2014 was used.

To collect the annual aggregate trade statistics between these countries, two sources were used. First of all, since the majority (14) of the 21 countries were OECD countries, the OECD iLibrary was used. In particular, the Monthly Statistics of International Trade from this iLibrary contained the appropriate data needed and hence they were extracted to be used in this paper. This report collects the data in close collaboration with the countries in the dataset. Furthermore, in this report the value of trade is converted to US Dollars. One concern with this report was that for a few countries, in certain years, the data was missing. For example bilateral trade values between the Netherlands and Mexico in 2002 as well as between Switzerland and Italy in 2006 was not available. However, there were only 14 such points, whereas the total number of observations are over 3000. Due to this, the missing data should not have any significant effect on the final results. Furthermore, it has to be noted that although Hong Kong is not considered an OECD country, the data for this country was also found on the database mentioned above.

The second source used to collect the bilateral annual trade statistics was the United Nations Comtrade Database. The United Nations is responsible for collecting these data. Similar to the OECD dataset, this source also collects the data in close collaboration with the countries and so they both have similar data collection methods. Only the aggregate trade data between China, Singapore, India, United Arab Emirates, Thailand and The Russian Federation (non OECD independent countries from the list of 21 countries) was obtained from this dataset. Unlike the OECD dataset however, all the data for these countries in the given time frame was available. The reason why this dataset was not used for all the 21 countries was mainly due to the difficulties in exporting the data and the time frame available.

The yearly nominal GDP sizes of countries, together with their population were obtained from the World Bank 'DataBank'. GDP sizes are all converted into US Dollars. Using the GDP and population data, yearly GDP per capita of each country was calculated. Specifically, each country's yearly nominal GDP was divided by its population of that specific year. In order to obtain the distance between countries and the officially recognized languages of countries, the CEPII database was used. It is a French research center and it produces research and databases on the world economy. The database guarantees independent judgement through the supervision of the 'Scientific Committee'. The distance measurement provides the distance, in km, between the most populous cities of two countries. In fact, Melitz (2003) argued that for trade purposes, it would be more accurate to measure distance as the distance between the most populous city rather than the country's geographical center or capital city. He states that most of the traded products will either end up there or will originate from there.

The World Trade (WTO) organization database provided the data on free trade agreements between countries. In particular, the data on 'Regional Trade Agreements' was used. Regional Trade Agreements, according to the WTO, are reciprocal trade agreements between two or more countries. Those who engage in these agreements are assumed to have free trade between each other. In order to determine whether countries had fixed or floating exchange rates with respect to each other, a report by Carmen M. Reinhart, Kenneth S. Rogoff and Ethan Ilzetzki was used. This report, 'The Country Chronologies and Background Material to Exchange Rate Arrangements into the 21st Century: Will the Anchor Currency Hold?', uses information from different publications such as the United Nations yearbook and the IMF's Annual Report on Exchange rate Agreements and Exchange Restrictions, in order to determine the exchange rate regimes of each country. Moreover, this report covered the time period as well as the countries used in this research.

The second part of the paper focuses on the top 4 traded commodities rather than aggregate trade. These commodities, starting from the most traded are: mineral fuels, oils & products of their distillation, organic chemicals, pharmaceutical products, plastics. This order was established by the International Trade Statistics database. To obtain the annual trade data for these commodities, the OECD iLibrary was again used for the 15 OECD countries included in the research. From this library, the International trade by commodity statistics database provided the ideal information. The trade values were again given in US Dollars and as was the case with aggregate trade statistics, there were also a few missing data points. For example in 1996, the data on the trade of pharmaceutical products between Hong Kong and The Russian Federation or between the US and Switzerland was missing. However, similarly to the aggregate data case, there were over 3000 observations and only around 9-17 missing data points (depending on the commodity). Therefore, the missing data is a very minor concern and should not affect the accuracy of the final results.

For the 6 remaining non OECD countries, bilateral commodity trade statistics from the United Nations Comtrade Database was again used. The only missing data from this database was for the trade of pharmaceutical products between the Russian Federation and United Arab Emirates in 1999. As before, the reason why this database was not used to extract commodity trade data for all the countries in this study was due to the difficulties involved in extracting data from this database together with the time scale available.

For each year, there was annual trade data between each of the 21 countries. Therefore, there were 210 data points for each year, assuming that there was no data missing. This explains why there were over 3000 data points for each model.

Methodology

After gathering all the data on the appropriate variables, an OLS regression, using the statistical software eViews, was formulated. In fact, the model could be described as a panel study with fixed effects. This is mainly due to the fact that the control variables in fact do not change at all or not a lot over the course of for example 1 year. For example the distance remains the same for all the years and GDP and population only changes slowly every year. For the first part of the study, a regression to find the effect of exchange rate regime on aggregate bilateral trade flows was formulated. This regression was in the form of the one stated in the theoretical framework above:

$$\log(T_{iz,t}) = \alpha_0 + \alpha_1 \log(Y_{i,t}) + \alpha_2 \log(Y_{z,t}) + \alpha_3 \log(y_{i,t}) + \alpha_4 \log(y_{z,t}) + \alpha_5 \log(D_{iz,t}) + \alpha_6 FI_{iz,t} + \alpha_7 FT_{iz,t} + \alpha_8 LN_{iz} + \alpha_9 IS_{iz}$$

