The Impact of the Great Recession on International Trade

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Abstract

The gravity model of trade is used as a framework to assess the impact of the financial crisis on international trade. Trade dynamics are explored over time across bilateral partners, accounting for the heterogeneity in the partners' characteristics; specifically, their income levels as well as their membership in a free trade agreement (FTA) and the European Monetary Union (EMU). Results show that membership in the EMU had a positive impact on a country's exports during the crisis, while membership in an FTA had a negative impact. Further, low-income countries were more negatively impacted by the recession than high-income countries.

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1 Introduction

The goal of this paper is to better understand the impact of the recent financial crisis on global trade dynamics. The approach taken by the bulk of relevant literature is to examine the causes of the global effect, largely ignoring interesting cross-country trends. To fill this gap in the literature, I study these trends in an effort to better understand how trade across different countries was impacted.

That the global economy displays a common pattern - evolution within the context of regular booms and busts - is not a novelty in economic thought. These busts often take the form of financial crises and have been a mainstay in the economic landscape at least since the 1800s (Reinhart and Rogoff, 2008). Their domino-like effect across countries and industries is largely a result of the interconnectedness of global markets. Accordingly, as this interconnectedness deepens, so does the spread of subsequent crises. For instance, the first international crisis in 1825 started in Britain but found its way to Latin America (Bordo and Murshid, 2000). Subsequently, the Great Depression in 1929 affected countries across Europe and Latin America, as well as Australia, Argentina, Uruguay, and Brazil. The most recent financial crisis, as noted by Laeven and Valencia (2012), has 'given rise to the largest wave of banking crises seen since the Great Depression'.

In September 2008, the spillover from the housing and financial sectors in the United States and some European countries spread rapidly through almost all sectors and all countries (Bems et. al., 2010). Although these declines were uneven across countries, even those with minimal direct exposure to the centers of the crisis were affected. Overall, in the fourth quarter of 2008, real world GDP decreased by 6.5% annualized and by 7.9% the subsequent quarter (IMF Data and Statistics).

A widely acknowledged reason for this 'spillover' is international trade - by connecting economies, it acts as a vehicle for transmitting country-specific shocks abroad. Indeed, standard open-economy macroeconomic models assume that co-varying output across countries

is a result of a spillover effect channelled through trade. Glick and Rose (1999) provide empirical evidence of this effect[1]. Using data from five different financial crises since 1970, they show how clusters of countries linked by trade are significantly more affected by a crisis originating from within. In the context of the 2008 recession, the GDP of other NAFTA nations experienced downward shocks 70% as severe as that in the United States while the GDP in emerging Europe (e.g. Czech Republic, Hungary, Poland, Romania) experienced downward shocks 35% as severe as that in the EU-15.

The dynamics involved in transmitting a crisis abroad via trade are further complicated by the feedback effect on trade itself. That is, as a crisis spreads from one country, it causes recessions across other countries. A recession is typically followed by a decrease in output and employment, asset market collapse, and rising government debt (Reinhart and Rogoff, 2008). *Ceteris paribus*, these symptoms reduce domestic demand, and thereby domestic imports. Further, if important trade partners also experience a recession, it can lead to a reduction in domestic exports.

Historical evidence validates this feedback effect. For instance, Freund (2009) finds that trade has become more responsive to income levels over time (i.e. the elasticity of trade value to income has increased from under 2 in the 1960s to over 3 presently), and even more so during global downturns. Data from the 2008 recession confirms this evidence. The collapse of international trade after the recession, characterized as 'sudden, severe, and synchronized' (Baldwin, 2009) led to a fall in exports and imports across all countries and virtually all product categories (Bems et. al., 2010). In the first quarter of 2009, global nominal trade collapsed by 30% (World Trade Monitor, 2009).

Recent investigations of the effect of the crisis on trade approach it with a view to understand overarching causes, rather than to explore consequences. For instance, Chor and Manova (2010) attribute the impact of the crisis on international trade to adverse credit

[1]See also Caramazza et. al. (2000), Kali and Reyes (2010), and references therein.

conditions[2]. Baldwin (2009) points to the roles of vertical trade linkages[3] and composition effects[4]. In fact, apart from basic analyses by international organizations (e.g. World Trade Organization, 2009), academic work overlooks an exploration of interesting post-crisis trends in trade. Taking a comprehensive look at global exports reveals that, among other trends: (i) emerging Europe, Japan, and the U.S. noted the greatest declines in 2009; (ii) emerging economies fared better than advanced economies, experiencing less decline as well as an earlier and swifter recovery; (iii) but, some emerging economies in Africa and the Middle East also suffered the longest drought in trade worldwide.

To gain a nuanced understanding of the effect of the crisis on trade, accounting for these trends is as important as accounting for their causes, for several different reasons. First, the relationship between trends and causes of trends is largely circular: without observing trends, there is no information with which to derive and test hypotheses about causes. Consequently, uncovering new trends provides a foundation for further research into causes. Second, a changing global economy implies that the post-crisis trends in trade observed in 2009 are different from the ones observed after prior crises. Understanding the discrepancy provides information about the nature of change in the economy. Third, from a policy-perspective, there is little relevance in accounting solely for overarching causes. For instance, a policy-maker in Japan risks ignoring critical country-specific trends if he is in search of global causes. Fourth, observing trends provides a rough framework for predicting how trade will react in the short-run if a similar crisis were to occur again. Inevitably, this reduces the uncertainty associated with what to expect in the near future.

For these reasons, this paper aims to explore *how* trade was affected by the crisis across individual economies, rather than explain *why*. As such, it should be seen as a complement to papers seeking a causal explanation. I segregate countries based on various characteristics,

[2]Using U.S. import data from 2008, they find that countries with tighter credit conditions (i.e. higher interbank rates) exported less to the U.S. during the crisis period.

[3]A drop in the demand for a final good also leads to a drop in the demand for intermediate goods, thereby decreasing trade more than final demand.

[4]Trade was impacted to a greater extent than GDP because production collapsed the most in sectors that were disproportionately involved in trade.

with the goal of studying which of these characteristics pushed the impact of the crisis on trade one way or the other. Specifically, I study trade dynamics in the context of (i) per capita income levels (i.e. high or low income countries), as well as membership in a (ii) free trade agreement (FTA) and (iii) a monetary union, as proxied by the European Monetary Union (EMU). These variables capture differences considered important by researchers in international trade.

