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Essays on Growth and Development: an International Economics Perspective

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ESSAYS ON GROWTH AND DEVELOPMENT: AN INTERNATIONAL ECONOMICS PERSPECTIVE

by

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ABSTRACT

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Under the Supervision of Professor Hamid Mohtadi

The title of this dissertation captures the intent of this study. It centers on aspects of international trade and finance and their impact on growth and development. The effect of openness on the financial crisis of 2008 which wreaked havoc worldwide on financial and non-financial systems alike is examined. It is observed that the role of both financial and trade openness is not constant throughout the crisis as was once thought. In addition, and contrary to popular belief, the effect of trade openness dominated that of financial openness, suggesting that while a shortcoming in the financial markets may have been to blame for the origin of the crisis, the negative consequences were spread through trade channels. Due to the increase in risk during this time period and the deleterious effects trade openness had on economies the world over, the role of risk in trade flow determination is studied. It is determined that risk has a significant impact on trade flow determination and as such, has a significant impact on growth rates across different countries, with developing countries suffering more due to a higher level of risk than their developed counterparts. This dissertation can thus be divided into two subsets. The first of these subsets, which is entirely discussed in the first chapter, takes a unique look at the effect of openness, both via trade and finance on an economy, paying particular attention to a period in

time during great recession of 2008 where we know that the detriments of openness were felt the world over. The second subset deals with factors that influence a country's choice in trading partners, specifically country specific risk. This is studied by introducing countries' idiosyncratic risk measures to the standard gravity model in order to determine what role risk plays in determining trade partnerships. This aspect is addressed in the second chapter while the third chapter examines the implication of this finding on growth rates. The implication of these factors on the growth rate of the economy through this trade nexus is studied in order to provide a more accurate estimate of the contribution of trade to growth rates and propose a reason for differences in success rates of trade expansionary policies designed to promote growth, particularly in developing countries.

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Chapter one

The Transmission of the Great Recession and the Role of Openness: A Counterfactual Diagnosis

1.1 Introduction

In early 2015, the volatility spike in stock exchanges across the globe and the corresponding decline in commodity prices, a response to the specter of some contraction of the Chinese economy, served to remind us once again how vulnerable the world economy could be to the propagation of risk. Can we apply the lessons learned from the most recent financial collapse of the global economy in 2008 to shed light on a likely propagation of new risk? Can we, for example, identify the path and the nature of this propagation in the sense of determining how and which potential countries would be most impacted, based on the type and extent of their relationship with China?

In light of the above, much rides on the accuracy of the retrospective analyses of the 2008 financial collapse. I therefore turn my attention to those analyses and find the literature wanting: As far as I can tell, past studies of this subject have used the degree of decline in growth as a measure of the impact of a crisis on an economy. A return to pre-crisis growth has then been assumed to indicate a return to normalcy. This approach is limited in three ways; first a return to pre-crisis growth rates may be a consequence of a depressed level of output as a result of the crisis and thus, far from indicating that the impact of a financial crisis has dissipated. Second, a decline in growth might be a natural part of the economy's progression through its business cycle that would have occurred even in the absence of a financial crisis. Thus, attributing this decline to the crisis can potentially overestimate the impact of the crisis or underestimate its duration. Third, this traditional measure

of impact does not capture the effects of the crisis on the other macroeconomic variables that are also impacted by the crisis.

To address these deficiencies, I propose an alternative approach: First, I predict counterfactual levels of output (and hence growth) for the post crisis era (post 2007) as if the financial crisis of 2008 never took place. The impact of the crisis in each country for each time period is then defined as the difference between the predicted counterfactual GDP and the observed GDP. This new approach enables us to study the role of the suspected factors in influencing the impact of the crisis on output and on growth. Put succinctly, I empirically investigate the potential for evolving roles of trade and financial openness from the onset of the financial crisis, using a more accurate measure of the impact of the financial crisis on output level and growth. This will allow us to identify its effects on the economies studied, and as such, highlight policy implications in the advent of another recession.