For all the regressions that are formulated in this paper, the conventional 5% significance level was used. Considering this, after the regressions were formulated, any of the coefficients whose significance was below this level were omitted from the final model. These coefficients are considered not to be significantly different from 0 and hence have no effect on the dependent variable. After these variables are removed from the regression, the Ramsey Regression Equation Specification Error (RESET) test was used to test whether the model (without the non-significant variables) had the correct linear specification. It is essential that the model has the correct linear specification as a wrong specification will weaken the model's explanatory power. Therefore, if the model were to fail the test, an alternative model, possibly one which is not linear would need to be formulated. As one of the assumptions of an OLS regression is homoscedasticity, if the model passes the Ramsey RESET test, a test to examine whether the model suffers from heteroscedasticity needs to be carried out. For the model in this paper, a White test is used. If the model passes this test then it means that there is no heteroscedasticity and the model does not need to be modified. However, if it fails the test then the model is corrected by using the heteroscedasticity-consistent White standard errors. From this new model with White standard errors, any coefficient that is not significant at the 5% level was again removed. Furthermore, the linear specification of this model was also tested using the Ramsey RESET test. The model left after these procedures was then used as the model for the first part of this paper which tests the first hypothesis.

The second part of the paper, which concerns commodity trade, needed 4 different regressions, all in the same form as the one stated in the theoretical framework, representing each of the commodities. The steps followed to arrive at the final regressions were identical to those taken above for the aggregate trade regression. To test the second hypothesis, a comparison between each of the 4 commodity regressions and the aggregate trade regression was made. In particular, the fixed exchange rate coefficients were compared using the following formula (Paternoster, Brame, Mazerolle, & Piquero, 1998):

$$Z = \frac{\alpha_{6a} - \alpha_{6c}}{\sqrt{(SE_a\alpha_{6a})^2 + (SE_c\alpha_{6c})^2}}$$

Where α_{6a} is the coefficient of fixed exchange rate in the aggregate trade model and α_{6c} is the fixed exchange rate coefficient of the commodity trade models. Furthermore, SE_a stands for the standard error of aggregate fixed exchange coefficient and SE_c stands for the standard error of the commodity fixed exchange coefficient. The null hypothesis of the test is $\alpha_{6a} = \alpha_{6c}$and the resulting z-scores determine whether this null hypothesis holds or not and hence also determine whether the second H_0 of this paper is rejected or not.

Results

The results of the OLS regression for aggregate trade data are shown in table 2. The regression stated in the theoretical framework is used. Furthermore, for each of the tables in this section, the corresponding full tables generated by Eviews can be found in the Appendix.

Table2: Outcome of the ***aggregate*** *trade regression*

Variable	Coefficient	t-Statistic	p-value
α_0	-8.645	-12.939	0.000
$\log(Y_{i,t})$	0.726	45.173	0.000
$\log(Y_{z,t})$	0.701	41.537	0.000
$\log(D_{iz,t})$	-0.694	-38.129	0.000
LN_{iz}	0.300	5.061	0.000
$FT_{iz,t}$	0.163	4.534	0.000
$FI_{iz,t}$	0.103	2.636	0.009
IS_{iz}	0.613	5.410	0.000
$\log(y_{i,t})$	0.270	7.631	0.000
$\log(y_{z,t})$	0.292	8.720	0.000

R-squared	0.679	Ramsey RESET test p-value	0.313
Std. Error $FI_{iz,t}$	0.041	White test p-value	0.000

Table 2 firstly shows that all of the coefficients of the model are statistically significant at the 5% confidence interval and therefore none of them need to be removed. As well as this, all the coefficients have the signs predicted in the theoretical framework. With an R^2 of 0.679, the table also shows that the model is a reasonably good fit. It can explain 67.9% of the variation in the data. In addition to this, the model has the correct linear specifications as the p-value of the Ramsey RESET test is 0.313 and its null hypothesis (the model has the correct linear specification) is not rejected. Therefore, there is no need to formulate a new model with a different functional form. The model however failed the heteroscedasticity test as the White test showed a p-value of 0.000, indicating that there is heteroscedasticity in the model. In order to correct for this, the model is reformulated using White standard errors. The results from this reformulation are shown in table 3:

*Table3: Outcome of the **aggregate** trade regression with white standard errors*

Variable	Coefficient	t-Statistic	p-value
α_0	-8.645	-11.316	0.000
$\log(Y_{i,t})$	0.726	45.823	0.000
$\log(Y_{z,t})$	0.701	42.039	0.000
$\log(D_{iz,t})$	-0.694	-35.618	0.000
LN_{iz}	0.300	4.711	0.000
$FT_{iz,t}$	0.163	3.840	0.000
$FI_{iz,t}$	0.103	2.436	0.011
IS_{iz}	0.613	5.862	0.000
$\log(y_{i,t})$	0.270	7.217	0.000
$\log(y_{z,t})$	0.292	7.966	0.000
R-squared	0.679	Ramsey RESET test	0.313
Std. Error $FI_{iz,t}$	0.041		

If the results in table 3 are compared to that of table 2, it is possible to see that there are no major changes. All the coefficients remain highly significant and the model still possesses the correct functional form as the Ramsey RESET test p-value is unchanged. Therefore this model is used to analyze the effect of exchange rate regime on aggregate trade between countries.

The variable that will aid in checking hypothesis 1, and hence the variable of interest for this study, is the fixed exchange rate dummy. The other variables are simply control variables and their coefficient values are therefore not as important for this paper. Furthermore, the constant does not have any useful meaning since it is the point where all other variables are 0. In reality this is impossible for the models and variables used here. Table 2 clearly shows that the fixed dummy variable is significant at the 5% level. Its coefficient reads 0.103 meaning that having a fixed exchange rate between two countries will increase aggregate trade by 10.3%. Therefore, using this information, the H_0 of hypothesis 1 is rejected meaning that indeed, the value of aggregate trade among the top 21 trading nations is affected by the bilateral exchange rate regime.