First, monetary unions and free trade agreements have emerged as major policy issues over the past two decades. A key motivation to forming such agreements is the belief that they will reduce the transaction costs of and thereby increase trade. In turn, a key policy objective is to quantify their impact on trade[5]. Second, the recent growth in emerging markets is changing the nature of global trade, making the study of the effect of income levels on trade increasingly relevant[6].

I use the gravity model of trade as the theoretical framework to study how these variables impacted trade during the 2008 crisis. I employ a large panel data set of bilateral exports between the years 2005 and 2010 (inclusively). Cross-country regressions show that being a member of the EMU during this time period had a positive impact on trade, while being a member of an FTA had a negative impact. Further, on average, trade between low-income countries was more affected (relative to trade between high-income countries) by the crisis, especially in 2009. This latter result is particularly counterintuitive, as those countries which experienced the brunt of the crisis (outside of trade) were actually high-income countries.

Although this study is unique in its focus on exploring post-recession trade dynamics, it adds to the growing literature that uses the gravity model to study how different types of

[5]There exists some uncertainty about the impact of these institutions on trade. Newer studies show a strong positive impact for both free trade agreements (Baier and Bergstrand, 2007; Ornelas, 2005; Carrre 2006; Caporale et. al., 2009) and monetary unions (Rose and Van Wincoop, 2001; Glick and Rose, 2002; Micco et. al., 2003). Whereas, older studies (see Frankel et. al., 1995) show an insignificant impact. Results largely depend on the nature of the econometric specification, with older studies using a standard cross-sectional gravity equation and treating these controls (i.e. free trade agreement and monetary union dummy variables) as exogenous, and more recent panel-data approaches adjusting for their endogeneity. The latter set of panel data studies are generally viewed as more robust (Matyas, 1997).

[6]For instance, see Baier and Bergstrand, 2001; Rodriguez and Gill, 2006; Hummels et. al., 2001.

economic shocks affect trade. Earlier, Blomberg and Hess (2006) used the model to estimate the effects of violence (e.g. terrorism, external conflict, revolutions, interethnic fighting and genocide), which can result in as much as a 30% tariff on trade. Qureshi (2009) and Martin et. al., (2008) studied the effects of war on trade and generally found large long-term trade losses between aggressors.

The first of these to explore the effect of recessions on trade was Ma and Cheng (2003), who analyzed bilateral trade using a sample of 52 countries over the period of 1981-1998. They found that banking crises had a large negative impact on imports but a positive impact on exports in the short term (i.e. during the crisis years). However, this result was not entirely substantiated by subsequent studies. For example, Abiad et. al. (2010) investigated crises in 153 countries from 1970 onwards, and concluded that while crises created large losses in imports, they also led to moderate losses in exports. Berman and Martin (2010) came closest in their approach to this study by zooming in on the confluence of a recession and cross-country characteristics of trade partners. Specifically, they studied how crises in advanced economies impacted trade in low-income sub-Saharan African countries. Using data from 1976 onwards, they found that in the aftermath of a crisis, the disruption in exports for these African countries is 20% higher than that for other countries - a trend also observed during the current crisis.

This paper focuses solely on the recent 2008 recession, rather than on a history of recessions. Further, in deconstructing trade dynamics based on country-level characteristics, it seeks to understand variation in trade across countries with particular characteristics not studied before. The next section elaborates on the theoretical gravity model, and subsequent sections discuss the econometric methodology and present an analysis of the results.

2 Data and Methodology

2.1 Theoretical Framework: The Gravity Model

The gravity model of trade, first applied by Tinbergen (1962), is now the most widely used empirical approach in international trade[7]. At its core, it asserts that larger economies will pull more goods (i.e. imports) from their trading partners as well as push more goods towards them (i.e. exports), but in the process be impeded by trading costs[8]. The model is conceptualized in terms of bilateral trade, and in its simplest form relates trade T_{ij} to the proportion of the product of two countries' economic size GDP_i and GDP_j and the distance between them D_{ij} (where A is a constant of proportionality):

$$T_{ij} = A\frac{GDP_iGDP_j}{D_{ij}}$$

The gravity model most commonly estimated using cross-sectional data can be charactertized using models (1) or (2).

$$X_{ij} = \beta_0 GDP_i^{\beta_1}(GDP_j)^{\beta_2}(D_{ij})^{\beta_3}\epsilon_{ij} \tag{1}$$

$$lnX_{ij} = ln\beta_0 + \beta_1 lnGDP_i + \beta_2 lnGDP_j + \beta_3 lnD_{ij} + ln\epsilon_{ij} \tag{2}$$

Here, X_{ij} is the value (in current prices) of the trade flow from exporter i to importer

[7]The gravity model is simple, intuitively appealing, and has strong explanatory power. Although a theoretical analysis of the model is not within the scope of this paper, a brief historical review follows. The earliest applications of the model appealed to informal economic foundations (and a physics analogy), rather than formal theoretical foundations. However, since 1979, formal theoretical foundations for the model have appeared (see Frankel (1997) for a comprehensive review). According to the review, the gravity model can be derived from both the traditional theories (e.g. the Ricardian framework and Heckscher-Ohlin (H-O) frameworks) and new theories of international trade.

[8]Hence, the name 'gravity', owing to its similarity to Newton's theory of gravity:

$$F = G\frac{M_iM_j}{D_{ij}^2}$$

where G is the gravitational constant, M_i and M_j are the masses of the two objects and D_{ij} is the distance between them.

j, GDP_i (GDP_j) is the level of real gross domestic product in country i (j), D_{ij} is the distance between the countries, and ϵ_{ij} is assumed to be a log-normally distributed error term.

A large subset of the empirical literature on international trade has contributed to the improvement of the performance of this model in two primary ways. First, as will be discussed in detail later, Matyas (1997) and Breuss and Egger (1999), among others improved the econometric framework of the gravity model. Second, Bergstrand (1985) and Helpman (1987), among others improved the selection of explanatory variables considered in the analysis.