The effects of the financial crisis in the late 2000s were profound and far reaching. Among scholars, they generated much interest in the study of crises, from the factors that cause financial collapse, to methods of prediction, to pathways of contagion. In this paper, the focus is primarily on the pathways of contagion. Financial crises can be attributed to the presence of systemic risk, stemming from an external shock that affects markets that co-move or, a failure of a particular system that spreads akin to a disease, infecting other systems to which it is connected. While studying an external shock can be managed by identifying causal factors that could lead to system failures, contagion can only be studied by examining the pathways through which systems are connected. The analogy between the spread of systemic risk and a disease is apt as much of the blame for the propagation of systemic risk has fallen on the type and extent of the relationship between market systems, specifically openness. Proponents of openness argue that it is a vital tool

in the mitigation of idiosyncratic risk and as such, push for policies that promote openness. Critics of openness, on the other hand, view it as the channel through which a crisis is spread and advocate for policies against it.

Given the fact that the 2008 financial crisis began with the bursting of the housing market bubble in the US and spread to other markets within and outside the US via housing related derivatives (e.g., MBS), financial openness has been identified as the culprit for the spread of the "disease" to other parts of the world. While a complete return to autarky may have protected countries against these adverse effects, such a strategy would not have aided in mitigating idiosyncratic risks during periods of regular economic activity. Does this then imply that countries should take up a position at the other end of the spectrum and become completely open? Either extreme is unlikely to be the answer. This then prompts the question: just how open is too open? This question may be quite difficult to answer categorically and is likely to depend both on the "state" of the economy and the "pathways" of contagion. In this paper, I study the pathways of contagion themselves and as with any other disease, will try to identify (a) how the "disease" is transmitted and (b) how the pathways of contagion contribute to the impact of the crisis on the host. With openness as the prime suspect, I look at the two variants of openness that may be associated with the propagation of a crisis: trade openness and financial openness.

In contrast to previous studies, my approach allows us to ask, among other things, whether the role of openness in the financial crisis was an *"asymmetric"* one, i.e. whether over time openness was transmuted from a "vector" contributed to the transmission of the crisis to a "remedy" that mitigated the negative effect of the crisis. Establishing this result would suggest policies that change over shorter periods of time during the crisis to take advantage of this asymmetry, instead of static policies implemented throughout the duration of the crisis, consequently slowing down

the return to normalcy. It would also help to determine what type of openness – trade or finance- has more of an impact as a vector and a remedy. Answering this question also has critical policy implications. For, it tells us whether countries must opt to become more (less) open via trade or finance in times of crises when becoming more (less) open is deemed viable. This study can thus provide invaluable insights towards developing efficient policies to account for openness in both the presence and absence of crises, bringing us one step closer to answering that ever illusive question of how open is too open. The brief summary of the literature which follows is by no means exhaustive, but serves first to point out the different views on the effects of the different kinds of openness on an economy; second, to show the need for the consideration of both types of openness in the analysis; and third, to highlight the gap in the literature and thus the contribution of this paper.

Stiglitz (1999) highlighted the dangers of premature financial market liberalization, pointing out that financial openness, while appropriate for economies with strong regulatory structures may harm those without such institutions, leading to risky lending behavior by banks faced with a sudden influx of capital. Examining the Asian financial crisis of the late 90s in this light, Stiglitz casts doubt on the efficacy of financial liberalization favoring trade openness instead. Hamdi and Jlassi (2014) studied 58 developing economies between 1984 and 2007 to determine whether financial liberalization led to any of the banking crises that occurred within that time period. Using a panel logit estimation procedure, they find no relationship between financial openness and crises.[1]

[1] The authors did show however that foreign debt liabilities and foreign direct investment liabilities increased the likelihood of a banking crisis.