After the final model for aggregate trade is established, the models for the trade of 4 commodity groups are estimated, starting from the most traded commodity group to the least traded commodity group. Table 4 therefore shows the initial OLS regression for the trade of ‘mineral fuels, oils & product of their distillation’.

*Table 4: Outcome of the **mineral fuels, oils & product of their distillation** data*

Variable	Coefficient	t-Statistic	p-value
α_0	-3.944	-2.992	0.003

$\log(Y_{i,t})$	0.437	13.176	0.000
$\log(Y_{z,t})$	1.047	21.847	0.000
$\log(y_{i,t})$	0.281	5.771	0.000
$\log(y_{z,t})$	0.395	6.697	0.000
$\log(D_{iz,t})$	-0.686	-23.657	0.000
$FT_{iz,t}$	-0.577	-7.381	0.000
LN_{iz}	0.538	4.853	0.000
IS_{iz}	1.219	15.032	0.000
$FI_{iz,t}$	0.349	5.096	0.000
R-squared	0.536	Ramsey RESET test	0.0985
Std. Error $FI_{iz,t}$	0.109	White test p-value	0.000

The model shows that all the all the coefficients are statistically significant at the 5% confidence interval and therefore all of them are kept as part of the model. The sign of the free trade coefficient however is negative which suggests that free trade has a negative effect on trade of these commodities. From an economic point of view this is a very strange result since trade should benefit from free trade, otherwise why make such an agreement in the first place. One possible explanation for this could be that it may take time, possibly a few years, before a country starts to see any obvious benefits from the agreement.

On top of this, the R^2 shows that the model explains 53.6% of the variation in the data. The linear specification of the model is also correct as the p-value of the Ramsey RESET test (0.0985) shows. This means that no new model with a different linear specification needs to be estimated. The model however, suffers from heteroscedasticity as it failed the White test (p-value 0.000). This final statistic means that the model has to be adjusted by applying white standard errors. The outcome for this adjustment is shown in table 5.

Table 5: Outcome of the ***mineral fuels, oils & product of their distillation*** *data, white standard errors*

Variable	Coefficient	t-Statistic	p-value
α_0	-3.944	-3.331	0.001
$\log(Y_{i,t})$	0.437	13.500	0.000
$\log(Y_{z,t})$	1.047	25.241	0.000
$\log(y_{i,t})$	0.281	5.765	0.000
$\log(y_{z,t})$	0.395	6.201	0.000
$\log(D_{iz,t})$	-0.686	-24.718	0.000
$FT_{iz,t}$	-0.577	-6.285	0.000
LN_{iz}	0.538	5.246	0.000
IS_{iz}	1.219	14.469	0.000
$FI_{iz,t}$	0.349	5.037	0.000
R-squared	0.536	Ramsey RESET test	0.0985
Std. Error $FI_{iz,t}$	0.111		

Even after the adjustment, table 5 shows that all the coefficients remain statistically significant. Furthermore, the model also keeps its correct linear specification as the p-value of the Ramsey

RESET test does not change. Consequently, this is model is used to find the effect of exchange rate regime on the trade of mineral fuels, oils & product of their distillation between the 21 countries. It shows that having a fixed exchange rate boosts the trade of these commodities by 34.9%.

Using these results as well as those from table 3, the z-score is calculated:

$$Z = \frac{0.103 - 0.349}{\sqrt{(0.041)^2 + (0.111)^2}} = -2.07$$

This z-score of -2.07 translates to a p-value of 0.0192 and therefore the null hypothesis, $\alpha_{6a} = \alpha_{6c}$, is rejected. Consequently, the second H_0 of this paper is also rejected for this commodity group: The aggregate trade statistics does not give an accurate estimation of the effect of exchange rate risk on the trade of the commodity group mineral fuels, oils & product of their distillation.

The second most traded commodity group is organic chemicals. The OLS regression result for the trade of these commodities is shown in table 6:

*Table 6: Outcome of the **organic chemicals** trade*

Variable	Coefficient	t-Statistic	p-value
α_0	-15.461	-18.985	0.000
$\log(Y_{i,t})$	0.694	33.857	0.000
$\log(Y_{z,t})$	0.756	37.131	0.000
$\log(y_{i,t})$	-0.148	-8.625	0.000
$\log(y_{z,t})$	0.128	3.520	0.000
$\log(D_{iz,t})$	-0.724	-13.376	0.000
$FT_{iz,t}$	0.764	11.760	0.000
LN_{iz}	0.380	5.550	0.000
IS_{iz}	0.575	11.469	0.000
$FI_{iz,t}$	0.442	5.519	0.000
R-squared	0.574	Ramsey RESET test	0.1269
Std. Error $FI_{iz,t}$	0.068	White test p-value	0.000

This regression, like the previous regressions, shows that all of the coefficients are statistically significant. Due to this, there was no need to eject any of them from the model. The R^2 of the model is 0.574 meaning that 57.4% of the variation in the data is explained by the model. However, unexpectedly, the sign of the coefficient of $\log(y_{i,t})$ was negative. All the previous papers who included this variable all obtained a positive value and therefore this negative value is definitely odd. One explanation for this could be due to countries such as China were in the model. Statistical data shows that they have relatively low GDP per capita but yet are amongst the leading traders. Countries such as these could have led to this negative coefficient. The Ramsey RESET test has a p-value of 0.1269. This indicates that the model has the appropriate linear specification and a new one is not needed. However, this model still needs to be modified by using White standard errors since the White test shows that it suffers from heteroscedasticity. This modification is shown in table 7:

*Table 7: Outcome of the **organic chemicals** trade data, white standard errors*