Building on the latter point, model (2) is generally augmented by the population of the trade partners, termed P_i and P_j, as well as a set of dummy variables representing institutional characteristics common to specific flows, termed W_{ij} (see model 3). W_{ij} includes characteristics which indicate that goods traded between two countries will receive preferential treatment in the importing country, thereby reducing trade costs. Some examples include whether (i) the trade partners have a common language, (ii) a common border, and whether (ii) one was/is a colony of the other. Additional dummy variables studied, depending on the research context, include bilateral membership in a free trade agreement and/or a monetary union.

$$lnX_{ij} = ln\beta_0 + \beta_1 lnGDP_i + \beta_2 lnGDP_j + \beta_3 lnD_{ij} + \beta_4 lnP_i + \beta_5 lnP_j + \beta_6 W_{ij} + ln\epsilon_{ij} \quad (3)$$

The higher the income of the exporting country, the higher its level of production, and thereby the higher the level of goods available for export. Likewise, the higher the income of the importing country, the higher the level of imports. Therefore, β_1 and β_2 are expected to be positive. The coefficient for the population of the exporter (β_3) has an ambiguous sign, as it depends on whether the country exports more when it is big (i.e. due to absorption effects) or whether it exports more when it is small (i.e. due to economies of scale). The same logic applies to deducing the sign for β_4. The distance coefficient (β_5) is expected to

be negative, as it proxies trade costs, which reduce the amount of bilateral trade. However, those institutional characteristics that reduce such costs are expected to be positive (i.e. the dummy variables incorporated in W_{ij}). The subsequent section elaborates on the precise econometric specification and method used for this study.

2.2 Atheoretical Gravity Model Specification

The nature of this study requires quantifying the evolving dynamics of trade, including how it is affected by shocks like the 2008 crisis. To do so, I estimate the gravity model in a panel data framework. Using panel data helps capture the relationships between variables over time, while controlling specific unobservable time and trading-partner individual effects.

I construct a panel data set of annual bilateral export flows (in current US Dollars) between 68 countries for the years 2005 to 2010. The data set also contains other relevant country-related characteristics (i.e. controls) for each country and year, including GDP (in current US Dollars), population, income-category (either advanced or developing), as well as distance between bilateral trade partners, dummy variables to represent membership in a free trade agreement and the European Monetary Union, and dummy variables included in W_{ij} (existence of a common border and language and whether one partner was/is a colony of the other). A full description of the control variables and their sources can be found in Appendix A.

Model 4 represents the basic structure of the econometric specification used; it is an augmented panel version of model 3[9].

$$\begin{aligned} lnX_{ij} = ln\beta_0 + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnD_{ij} + \beta_4 lnP_{it} + \beta_5 lnP_{jt} + \beta_6 W_{ij} + \\ \beta_7 Trend_t + \beta_8 2009_t + \beta_9 2010_t + \beta_{10} FTA_{ijt} + \beta_{11} EMU_{ijt} + ln\epsilon_{ij} \end{aligned} \quad (4)$$

The one novelty in this method, as opposed to other existing literature in international trade, is the presence of the $Trend_t$ control. This linear trend variable (with the year 2005

[9]This is a restricted model, in that time dummies for ever year are not included. The Discussion section further examines an unrestricted model.

taking a value of one, 2006 a value of two, and so on), helps isolate the impact of the crisis from long term trends. Since most research in international trade does not study trends, this insight came from Klapper and Love (2011), who use the same control to study the impact of the crisis on new firm registration.

I also use two crisis dummies, 2009_t and 2010_t (represented by 1 for the respective year) to determine the effect of the particular year of the crisis on trade. Although 2008 was the year of the crisis, its effect did not spillover onto trade till 2009 and beyond, and therefore the impact of the crisis did not appear until then. The distance lnD_{ij} and the dummy controls within W_{ij} do not change over the time frame used in this study (and hence, are not denoted with the subscript t).

The dummy FTA_{ijt} represents the presence of a free trade agreement between the bilateral trading partners (represented by 1), while the dummy EMU_{ijt} proxies common membership of partners in a monetary union by membership in the European Monetary Union (EMU). Each can change over time since countries within the sample can enter/exit a free trade agreement and/or the EMU.

To explore the effect of income levels of trade partners on trade dynamics, model 4 is run multiple times across different sub-samples of countries in different income categories. These categories are defined as 'high' income (i.e. advanced economies) or 'low' income (i.e. developing economies), as per the IMF World Economic Outlook Report (2012). An alternative to this method would involve including and measuring the effect of a dummy control for income category. However, this approach is not pursued because the income category that a country in the sample is part of does not change over the time frame of this study. So, it is not possible to measure the effect of income category with a fixed effects regression.

2.3 Fixed effects versus random effects

Two main econometric methods exist to study model 4, including fixed effects and random effects. A fixed effects estimator assumes the existence of time-invariant unobserved heterogeneity which affects each individual (in this case, bilateral trading pairs) of the panel in a different way. It assumes that these individual specific effects are correlated with the independent variables, and in controlling for them, reduces a potentially large source of bias. A random effects estimator assumes that individual specific affects are not correlated with the independent variable, and thereby does not control for them. I choose to apply a fixed effects estimator. Accordingly, model 5 shows the augmented version of model 4, accounting for the individual specific effects, α_{ij}, which are treated as fixed.

$$lnX_{ij} = ln\beta_0 + \alpha_{ij} + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnD_{ij} + \beta_4 lnP_{it} + \beta_5 lnP_{jt} + \beta_6 W_{ij} + \beta_7 Trend_t + \beta_8 2009_t + \beta_9 2010_t + \beta_{10} FTA_{ijt} + \beta_{11} EMU_{ijt} + ln\epsilon_{ij} \quad (5)$$

There are three primary reasons behind this choice. First, fixed effects deals directly with the issue of omitted variable bias. In testing the effects of free trade agreements (FTAs) on trade flows, for example, there is reason to believe that there are unobserved time-invariant individual-specific effects that simultaneously influence the presence of an FTA and the volume of trade. Since these effects are correlated with the presence of FTAs, they are best controlled using fixed effects.