Cavallo and Frankel (2008) used annual data for all countries listed on the IMF financial statistics database between 1970 and 2002 to find that trade openness reduces the impact of a crisis, suggesting a restorative role of trade openness during a crisis. A contradictory view was suggested by Classens et. al. (2010), who used a cross sectional dataset from 58 countries to study the impact of certain factors on the depth and the duration of the 2008 financial crises and found that an increase in trade openness led to increase both the duration and the severity of the financial crisis across countries. Classens et. al. (2012) presented further confirmation of this view by using accounting data from non-financial firms in 42 countries between 2007 and 2009 to show that the crisis had a larger negative impact on firms in countries that are more open to trade while financial openness had little to no contribution.

Ranciere et. al. (2006) addressed the question of the dual nature of financial openness by disaggregating the contribution of financial openness to growth and to the occurrence of financial crises. Using a panel dataset of 60 countries between 1980 and 2002, they find that the direct effect of financial openness on growth is much greater than a potential adverse indirect effect that might lead to a financial crisis. In other words, the authors suggest that the benefits of financial openness far outweigh the costs, corroborating the conclusions of Schmukler (2004) whose literature review on various studies on the benefits and risks of financial globalization, point to the conclusion that the net effect of financial openness is likely to be positive in the long run. Finally, Ozkan and Unsal (2012) contribute theoretically to the literature on systemic risk contagion. They develop a two country dynamic stochastic general equilibrium model to investigate the contagion effects of systemic risk, taking both trade and financial linkages into account, particularly mimicking the events of the 2008 crisis which showed a transfer from developed to developing economies. They

find that the lower the level of openness (both financial and trade), the lower the impact of the crisis.

It is by now evident that the existing literature yields conflicting results on the relationship between the effect of openness in a crisis, depending on the time frame, the measure chosen, the approach taken, and the countries studied. Besides these sources of variation, however, these studies share several common substantive shortcomings that I address presently.

One issue is using the drop in growth rate as a measure for the impact of a crisis, and assuming that this drop is entirely due to the crisis. This ignores the business cycle effects.[2] The second issue is the implicit assumption that financial crisis does not have a lasting effect on the level of output. In the case of the Great Recession for example, most studies assume that the effects of the crisis ended a short time afterwards. However, if it should turn out that financial crisis altered the overall *trend of output*, it would follow that a much longer return time to the pre-crisis path may be needed. The third issue is that a return to pre-crisis growth *rates* may be the result of depressed output, brought on by the financial crisis. This would overstate the growth rate, given that the base output is lower. In this case, a return to pre-crisis growth *rates* do not necessarily imply a return to the pre-crisis *state (output level)*.

I address these shortcomings by predicting counterfactual levels of output (and growth) for the post crisis era (2008 to 2013) from pre-crisis data as if the financial crisis of 2008 never took place. The impact of the crisis in each country for each time period is then measured by the difference

[2] To illustrate how this leads to a bias in measuring the role of trade in the transmission of crisis, consider an open agrarian economy with peak harvest periods of higher than average output and the exporting of the excess, and a planting season with a dip in output and thus of importing the shortage. Associating this regular decline in output to the crisis will (a) overestimate the impact of the crisis and (b) provide false evidence of a relationship between the crisis and trade.

between the predicted counterfactual output and the observed output. This enables us study the impact of openness on the effect of the crisis alone, without the inclusion of regular cyclical declines in output. In this way, I am able to extract the potential dynamic relationship between openness and the impact of the financial crisis on growth and output *separately* over time, instead of lumping them together.

These modifications highlight my main contribution. As far as I know, the drop in output and in growth rate have not been disentangled in studying the overall effect of the crisis, and the effect of the financial crisis on output has not been studied previously. The closest studies to mine nonetheless differ from mine in several significant ways. For example, a study by Furceri and Mourougane (2012) that considers the effects of financial crises in OECD countries between 1960 and 2008 focus on *potential* output estimates whereas I focus on *observed* output. A study by Berkmen et. al. (2009) that also examines the impact of the 2008 financial crisis focuses on growth rate, not on output level, but even then it uses growth forecast revisions by field experts in a static cross country context, rather than in a dynamic setting. Finally, a study by Gupta et al. (2007) that measures the effect of currency crises in developing countries between 1970 and 2000 bears some resemblance to mine but also differs from mine in one fundamental respect. Gupta et al. estimate a trend and then measure the annual deviation from that trend to capture the cycle. They then use the change in this measure at times of currency crises as an indication of the effect of the currency crisis. Here, the key difference with my methodology is that by estimating a counterfactual in projecting estimated output and growth, my approach allows for the possibility of *changes* in the trend itself while theirs does not.