Variable	Coefficient	t-Statistic	p-value
α_0	-15.462	-19.371	0.000
$\log(Y_{i,t})$	0.694	33.583	0.000
$\log(Y_{z,t})$	0.756	37.352	0.000
$\log(y_{i,t})$	-0.148	-9.687	0.000
$\log(y_{z,t})$	0.128	3.187	0.001
$\log(D_{iz,t})$	-0.724	-16.514	0.000
$FT_{iz,t}$	0.764	13.492	0.000
LN_{iz}	0.380	6.346	0.000
IS_{iz}	0.574	11.579	0.000
$FI_{iz,t}$	0.402	5.119	0.000
R-squared	0.574	Ramsey RESET test	0.1269
Std. Error $FI_{iz,t}$	0.062		

The inclusion of white standard errors has no effect on the statistical significance of the coefficients as they all remain significant. The Ramsey RESET test p-value also remains unchanged. Therefore, no more adjustments are needed and this model is used to represent the effect of exchange rate regime on the trade of organic chemicals between nations. It shows that having a fixed exchange rate boosts the trade of these commodities by 40.2%. To see weather this is statistically different from the aggregate trade results of 10.3% the z-score is calculated:

$$Z = \frac{0.103 - 0.402}{\sqrt{(0.041)^2 + (0.062)^2}} = -4.02$$

This z-score of -4.02 translates to give a p-value of 0.000 and consequently means that $\alpha_{6a} \neq \alpha_{6c}$. It also means that the second H_0 of this research for this commodity group is rejected: The aggregate trade statistics does not give an accurate estimation of the effect of exchange rate risk on the trade of the commodity group organic chemicals.

Table 8 contains the results for the OLS regression statistics for the 3rd most traded commodity group, pharmaceutical products:

*Table 8: outcome of the **pharmaceutical products** trade data*

Variable	Coefficient	t-Statistic	p-value
α_0	-26.480	-31.722	0.000
$\log(Y_{i,t})$	0.705	33.539	0.000
$\log(Y_{z,t})$	0.631	30.170	0.000
$\log(y_{i,t})$	0.344	19.543	0.000
$\log(y_{z,t})$	0.520	17.381	0.000

$\log(D_{iz,t})$	-0.685	-21.576	0.000
$FT_{iz,t}$	0.802	10.512	0.000
LN_{iz}	0.620	5.815	0.000
IS_{iz}	-0.148	-2.873	0.004
$FI_{iz,t}$	-0.233	-3.354	0.001
R-squared	0.657	Ramsey RESET test	0.4870
Std. Error $FI_{iz,t}$	0.070	White test p-value	0.000

All the coefficients are again statistically significant meaning that they are all statistically different from 0. Due to this they remain part of this model. The dummy variable for island, IS_{iz}, has a negative sign that was not predicted in the theoretical framework. Furthermore, this model explains 65.7% of the variation in the data as the R^2 value suggests. On top of this, it passes the linearity test comfortably as the Ramsey RESET test shows a p-value of 0.4870. This is enough reason not to design a different model with a different functional form. As was the case with the previous models however, this model also suffers from heteroscedasticity as seen by the White test p-value of 0.000. In order to address this problem White standard errors were applied to this model. The results of this are shown in table 9:

*Table 9: outcome of the **pharmaceutical products** trade data, with white standard errors*

Variable	Coefficient	t-Statistic	p-value
α_0	-26.480	-31.730	0.000
$\log(Y_{i,t})$	0.705	36.064	0.000
$\log(Y_{z,t})$	0.631	29.166	0.000
$\log(y_{i,t})$	0.344	19.772	0.000
$\log(y_{z,t})$	0.520	21.646	0.000
$\log(D_{iz,t})$	-0.685	-25.481	0.000
$FT_{iz,t}$	0.802	10.833	0.000
LN_{iz}	0.620	5.124	0.000
IS_{iz}	-0.148	-2.874	0.004
$FI_{iz,t}$	-0.233	-3.906	0.000
R-squared	0.657	Ramsey RESET test	0.4870
Std. Error $FI_{iz,t}$	0.060		

The adjustment led to no change in the significance of the coefficients nor did they alter the correct linear specification of the model. This is therefore enough reason to use this model to represent the effect of exchange rate regime on the trade of pharmaceutical products. This model predicts that having a fixed exchange rate with respect to the partner country leads to 23.3% less trade. This result is certainly contrasting to the previous results as it predicts a negative effect of fixed exchange rate on trade.

The z-score used to test the H_0 of hypothesis 2 is calculated below:

$$Z = \frac{0.103 - (-)0.233}{\sqrt{(0.041)^2 + (0.060)^2}} = 4.62$$

The z-score of 4.62 is equivalent to a p-value of 0.000 and therefore the two coefficients are not equivalent. Thus the second H_0 of this paper is rejected for the trade of pharmaceutical products: The aggregate trade statistics does not give an accurate estimation of the effect of exchange rate risk on the trade of the pharmaceutical products.

The commodity group 'plastics and articles thereof.' is the 4th most traded commodity group. The estimated effects of exchange rate regime on the trade of these products are summarized in table 9.