This view is supported by prior research (see Baier and Bergstrand, 2004 & 2007). Using a theoretical and empirical model of the determinants of FTAs, the authors find that bilateral trade partners that have FTAs also tend to share economic characteristics that enhance the welfare gains from an FTA. That is, trade partners tend to have an FTA if they have larger and similar GDPs and are closer to each other but also farther away as a pair from the rest of the world. Both of these characteristics stand out as being strong determinants of trade flows. Therefore, as Baier and Bergstrand (2007) put it, countries with FTAs have 'chosen well', providing evidence for selection bias, which can be viewed

as a form of omitted variable bias. This source of endogeneity exists due to time-invariant heterogeneity present in the sample, which can be controlled using a fixed effects estimator. Similar reasoning may also apply to the variable representing membership in the EMU.

Second, in controlling for the impact of time-invariant individual effects, a fixed effects regression accounts for all time-invariant heterogeneity, including those controls that are not included in the model itself and especially those that would otherwise be hard to define (e.g. cultural, historical, political, and geographic factors that may impact trade). For example, the distance variable in the gravity model is a proxy for costs (e.g. information and transportation costs), but determining the best measure of economic distance to capture these costs has long been a contentious issue (Head and Mayer, 2002). The conventional method for calculating distance is by measuring it between the economic centers (usually assumed to be the capital cities) of the trade partners. The problem with this assumption is that the capital cities are often not the economic centers. Further implicit in this measurement is the assumption that all forms of transport cost (e.g. sea, air, land) are the same. For instance, since Moscow is about 1,300 km closer to Tokyo than is Los Angeles, transport costs from Moscow (to Tokyo) should be lower. In fact, this intuition does not hold because the true economic distance between Los Angeles and Tokyo is much lower (Cheng and Wall, 2005).

A similar issue arises when trying to control for common borders, usually represented as a dummy variable (i.e. 1 if a common border exists). Although a great deal of trade occurs between countries with common borders, not all common borders can be counted as equivalent in terms of their influence on trade. For instance, there is a stark difference in how the border between Canada and the US compares to the border between China and Russia in impacting trade. A fixed effects regression removes the need to include either of these variables, making it easier to deal with contentious definitions.

Third, the Hausman test provides support for the fixed effects estimator. Under the null hypothesis of zero correlation, the random effects model is more efficient. However,

if the null is rejected, only the fixed effects model provides consistent estimators. Many recent econometric evaluations (including this paper) have used this test and virtually all find overwhelming evidence in favour of fixed effects[10]. This test is shown alongside the presentation of the results (below). Given these advantages, the one prominent disadvantage to using fixed effects is the inability to make predictions for bilateral trade-partner-pairs outside the sample used. This would, however, be possible if a random effects model was used.

2.4 Preliminary Data Analysis and Descriptive Statistics

Table 1: Growth rate of exports

	2006	2007	2008	2009	2010
Total Exports	14%	19%	11%	-16%	-19%
Exports between High Income Traders	12%	18%	9%	-15%	-19%
Exports between Low Income Traders	28%	21%	35%	-24%	21%
Exports when only Exporter is High Income	14%	19%	11%	-16%	-20%
Exports when only Exporter is Low Income	20%	29%	24%	-17%	10%
Exports between EMU members	17%	19%	13%	-11%	2%
Exports between FTA members	21%	19%	14%	-14%	-58%

Looking at the data provides some initial insight into trade dynamics over the years preceding and succeeding the 2008 recession. Figure 1 shows the trajectory over time (from 2005 to 2010) of total exports of the sample used in the study, and Table 1 shows growth rates over the same period for different sample sets. Generally, the trend prior to the crisis was positive growth in exports, which was impeded by the crisis in 2008 and subsequently led to declining exports until 2010.

This dynamic changes when the sample is separated by income level (i.e. high or low income; see Figure 2). After the crisis in 2008, both types of countries experienced a decline in exports, though the magnitude of decline was initially larger among low income countries. In 2009, low income countries experienced a 24% reduction in exports while

[10]For a review, see Egger (2000).

Figure 1: Total exports of sample across years 2005-2010

Figure 2: Total exports of sample by income-category

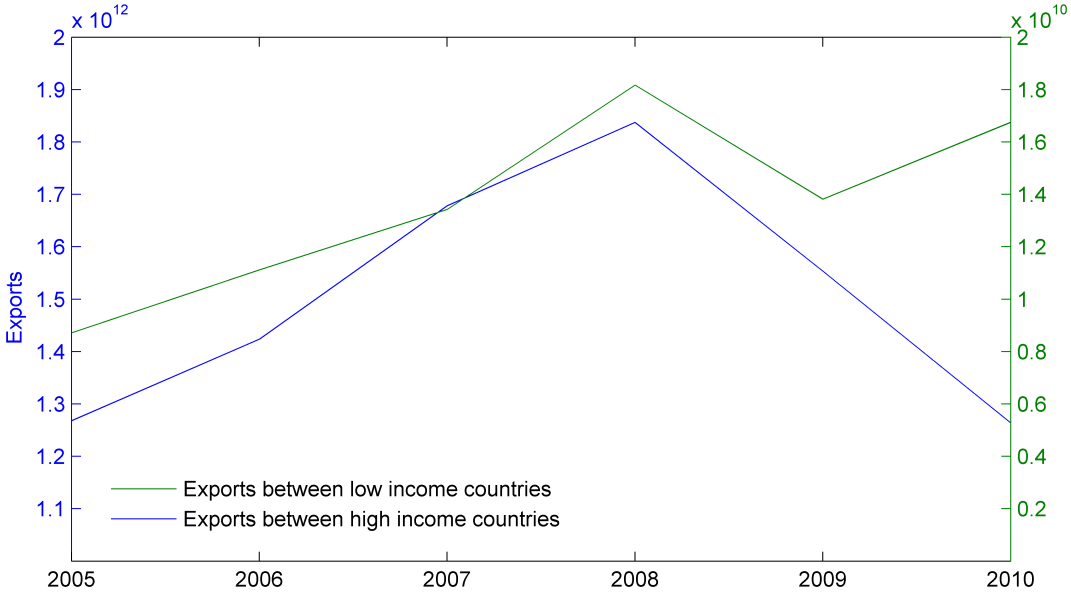
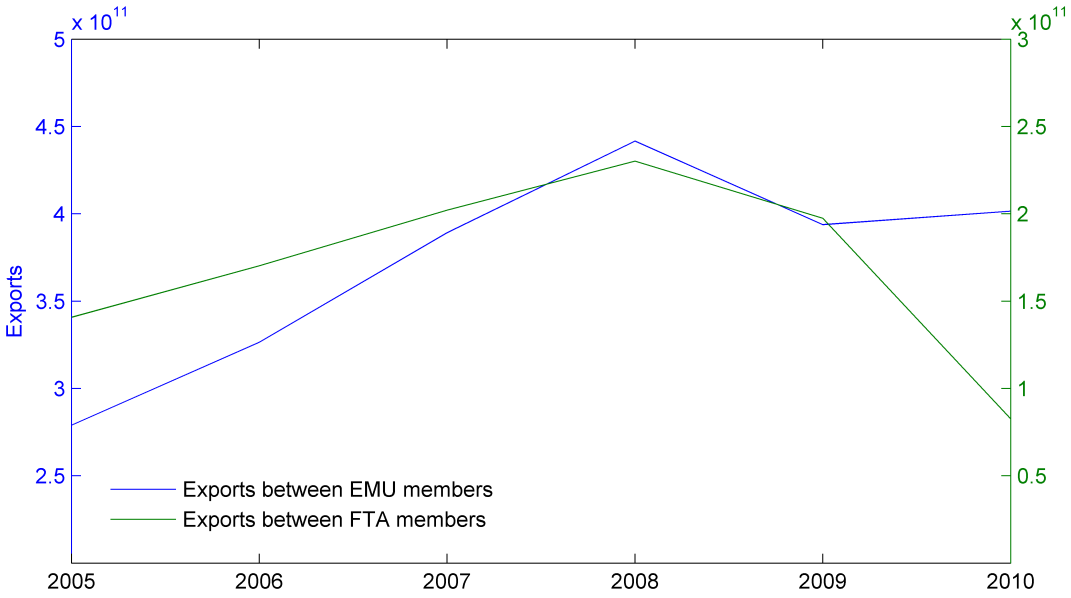