What remains is organized as follows; section 2 discusses the data and estimation procedures used for both the prediction of the counterfactual output, as well as the analysis of the relationship

between openness and the crisis. Section 3 discusses the estimation results and robustness checks. Section 4 concludes.

1.2. Data and Estimation Procedures

1.2.1 Data

As with most empirical studies, the problem of data availability is present in this analysis. To overcome this problem, I use two datasets: Annual and quarterly. Each has its own advantage; the quarterly data yields fewer countries but more time entries (large N and large T setup); the annual data yields more countries and less time entries (Large N and small T setup). Both datasets are analyzed using different procedures designed to handle the varying country and time sizes. The annual dataset consists of 50 countries between 2008 and 2013, and the quarterly dataset consists of 30 countries between the first quarter of 2008 and the fourth quarter of 2013[3]. Output is measured by real gross domestic product and growth is measured by the change in output between any two time periods.

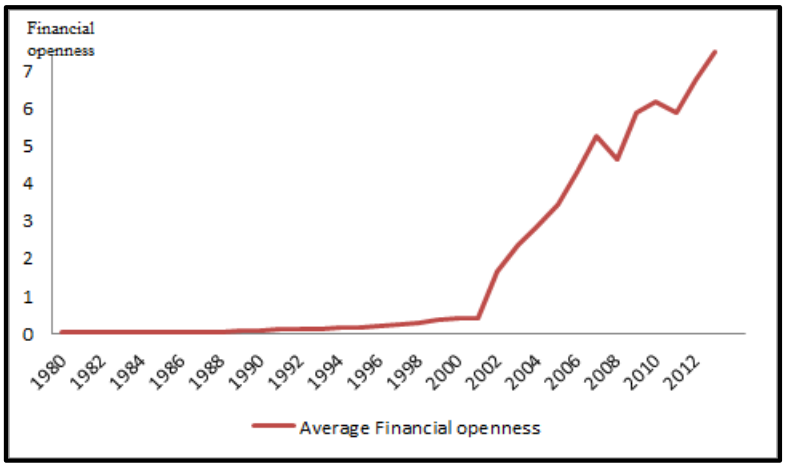
1.2.1.1 Measure of financial openness

There are two main measures of financial openness used in this paper; a de-facto measure which captures the actual flow of financial capital across countries, and a de-jure measure which measures the restrictions placed on capital mobility across countries. The de-facto measure is obtained by aggregating a country's total international investment position, which is a sum of its external assets and liabilities[4] as a fraction of its GDP, in line with the Lane-Milesi-Ferretti (2001) definition. This implies that quarterly, as well as annual observations of this measure of financial

[3] A full list of the data used as well as their sources can be found in table A.2 of Appendix 1.
[4] Assets and liabilities used here are sums of both direct investment and portfolio investment

openness can be obtained. The de-jure measure is one developed by Chinn and Ito (2006). However, this measure is only an annual measure and has no quarterly equivalent. Figure 1 below summarizes the average de-facto financial openness measures for the 50 countries used in this analysis.