*Table 9: outcome of the **plastics and articles thereof.** trade data*

Variable	Coefficient	t-Statistic	P-value
α_0	-10.276	-15.535	0.000
$\log(Y_{i,t})$	0.710	42.641	0.000
$\log(Y_{z,t})$	0.556	33.605	0.000
$\log(y_{i,t})$	0.022	2.2475	0.031
$\log(y_{z,t})$	0.052	2.088	0.040
$\log(D_{iz,t})$	-0.782	-31.033	0.000
$FT_{iz,t}$	0.274	5.176	0.000
LN_{iz}	0.081	1.455	0.146
IS_{iz}	0.372	9.115	0.000
$FI_{iz,t}$	0.327	15.001	0.000
R-squared	0.635		
Std. Error $FI_{iz,t}$	0.055		

The first thing to notice here is that the language dummy variable is not statistically significant as the p-value shows (0.146). Therefore this variable does not significantly affect the dependent variable and it should be omitted from the model. The results after omitting this variable are given in table 10:

*Table10: outcome of the **plastics and articles thereof.** trade data, without insignificant variables*

Variable	Coefficient	t-Statistic	P-value
α_0	-10.334	-15.647	0.000
$\log(Y_{i,t})$	0.711	42.646	0.000
$\log(Y_{z,t})$	0.554	33.575	0.000
$\log(y_{i,t})$	0.051	2.538	0.024
$\log(y_{z,t})$	0.060	2.074	0.038
$\log(D_{iz,t})$	-0.780	-30.995	0.000
$FT_{iz,t}$	0.277	5.235	0.000
IS_{iz}	0.378	9.335	0.000
$FI_{iz,t}$	0.350	16.000	0.000
R-squared	0.635	Ramsey RESET test	0.2286
Std. Error $FI_{iz,t}$	0.053	White test p-value	0.000

Without the variable for language, all the variables in this model are now significant and therefore no more variables need to be removed. The R^2 of this model is 0.635 meaning that 63.5% of the variation in the data is explained by this model. On top of this, the model has the correct linear form as the p-value from the Ramsey RESET test shows (0.2286). Thus no adjustment to the functional form of the model needs to be made. The only adjustment that needs to be made is to use white standard errors since the White test showed that the model suffers from heteroscedasticity (p-value 0.000). This adjustment is presented in table 11:

*Table 11: outcome of the **plastics and articles thereof.** trade data, with white standard errors*

Variable	Coefficient	t-Statistic	P-value
α_0	-10.334	-14.902	0.000
$\log(Y_{i,t})$	0.711	43.471	0.000
$\log(Y_{z,t})$	0.554	31.007	0.000
$\log(y_{i,t})$	0.021	2.520	0.024
$\log(y_{z,t})$	0.060	2.025	0.039
$\log(D_{iz,t})$	-0.780	-33.310	0.000
$FT_{iz,t}$	0.277	5.463	0.000
IS_{iz}	0.378	9.102	0.000
$FI_{iz,t}$	0.350	16.037	0.000
R-squared	0.635	Ramsey RESET test	0.2286
Std. Error $FI_{iz,t}$	0.053		

Following this adjustment, table 11 shows that there were no major changes in the significance of the coefficients as all of them remained significant. The linearity of the model has also remained correct. Consequently, there is no reason to alter the model any further and so it is used to represent the effect of exchange rate regime on the trade of 'plastics and articles thereof'. It predicts that having a fixed exchange rate between two countries will lead to a 35.0% higher trade in the commodity group plastics and articles thereof.

The z-score used to test hypothesis 2 of this paper is:

$$Z = \frac{0.103 - 0.350}{\sqrt{(0.041)^2 + (0.053)^2}} = -3.69$$

This z-score (-3.69) translates to give a p-value of 0.000. The null hypothesis of the test, $\alpha_{6a} = \alpha_{6c}$, is consequently rejected. It also means that the second H_0 of this paper is rejected for this particular commodity group: The aggregate trade statistics does not give an accurate estimation of the effect of exchange rate risk on the trade of plastics and articles thereof commodities. This was the conclusion for all of the 4 commodities hence the aggregate trade statistics does not give an accurate estimation of the effect of exchange rate risk on trade for the top 4 most traded commodity groups.

Conclusion

The primary focus of this paper was the research question *'What is the effect of exchange rate regime on the value of trade among the top trading nations?'.* The first part of the paper used aggregate trade data for the top 21 trading nations and the time period between 1996 and 2014 in order to see the effect of exchange rate regime on aggregate trade. The model used to see this effect was the augmented bilateral gravity model of trade. A few careful steps were taken in order to arrive to the final model. Firstly, following the initial OLS regression, any non-statistically significant (at 5%) coefficients were omitted. Then the general specification of the linear model was tested using the Ramsey RESET test. The White test was also used in order to detect whether the model suffers from heteroscedasticity. If the model indeed suffered from heteroscedasticity, it was corrected by using White standard errors instead of the OLS ones. Finally, the model which had fully significant variables, had the correct linear specification and corrected for heteroscedasticity (if it was necessary) was used as the final model to determine the effect of exchange rate regime on aggregate trade values between countries. This particular model showed that having a fixed exchange rate with regard to the trading country boosts aggregate trade by about 10.3%.

The second part of the paper focused on the 4 most frequently traded commodity groups rather than aggregate trade. In particular it tested whether the aggregate trade models can accurately predict the effect of exchange rate regime on these traded commodity groups. In order to achieve this, firstly, the augmented bilateral gravity trade models were estimated for each commodity group using the same methods as for the aggregate trade model. Afterwards, the fixed exchange rate dummy variable from each of these regressions was compared to the aggregate trade regression by obtaining a z-score. The results showed that the aggregate trade regression falsely estimates the effect of exchange rate regime on each of the top 4 traded commodity groups.