Figure 3: Total exports of sample by membership in an FTA or the EMU



high income countries experienced a 15% reduction. The following year, the resurgence of exports between low income countries was swifter, rebounding with a 10% increase, than that between high income countries, which experienced a further 19% decline.

Figure 3 shows trade dynamics between countries in the sample that are members of the EMU or a bilateral FTA. Exports fell dramatically and continued to fall beyond 2009 for those countries that were members of an FTA; they experienced a decline of 14% in 2009 and a further 58% in 2010. In contrast, EMU members experienced a decline of 11% in 2009 but an increase of 2% in 2010.

Table 2 presents descriptive statistics for some of the controls used in the analysis. Two noteworthy observations include (i) the mean level of exports is highest for members of an FTA, suggesting that a large proportion of the sample is a member of at least one FTA and (ii) the standard deviation of exports is highest among low-income countries, showing that there exist some low income countries with very high levels of exports. Note, however, that some of the standard deviation is due to variation over time. Table 3 provides a correlation matrix of the control variables, confirming the intuition behind the gravity model of trade:

GDP is positively correlated with exports, while bilateral distance is negatively correlated.

Table 2: Descriptive statistics across the years 2005-2010

Variable	Full Sample		High Income		Low Income		EMU		FTA	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Exports	18.9	2.7	19.9	2.2	15.7	2.4	20.6	1.8	20.7	2.3
GDP (exporter)	26.1	1.6	26.2	1.7	25.6	0.9	26.2	1.4	27.1	1.8
GDP (importer)	26.2	1.5	26.4	1.7	25.3	1.5	26.3	1.4	26.4	1.6
Population (Exporter)	16.5	1.5	16.2	1.5	17.7	0.9	16.3	1.4	17.3	1.6
Population (Importer)	17.0	1.7	16.4	1.5	17.6	1.6	16.3	1.5	17.0	2.0
Distance	8.2	1.0	7.8	1.1	8.6	0.8	7.1	0.6	8.5	0.8
Observations	7403		3590		670		765		212	

[1] All variables are transformed to natural logs
[2] SD denotes standard deviation; High Income and Low Income represent samples where both trade partners are high income or low income, respectively; EMU and FTA represent samples where trade partners are members of the EMU or an FTA, respectively.

Table 3: Correlations among controls across the years 2005-2010

Variable	Exports	GDP Exporter	GDP Importer	Population Exporter	Population Importer	Distance
Exports	1.00					
GDP (Exporter)	0.55	1.00				
GDP (Importer)	0.46	0.06	1.00			
Population (Exporter)	0.27	0.81	-0.01	1.00		
Population (Importer)	0.13	0.05	0.70	0.03	1.00	
Distance	-0.30	0.14	0.15	0.15	0.33	1.00

[1] All variables are transformed to natural logs

3 Results

This paper examines how global exports were impacted by the 2008 recession, within the context of cross-country differences in income levels and membership in an FTA and/or a monetary union (proxied by the EMU). A panel data set consisting of bilateral exports among 68 countries between the years 2005 and 2010 is used. Table 4 shows the results for four different fixed effects specifications based on model 5. These include regressions using the full sample with and without controls for membership in the EMU or an FTA, as well as using the high-income-only and low-income-only samples. Though the distance control

is shown, it cannot be measured using a fixed effects regression because its value is time-invariant. Table 4 also presents results for a Hausman test between the fixed effects and random effects versions of each specification, confirming that fixed effects is more efficient.

For each specification, the $Trend_t$ control is always significantly positive, confirming that, on average, bilateral exports for this sample have been increasing over time. This result was earlier motivated by Figures 1, 2, and 3. When the sample is split into high and low-income countries, the $Trend_t$ control for low-income countries is more than twice that of high-income countries. This signifies that trade was increasing faster in low-income countries than high-income countries over the time frame of this study (also confirmed by growth rates shown in Table 1).

Both crisis dummies are significantly negative across the specifications tested. For the entire sample, the 2009 crisis dummy shows a 22% (i.e. $e^{-.26} - 1$) reduction in exports (relative to trend). Prior research, which shows that post-crisis years tend to see significant decreases in trade, confirms this finding. For instance, IMF (2010) used a similar augmented gravity model to find that, on average over the past 40 years, crises have led to an 8% reduction in exports the following year. The much larger estimated impact of 2009 in this study is a result of a combination of two factors: (i) the sample used, which upon examination is skewed towards countries that experienced large losses in exports, and (ii) the fact that the 2008 recession was larger in scale than prior recessions.