Overall, the obtained results are of added value to the arguments of many economists who estimated that fixed exchange rates will boost trade between countries. Thus the benefits of fixed exchange rates such as lack of volatility are greater than the costs such as trade restrictions. This means that having fixed exchange rates could aid economies achieve full employment and their target growth rates. What is more, this paper also supports the idea that aggregate trade data does not accurately predict the effect of exchange rate volatility on individual sectors or commodity groups. This is mainly due to that fact that each sector has different characteristics and therefore it is likely that the effect of exchange rate volatility will differ among them (Bini-Smaghi, 1991). This result is in particular very relevant to those countries whose exports or imports focus on one particular commodity group. These nations would benefit further from focusing on the effect of exchange rate regime on the particular commodity group which they trade the most.

There were however a few surprising results. One of them was the coefficient of the fixed exchange rate dummy for the pharmaceutical products. In contrast to the other results in this paper, it showed fixed exchange rate to have a negative effect on trade. An explanation for this, as stated by some of the past research mentioned in the literature review could be due to the excessive costs experienced from enforcing a fixed exchange rate. If these costs outweigh the benefits (eg. lower volatility) then fixed exchange rate can degrade trade. This result could also explain why the aggregate trade model does not accurately predict the effect of fixed exchange rate on the trade of individual commodities. When the aggregate trade is considered, some odd results such as the one for pharmaceutical products could affect the aggregate trade fixed dummy in such a way that it is significantly different than the individual commodity trade fixed dummies.

The results of the paper are however not without any error. To begin with, although as many appropriate variables as possible were included in the models used, the OLS regressions could be suffering from an omitted variable bias (OVB). If this was the case then the validity of the results should be greatly questioned since the coefficients would not accurately reflect the real effects of exchange rate regime on trade. Unfortunately this limitation cannot be easily tested using a statistical method. One way around it is by including further variables which could have an effect on the dependent variable, trade. Political relation and extra trade barriers could be two of the variables which may improve the validity of the results in this paper. Since data representing these variables is not readily available, they were not included in the models used here.

Another potential limitation of the results is that the countries considered are the 21 countries which trade the most. It therefore could be inaccurate to generalize these results to other countries around the world which have different characteristics. Exchange rate regime may have a variety of different effects on countries which do not rely on trade as much. For example, the costs and benefits of a certain exchange rate regime would not be as big for these countries compared to those who rely on trade more. Therefore, the effect of exchange rate regime on the value of trade for these countries should be less. In order to see what the real magnitude of this effect would be, all the other countries would also need to be included. Hence these results only hold true for the 21 countries used in the paper.

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Appendix

EViews version of Table 2:

Included observations: 3977

Variable	Coefficient	Std. Error	t-Statistic	p-value
C	-8.645469	0.330797	-12.93915	0.0000
LOG(GDP1)	0.726362	0.011117	45.17375	0.0000
LOG(GDP2)	0.701438	0.011236	41.53717	0.0000
LOG(DISTANCE)	-0.693597	0.018314	-38.12862	0.0000
LANGUAGE	0.300255	0.060907	5.061109	0.0000
FREETRADE	0.162701	0.038747	4.534466	0.0000
FIXED	0.102636	0.040441	2.636412	0.0085
ISLAND	0.613234	0.051257	5.410421	0.0000
LOG(GDPCAPITA1)	0.270324	0.035791	7.630795	0.0000
LOG(GDPCAPITA2)	0.292066	0.035350	8.720040	0.0000

R-squared	0.679416	Mean dependent var	17.471974
Adjusted R-squared	0.679094	S.D. dependent var	2.110711
S.E. of regression	1.369371	Akaike info criterion	3.467706
Sum squared resid	14963.90	Schwarz criterion	3.475575
Log likelihood	-13842.75	Hannan-Quinn criter.	3.470399
F-statistic	1374.766	Durbin-Watson stat	1.099160
Prob(F-statistic)	0.000000		

EViews version of Table 3:

Included observations: 3977
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	p-value
C	-8.645469	0.365535	-11.31567	0.0000
LOG(GDP1)	0.726362	0.012985	45.82308	0.0000
LOG(GDP2)	0.701438	0.012459	42.03873	0.0000
LOG(DISTANCE)	-0.693597	0.020410	-35.61844	0.0000
LANGUAGE	0.300255	0.068569	4.710509	0.0000
FREETRADE	0.162701	0.044978	3.840398	0.0001
FIXED	0.102636	0.041424	2.435589	0.0110
ISLAND	0.613234	0.051483	5.862136	0.0000
LOG(GDPCAPITA1)	0.270324	0.035603	7.216291	0.0000
LOG(GDPCAPITA2)	0.292066	0.036136	7.965877	0.0000

R-squared	0.679416	Mean dependent var	17.471974
Adjusted R-squared	0.679094	S.D. dependent var	2.110711
S.E. of regression	1.369371	Akaike info criterion	3.467706
Sum squared resid	14963.90	Schwarz criterion	3.475575
Log likelihood	-13842.75	Hannan-Quinn criter.	3.470399
F-statistic	1374.766	Durbin-Watson stat	1.099160
Prob(F-statistic)	0.000000	Wald F-statistic	1040.123
Prob(Wald F-statistic)	0.000000		

EViews version of Table 4

Included observations: 3976

Variable	Coefficient	Std. Error	t-Statistic	p-value
C	-3.943566	1.318210	-2.991606	0.0028
LOG(GDP1)	0.436607	0.033136	13.17638	0.0000
LOG(GDP2)	1.047252	0.032884	21.84722	0.0000
LOG(GDPPERCAPITA1)	0.281355	0.027711	5.770624	0.0000
LOG(GDPPERCAPITA2)	0.395232	0.059013	6.697405	0.0000
LOG(DISTANCE)	-0.685908	0.050091	-23.65679	0.0000
FREETRADE	-0.676875	0.105259	-7.380627	0.0000
LANGUAGE	0.537596	0.110787	4.852507	0.0000
ISLAND	1.219075	0.081099	15.03186	0.0000
FIXED	0.348547	0.109495	5.096451	0.0000