Further, the magnitude of the 2009 crisis dummy is highest in the low-income sample. According to the model, in 2009 the crisis led to a 37% decline in exports (relative to trend) for low-income countries compared to an 18% decline in high income countries. Although the magnitude of the impact may be overstated, the result is confirmed by the growth rates shown in Table 1: trade between low-income countries in the sample reduced by 24% in 2009, while trade between high-income countries reduced by 15%.

This result seems counterintuitive, since exports between those countries greatest hit by the crisis (i.e. high-income countries) are less affected. Indeed, reports such as the World

Table 4: Fixed effects model under varying specifications

	Full Sample				H-H Sample		L-L Sample	
	1		2		3		4	
Variables	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
GDP (Exporter)	0.44*	0.23	0.42*	0.24	0.34	0.27	-1.75*	1.04
GDP (Importer)	1.09***	0.18	1.10***	0.18	1.65***	0.37	-1.01	0.95
Distance								
Population (Exporter)	-1.83***	0.60	-1.81***	0.60	-0.14	0.61	-7.15	9.76
Population (Importer)	0.42	0.53	0.47	0.53	-0.37	0.84	2.23*	1.16
EMU			0.08***	0.06				
FTA			-0.16**	0.08				
Trend	0.17***	0.01	0.17***	0.01	0.13***	0.01	0.31***	0.09
2009	-0.26***	0.03	-0.26***	0.03	-0.21***	0.04	-0.47**	0.20
2010	-0.41***	0.04	-0.41***	0.04	-0.34***	0.04	-0.59**	0.25
Constant	1.49	13.58	0.53	13.60	-24.70	15.33	172.50	168.75
Observations	7403		7403		3590		670	
R^2 within	0.25		0.26		0.32		0.17	
R^2 between	0.02		0.02		0.39		0.03	
R^2 overall	0.02		0.02		0.38		0.03	
Hausman χ^2	69.52		88.13		54.34		24.01	
Probability $> \chi^2$	0		0		0		0.0002	

[1] All variables are in natural logorithms

[2] *, **, *** indicate significance at 10%, 5%, 1%, respectively

[3] (1) is the full sample without controls for EMU and FTA; (2) is the full sample with controls for EMU and FTA; (3) only the high-income sample; (4) only the low income sample

Trade Monitor (2009) show that high-income countries suffered a greater blow to exports than low-income countries. Therefore, the result is likely a product of the sample used in this study. Closer examination of the sample reveals that each of the low-income exporters are from Central and Eastern Europe - an outlier region in terms of being heavily impacted by the crisis, as it experienced the greatest decrease in trade globally in 2009.

Specification (2) provides insight into the impact of being a member of the EMU or an FTA during the crisis[11]. Being part of a regional free trade agreement decreased exports by 15%, relative to trend. This result is in-line with prior research that alludes to the impact of FTAs during economic crises. For instance, Clarete et. al. (2003) assessed the impact of 11 different regional FTAs from 1980 to 2000 and found that they can lead to anywhere between a 1% and an 82% increase in regional exports. However, upon zooming into cross-sectional data by year, they found that during crisis years (e.g. the Asian Financial Crisis (1997) or the Ruble Crisis in Russia (1998)) FTAs had negative impacts. For instance, after the Asian Financial Crisis, AFTA (i.e. a dummy variable for the FTA between ASEAN countries) decreased exports of East Asian countries by 12%. This is similar to the 15% decrease that can be attributed to FTAs during the 2008 crisis, as estimated in this study.

In contrast, results show that being a member of the EMU increased exports by 7%. Other research indirectly supports this estimate. For instance, Rose (2000) uses cross-sectional data to show that through the years 1970-1990, currency unions (including but not restricted to the EMU) had a significantly positive impact on trade. In fact, the magnitude of the impact increased over time, without regard to the ebb and flow of economic crises. Micco et. al (2003) examined the EMU from the years 1992-2002 and found a similar positive impact; specifically, countries in the Euroland traded between 4% and 26% more than other bilateral trade partners (these results are confirmed by De Nardis and Vicarelli (2003)). The estimated impact in this study (i.e. 7%) falls within these boundaries, and

[11]Note that numerous other models (not shown) were tested using interaction terms between EMU/FTA and crisis dummies (i.e. 2009 and 2010); however, these interaction terms were not significant.

may be attributed to a fall in the value of the euro which stimulated Euroland exports to the rest of the world, relative to non-EMU members (though its magnitude is likely muted by other indirect effects of the crisis).

4 Discussion

4.1 Control Sensitivity

The main findings in Table 4 are robust to changes in control variables. First, I replace GDP with consumption in the importing country. As per the theory underlying the gravity model, import demand in a country is a function of its domestic absorption and the domestic output in the exporting country. Though GDP is a realistic proxy for output in the exporting country, it is not an ideal proxy for absorption in the importing country. This distinction is especially important during times of economic crises, when absorption decreases more than GDP, biasing the magnitude of the demand in importing countries. The ideal way to account for this would be to substitute GDP in the importing country with absorption (i.e. the sum of consumption and investment expenditure). Since this data is not freely available, I substitute it solely with domestic consumption. Second, I add a control variable to account for exchange rates. Export dynamics are impacted by changes in exchange rates, especially after an economic crisis. Due to the difficulty in gathering exchange rate data between every bilateral trading pair in the sample, I use the real effective exchange rate for each exporter.

Tables 5 and 6 present the results for the models containing these controls. The coefficient on the consumption control is positive and significant, and more so than the GDP of the importer (see Table 4). The coefficient on the real effective exchange rate is also positive and significant; that is, a depreciation of the exporter currency increases exports, indicating the importance of price competitiveness. Adding these variables render the EMU and FTA controls insignificant, though this outcome is not surprising because in both cases

the new variables are absorbing some explanatory power of other variables. On the whole, however, these controls do not change the direction, magnitude, or significance of the trend and crisis variables, or impact the within R^2.