R-squared	0.536074	Mean dependent var	18.83237
Adjusted R-squared	0.534794	S.D. dependent var	3.103276
S.E. of regression	2.333047	Akaike info criterion	4.534740
Sum squared resid	12587.38	Schwarz criterion	4.550555
Log likelihood	-9005.062	Hannan-Quinn criter.	4.540347
F-statistic	340.7600	Durbin-Watson stat	1.523572
Prob(F-statistic)	0.000000		

EViews version of Table 5

Included observations: 3976
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	p-value
C	-3.943566	1.183755	-3.331403	0.0009
LOG(GDP1)	0.436607	0.032340	13.50044	0.0000
LOG(GDP2)	1.047252	0.029717	25.24075	0.0000
LOG(GDPPERCAPITA1)	0.281355	0.027928	-0.764653	0.4445
LOG(GDPPERCAPITA2)	0.395232	0.063733	-6.201326	0.0000
LOG(DISTANCE)	-0.685908	0.048561	-24.71764	0.0000
FREETRADE	-0.676875	0.123609	-6.284918	0.0000
LANGUAGE	0.537596	0.102472	5.246260	0.0000
ISLAND	1.219075	0.084256	14.46867	0.0000
FIXED	0.348547	0.110880	5.037390	0.0000

R-squared	0.436074	Mean dependent var	18.83237
Adjusted R-squared	0.434794	S.D. dependent var	3.103276
S.E. of regression	2.333047	Akaike info criterion	4.534740
Sum squared resid	21587.38	Schwarz criterion	4.550555
Log likelihood	-9005.062	Hannan-Quinn criter.	4.540347
F-statistic	340.7600	Durbin-Watson stat	1.523572
Prob(F-statistic)	0.000000	Wald F-statistic	372.5346
Prob(Wald F-statistic)	0.000000		

EViews version of Table 6:

Included observations: 3977

Variable	Coefficient	Std. Error	t-Statistic	p-value

C	-15.46097	0.814388	-18.98476	0.0000
LOG(GDP1)	0.693646	0.020487	33.85710	0.0000
LOG(GDP2)	0.755803	0.020355	37.13081	0.0000
LOG(GDPPERCAPITA1)	-0.147744	0.017130	-8.625075	0.0000
LOG(GDPPERCAPITA2)	0.127978	0.036352	3.520479	0.0004
LOG(DISTANCE)	-0.723702	0.030959	-13.37621	0.0000
FREETRADE	0.764410	0.065004	11.75952	0.0000
LANGUAGE	0.380179	0.068497	5.550316	0.0000
ISLAND	0.574561	0.050095	11.46939	0.0000
FIXED	0.441999	0.067798	5.519374	0.0000

R-squared	0.573657	Mean dependent var	18.78584
Adjusted R-squared	0.572690	S.D. dependent var	2.206797
S.E. of regression	1.442560	Akaike info criterion	3.573226
Sum squared resid	8255.241	Schwarz criterion	3.589038
Log likelihood	-7095.361	Hannan-Quinn criter.	3.578833
F-statistic	593.0804	Durbin-Watson stat	1.570971
Prob(F-statistic)	0.000000		

EViews version of Table 7:

Included observations: 3977
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	p-value
C	-15.46097	0.798163	-19.37069	0.0000
LOG(GDP1)	0.693646	0.020655	33.58258	0.0000
LOG(GDP2)	0.755803	0.020234	37.35224	0.0000
LOG(GDPPERCAPITA1)	-0.147744	0.015252	-9.686985	0.0000
LOG(GDPPERCAPITA2)	0.127978	0.040156	3.187051	0.0014
LOG(DISTANCE)	-0.723702	0.027295	-16.51372	0.0000
FREETRADE	0.764410	0.056658	13.49154	0.0000
LANGUAGE	0.380179	0.059913	6.345503	0.0000
ISLAND	0.574561	0.049621	11.57910	0.0000
FIXED	0.441999	0.062089	5.118795	0.0000

R-squared	0.573657	Mean dependent var	18.78584
Adjusted R-squared	0.572690	S.D. dependent var	2.206797
S.E. of regression	1.442560	Akaike info criterion	3.573226
Sum squared resid	8255.241	Schwarz criterion	3.589038
Log likelihood	-7095.361	Hannan-Quinn criter.	3.578833
F-statistic	593.0804	Durbin-Watson stat	1.570971
Prob(F-statistic)	0.000000	Wald F-statistic	648.6853
Prob(Wald F-statistic)	0.000000		

EViews version of Table 8:

Included observations: 3974

Variable	Coefficient	Std. Error	t-Statistic	p-value
C	-26.48008	0.834750	-31.72219	0.0000
LOG(GDP1)	0.705020	0.021021	33.53944	0.0000

LOG(GDP2)	0.630919	0.020912	30.17074	0.0000
LOG(GDPPERCAPITA1)	0.343649	0.017584	19.54325	0.0000
LOG(GDPPERCAPITA2)	1.019712	0.037241	17.38143	0.0000
LOG(DISTANCE)	-0.685318	0.031763	-21.57564	0.0000
FREETRADE	0.801829	0.066739	10.51285	0.0000
LANGUAGE	0.619595	0.070287	5.815169	0.0000
ISLAND	-0.147832	0.051462	-2.872630	0.0041
FIXED	-0.233220	0.069525	-3.354458	0.0008

R-squared	0.656944	Mean dependent var	18.29787
Adjusted R-squared	0.656165	S.D. dependent var	2.524750
S.E. of regression	1.480448	Akaike info criterion	3.625080
Sum squared resid	8688.001	Schwarz criterion	3.640901
Log likelihood	-7193.033	Hannan-Quinn criter.	3.630690
F-statistic	843.4418	Durbin-Watson stat	1.501703
Prob(F-statistic)	0.000000		

EViews version of Table 9:

Included observations: 3974
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	p-value
C	-26.48008	0.834525	-31.73073	0.0000
LOG(GDP1)	0.705020	0.019549	36.06437	0.0000
LOG(GDP2)	0.630919	0.021632	29.16603	0.0000
LOG(GDPPERCAPITA1)	0.343649	0.017380	19.77232	0.0000
LOG(GDPPERCAPITA2)	1.019712	0.047107	21.64672	0.0000
LOG(DISTANCE)	-0.685318	0.026895	-25.48119	0.0000
FREETRADE	0.801829	0.056957	10.83355	0.0000
LANGUAGE	0.619595	0.051105	5.12402	0.0000
ISLAND	-0.147832	0.051425	-2.874727	0.0041
FIXED	-0.233220	0.059701	-3.906475	0.0001

R-squared	0.656944	Mean dependent var	18.29787
Adjusted R-squared	0.656165	S.D. dependent var	2.524750
S.E. of regression	1.480448	Akaike info criterion	3.625080
Sum squared resid	8688.001	Schwarz criterion	3.640901
Log likelihood	-7193.033	Hannan-Quinn criter.	3.630690
F-statistic	843.4418	Durbin-Watson stat	1.501703
Prob(F-statistic)	0.000000	Wald F-statistic	827.6823
Prob(Wald F-statistic)	0.000000		

EViews version of Table 10:

Variable	Coefficient	Std. Error	t-Statistic	P-value
C	-10.27582	0.661462	-15.53501	0.0000
$\log(Y_{i,t})$	0.710493	0.016662	42.64126	0.0000
$\log(Y_{z,t})$	0.555951	0.016544	33.60530	0.0000
$\log(y_{i,t})$	0.021564	0.013934	1.547547	0.1218
$\log(y_{z,t})$	0.052197	0.029526	1.767839	0.0772
$\log(D_{iz,t})$	-0.781639	0.025187	-31.03319	0.0000

$FT_{iz,t}$	0.273930	0.052916	5.176648	0.0000
LN_{iz}	0.081105	0.055736	1.455161	0.1457
IS_{iz}	0.371512	0.040759	9.114786	0.0000
$FI_{iz,t}$	0.326808	0.055119	15.00051	0.0000

R-squared	0.635392	Mean dependent var	19.03649
Adjusted R-squared	0.634566	S.D. dependent var	1.942086
S.E. of regression	1.174013	Akaike info criterion	3.161242
Sum squared resid	5474.637	Schwarz criterion	3.177036
Log likelihood	-6284.032	Hannan-Quinn criter.	3.166842
F-statistic	769.0986	Durbin-Watson stat	1.569536
Prob(F-statistic)	0.000000		

EViews version of Table 11:

Included observations: 3982

Variable	Coefficient	Std. Error	t-Statistic	p-value
C	-10.33289	0.660391	-15.64664	0.0000
$\log(Y_{i,t})$	0.710663	0.016664	42.64649	0.0000
$\log(Y_{z,t})$	0.554467	0.016514	33.57472	0.0000
$\log(y_{i,t})$	0.051432	0.013936	2.537922	0.0241
$\log(y_{z,t})$	0.060179	0.029016	2.073982	0.0381
$\log(D_{iz,t})$	-0.779715	0.025156	-30.99519	0.0000
$FT_{iz,t}$	0.276867	0.052885	5.235228	0.0000
IS_{iz}	0.378152	0.040509	9.335076	0.0000
$FI_{iz,t}$	0.349907	0.052791	16.09952	0.0000

R-squared	0.635197	Mean dependent var	19.03649
Adjusted R-squared	0.634463	S.D. dependent var	1.942086
S.E. of regression	1.174179	Akaike info criterion	3.161272
Sum squared resid	5477.556	Schwarz criterion	3.175488
Log likelihood	-6285.093	Hannan-Quinn criter.	3.166312
F-statistic	864.7280	Durbin-Watson stat	1.569504
Prob(F-statistic)	0.000000		

EViews version of Table 12:

Variable	Coefficient	Std. Error	t-Statistic	p-value
C	-10.33289	0.693391	-14.90198	0.0000
$\log(Y_{i,t})$	0.710663	0.016348	43.47113	0.0000
$\log(Y_{z,t})$	0.554467	0.017882	31.00686	0.0000
$\log(y_{i,t})$	0.021432	0.014104	2.519607	0.0240
$\log(y_{z,t})$	0.060179	0.032977	2.024859	0.0386
$\log(D_{iz,t})$	-0.779715	0.023408	-33.30971	0.0000
$FT_{iz,t}$	0.276867	0.050680	5.463078	0.0000
IS_{iz}	0.378152	0.041547	9.101867	0.0000
$FI_{iz,t}$	0.349907	0.052997	16.03681	0.0000

R-squared	0.635197	Mean dependent var	19.03649
Adjusted R-squared	0.634463	S.D. dependent var	1.942086
S.E. of regression	1.174179	Akaike info criterion	3.161272
Sum squared resid	5477.556	Schwarz criterion	3.175488
Log likelihood	-6285.093	Hannan-Quinn criter.	3.166312
F-statistic	864.7280	Durbin-Watson stat	1.569504

Prob(F-statistic)	0.000000	Wald F-statistic	926.2284
Prob(Wald F-statistic)	0.000000		