4.2 Specification Sensitivity

The restrictive nature of the original model, though contributing to its parsimony, is also its primary downside. The $Trend_t$ control, which acts as a substitute for time effects (i.e. a dummy variable for every year in the sample) does not capture all time varying effects that the inclusion of time dummies would. Generally, such time effects would capture the impact of any control that varies over time in its influence on bilateral exports, including common business cycle or globalization processes.

Model 6 is an augmented version of model 5, which includes time dummies for every year except 2008 (i.e. the base year). 2008 saw peak levels of exports globally before the effects of the crisis caused exports to collapse. Therefore, years 2009 and 2010 will be compared to 2008. Results for model 6 are shown in Table 7.

$$\begin{aligned} lnX_{ij} = ln\beta_0 + \alpha_{ij} + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnD_{ij} + \beta_4 lnP_{it} + \beta_5 lnP_{jt} + \\ \beta_6 W_{ij} + \beta_7 2005_t + \beta_8 2006_t + \beta_9 2007_t + \beta_{10} 2009_t + \beta_{11} 2010_t + \beta_{12} FTA_{ijt} + \\ \beta_{13} EMU_{ijt} + ln\epsilon_{ij} \end{aligned} \quad (6)$$

Results that emerge from this alternative model share similarities to the original one, but are not without interesting differences. First, FTAs lead to a 15% decrease in exports, confirming the results of the original model.

Second, some results follow a similar pattern to the original model but are more muted in magnitude. For instance: (i) where the impact of the year 2009 is a 22% decrease in exports for the entire sample in the original model, it is an 8% decrease in the alternative model; where the same year leads to an 18% decrease for the high-income sample in the original model, it leads to a 7% decrease in the alternative model; and (iii) where EMU has a small but significant positive effect on exports in the original model, it has a non-significant

Table 5: Control sensitivity: fixed effects model replacing GDP (of importer) with consumption

	Full Sample				H-H Sample		L-L Sample	
	1		2		3		4	
Variables	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
GDP (Exporter)	0.44*	0.23	0.42*	0.23	0.4	0.26	-2.3**	1.12
Consumption (Importer)	1.21***	0.22	1.21***	0.22	2.06***	0.39	-1.29	1.22
Distance								
Population (Exporter)	-1.83***	0.59	-1.81***	0.60	-0.16	0.60	-4.64	10.96
Population (Importer)	0.48	0.65	0.54	0.65	-0.19	0.80	1.74	2.36
EMU			0.07	0.06				
FTA			-0.15***	0.07				
Trend	0.16***	0.01	0.16***	0.01	0.12***	0.01	0.38***	0.11
2009	-0.28***	0.03	-0.29***	0.03	-0.25***	0.03	-0.52***	0.22
2010	-0.42***	0.04	-0.42***	0.04	-0.37***	0.04	-0.65***	0.26
Constant	-2.12	15.52	-3.21	15.54	-38.91**	15.66	157.34	209.24
Observations	7183		7183		3590		582	
R^2 within	0.27		0.27		0.33		0.18	
R^2 between	0.02		0.02		0.35		0.00	
R^2 overall	0.02		0.02		0.34		0.00	

[1] All variables are in natural logorithms

[2] *, **, *** indicate significance at 10%, 5%, 1%, respectively

[3] (1) is the full sample without controls for EMU and FTA; (2) is the full sample with controls for EMU and FTA; (3) only the high-income sample; (4) only the low income sample

Table 6: Control sensitivity: fixed effects model with added real effective exchange rate control

	Full Sample				H-H Sample		L-L Sample	
	1		2		3		4	
Variables	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
GDP (Exporter)	0.35*	0.20	0.35	0.28	-0.03	0.33	-2.57*	1.36
GDP (Importer)	1.24***	0.13	1.24***	0.20	2.11***	0.44	-0.45	0.89
Distance								
Population (Exporter)	-1.15**	0.48	-1.13	0.70	1.65***	0.56	12.4	16.61
Population (Importer)	0.80*	0.42	0.8	0.74	-0.58	0.93	5.21*	3.01
EMU			0	0.09				
FTA			-0.19	0.14				
Trend	0.14***	0.01	0.14***	0.01	0.10***	0.01	0.6***	0.16
2009	-0.23***	0.03	-0.23***	0.03	-0.17***	0.04	-0.96***	0.40
2010	-0.36***	0.03	-0.36***	0.04	-0.29***	0.04	-1.11***	0.49
Real Exchange Rate	0.42***	0.12	0.42***	0.16	0.55***	0.16	-1.35	1.44
Constant	-18.99	11.86	-19.34	16.41	-55.17***	15.39	-211.74	283.51
Observations	5364		5364		2858		392	
R^2 within	0.27		0.27		0.35		0.21	
R^2 between	0.11		0.11		0.45		0.02	
R^2 overall	0.12		0.12		0.44		0.03	

[1] All variables are in natural logorithms

[2] *, **, *** indicate significance at 10%, 5%, 1%, respectively

[3] (1) is the full sample without controls for EMU and FTA; (2) is the full sample with controls for EMU and FTA; (3) only the high-income sample; (4) only the low income sample

positive effect in the alternative. The lower magnitude of results can be attributed to the introduction of time fixed effects, which are absorbing some of the explanatory power of the other variables.

Third, some results in the alternative contrast quite starkly to results in the original. For instance, where the impact of the year 2009 is a large 37% decrease in exports for the low-income sample in the original model, it is an insignificant negative impact in the alternative model. Interestingly, the GDP of the exporter is significant and of greater magnitude in the alternative model for the low-income sample, as it is absorbing some of the explanatory power that was originally attributed to the 2009 control.

4.3 Data Limitations

Perhaps the biggest limitation in this study is the sample itself. Although a sample of 68 countries is used, the source of the data (the United Nations Service Trade Database) only maintains export values for 31 of these countries. Therefore, the sample actually consists of 31 exporters and 68 importers. This considerably reduces the heterogeneity in the sample. For instance, 27 of these exporters are high income countries, while only 4 are low-income countries. Therefore, the low-income sample tested in the study is heavily skewed. Coincidentally, it is based on 4 low-income exporters who also happen to have been some of the worst hit during the recession. A more realistic sample of low-income countries would likely have provided results more in line with one's intuition as well as other research on the repercussions of the crisis - that exports of high-income countries were unambiguously worse hit than those in low-income countries[12]

4.4 Conclusion

Examining the impact of the 2008 financial crisis for the low-income sample reveals that trade between low-income exporters was strongly influenced by the crisis. However, this

[12]See WTO (2010).

Table 7: Specification sensitivity: alternative fixed effects model

	Full Sample				H-H Sample		L-L Sample	
	1		2		3		4	
Variables	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
GDP (Exporter)	0.44*	0.25	0.43*	0.25	0.44	0.29	-1.96*	1.14
GDP (Importer)	1.10***	0.19	1.10***	0.19	1.72***	0.39	-1.05	0.96
Distance								
Population (Exporter)	-1.86***	0.60	-1.83***	0.60	-0.18	0.61	-5.65	10.30
Population (Importer)	0.40	0.53	0.45	0.53	-0.45	0.86	2.28*	1.17
EU		0.07	0.06					
FTA		-0.15*	0.08					
2005	-0.48***	0.04	-0.48***	0.04	-0.35***	0.04	-0.99***	0.30
2006	-0.37***	0.03	-0.37***	0.03	-0.30***	0.03	-0.59***	0.19
2007	-0.149***	0.02	-0.14***	0.02	-0.13***	0.01	-0.27***	0.09
2009	-0.09***	0.02	-0.09***	0.02	-0.08***	0.03	-0.14	0.12
2010	-0.07***	0.02	-0.08***	0.02	-0.09***	0.03	0.06	0.10
Constant	2.65	13.77	1.78	13.78	-26.51*	15.72	152.70	175.14
Observations	7403		7403		3590		670	
R^2 within	0.26		0.26		0.33		0.17	
R^2 between	0.02		0.02		0.41		0.03	
R^2 overall	0.02		0.02		0.40		0.03	

[1] All variables are in natural logorithms

[2] *, **, *** indicate significance at 10%, 5%, 1%, respectively

[3] (1) is the full sample without controls for EMU and FTA; (2) is the full sample with controls for EMU and FTA; (3) only the high-income sample; (4) only the low income sample

result is not confirmed by an alternative model, which attributes the decline in trade more to a decline in the GDP of the exporter. Interestingly, these results do not apply to the high-income sample, where in both model specifications, the GDP of the exporter is low in magnitude and insignificant. The contrast in results for the low-income sample across the two specifications raises some interesting questions regarding (i) whether a crisis impacts trade directly or indirectly via a decline in GDP, (ii) whether a low-income exporter is more prone to first experience a decline in GDP before a decline in trade and (iii) why a low-income exporter would have a greater variation in its exports attributed to its GDP than a high-income exporter.

One way to approach these questions would be to first study the impact of economic crises on trade in low-income exporters over a longer time frame, accounting for multiple crises rather than just one. If the results are comparable to those from this study, one can then examine the causes of this effect. Such an exercise has important policy implications. If the GDP of a low-income exporter is accounting for a large variation in trade during a crisis, then policies can be erected to diminish this effect. For instance, rather than allow trade to collapse, tariffs could be reduced during crises or trade could be subsidized to reduce prices and thereby stabilize exports.

The trend in the remaining set of results for the original model is confirmed by subsequent robustness tests. That is, being a member of an FTA or the EMU had a negative or positive impact, respectively, on trade during the crisis. There is a theoretical case to be made for the former result: if being a member of an FTA increases trade, then it also increases the likelihood of a crisis being transmitted via trade. That is, when one member country reduces imports, it reduces income across trading partners. This eventually reduces incomes across an entire free trade zone, and thereby reduces the level of exports among regional trade partners.

A total of 15 FTAs are examined in this study; as a result, valuable information on the heterogeneity across the sample is lost. There are likely to be some FTAs in which

members experienced very low to insignificant reductions in trade and some in which they experienced very high reductions. This is supported by the fact that the impact of the crisis on trade differed from region to region. It would be worthwhile to investigate which FTAs did well or not so well and why. Insights from such research can drive the formation of policy to ensure that free trade agreements are less prone to collapsing during the onset of a crisis.

The same logic that explains the negative impact of FTAs does not explain the significantly positive impact of the EMU. Rather, this result may be attributed to a fall in the value of the euro, which stimulated Euroland exports to the rest of the world, relative to non-EMU members. However, such a result should not be misconstrued to signify the strength of monetary unions. Rather, to ensure that the positive impact of the EMU during the 2008 crisis was not a one-off event, it would be important to investigate the trade performance among other currency unions during the current and past crises.

Subsequent research can also study variables that were not introduced in this paper. For instance, the impact of trade finance during the international crisis may account for a large portion of the reduction in trade. Further, the current focus on trends across geographic regions can be shifted to study trends across product categories. Different types of commodities will have different demand elasticities; in turn, their exports will also be impacted differently by crises. Altogether, a detailed examination of trends will provide a roadmap to subsequently analyze causes of the effect of economic crises on trade.

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6 Appendix

6.1 Sample of countries used in study

Australia	France	Korea	Philippines	Egypt	Switzerland
Bangladesh	Germany	Kuwait	Poland	Estonia	Tanzania
Belgium	Ghana	Lebanon	Portugal	Ethiopia	Thailand
Brazil	Greece	Liberia	Qatar	Finland	Turkey
Canada	Guyana	Luxembourg	Russia	Italy	Uganda
Chile	Hungary	Malaysia	Saudi Arabia	Jamaica	Ukraine
China	Iceland	Mexico	Singapore	Japan	United Kingdom
Colombia	India	Morocco	Slovakia	Kenya	Uruguay
Costa Rica	Indonesia	Netherlands	Slovenia	Norway	USA
Czech Republic	Ireland	New Zealand	South Africa	Oman	Venezuela
Denmark	Israel	Nigeria	Spain	Pakistan	Poland
Sri Lanka	Sweden	Peru			

[1] These countries were selected randomly

6.2 Sources and description of data

Bilateral Export values (current US Dollars)
UN Service Trade Database
Note: the panel data set is unbalanced; the UN database does not have export data across each year for each set of bilateral trade partners.

GDP (current US Dollars), Population
International Monetary Fund (World Economic Outlook Database 2012)

Bilateral distance, common-border, common-language, colony
CEPII GeoDist Database: http://www.cepii.fr/anglaisgraph/bdd/distances.htm

Income-category
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