Figure 1: Average financial openness over time

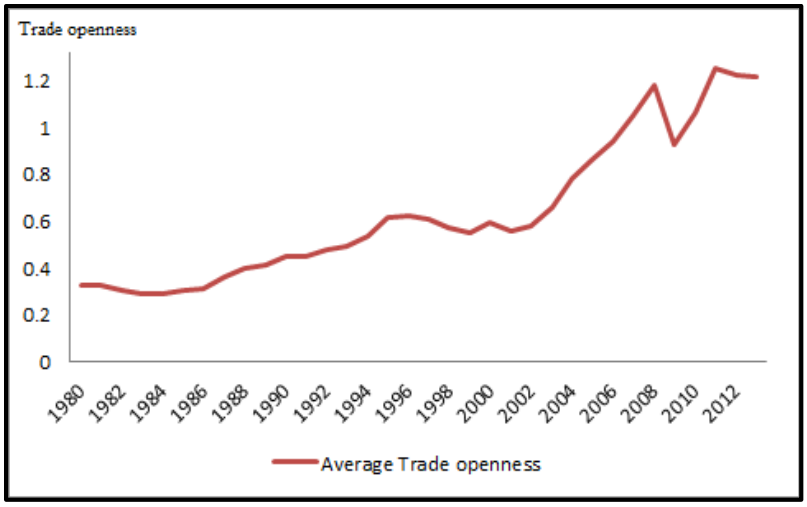


1.2.1.2 Measure of Trade openness

The measure of trade openness used in this paper is the sum of exports and imports as a fraction of GDP, which allows for a quarterly and an annual measure. As with all measures of trade openness, there are potential issues with this measure, primarily the fact that this measure only captures a country's level of integration in international markets and not its trade policies that might hold more information about its attitude towards openness. An example of this might be a country that has limited resources and has no choice but to engage in importation to sustain itself. This country would appear open to trade using this measure, but might have very strict export restrictions that might make its measure of openness lower using other trade measures. An ideal alternative measure for trade openness would be the tariffs placed on goods in each country. The

problem with this is that these tariff measures depend on what each country can produce and the preferences of its constituents. As a result, it provides no real comparison across countries and fails to measure the extent of a country's integration in the international market, but provides information on trade policies (regarding certain goods). Ultimately the measure of trade openness used here is because of its availability, its measure of the level of integration and for easier comparison to other works in the literature. Figure two below captures the average measure of Trade openness for the 50 countries used in this study.

Figure 2: Average trade openness over time



In the following sub-sections, I examine the estimation procedures that will be applied to both data sets. First, I discuss the procedure used in estimating the effect of the crisis on both the growth rate and the output level. Next, I discuss the Arellano Bond GMM approach to estimating the annual dataset, and finally, the application of the pooled mean group estimate (PMG) to the quarterly dataset.

1.2.2 Measuring the impact of the crisis

I estimate the counterfactual GDP for a different panel of countries for both the annual and quarterly datasets in order to take advantage of the differing measures of openness available at the annual level, and the increase in the number of time parameters at the quarterly level thereby getting a better fit for each dataset. Using pre crisis data[5], I fit an Auto regressive (AR) model to GDP and then forecast post crisis GDP using 2007 observed data and the same estimated AR specification. The Schwarz information criterion (SIC) is used in selecting the appropriate AR model[6]. This way, the pre-crisis pattern is not broken due to the financial crisis thus generating counterfactual estimates. However, these estimates are subject to prediction errors, which I subsequently correct for, i.e.

$$Y^{A}_{i,t} = Y^{P}_{i,t} + \varepsilon^{P}_{i,t} \text{ for pre-crisis data where,} \quad (1)$$

Where, $Y^{A}_{i,t}$ is the observed pre crisis GDP for country i at time t; t = 1980 to 2007 for annual data and 1996 second quarter to 2007 fourth quarter for quarterly data; $Y^{P}_{i,t}$ is the predicted GDP value for country i at time t using the determined pre-crisis AR process as described above; $\varepsilon^{P}_{i,t}$ is the prediction error for country i at time t in the pre-crisis period. In order to generate a more accurate value for the predicted GDP for the crisis period, I first generate an average prediction error for each country from the pre-crisis period,

$$\frac{1}{T}\sum_{t=1}^{T}\varepsilon^{P}_{i,t} \equiv \varepsilon^{P}_{i} \text{ for each country i,} \quad (2)$$

[5] 1980 to 2007 for annual dataset and second quarter in 1996 to fourth quarter in 2007 for the quarterly dataset
[6] usually the one with the smallest SIC value

and then augment the initial counterfactual estimates with this estimated prediction errors. I simply add the estimate of each country's prediction error $\varepsilon^{p}{}_{i}$ to the initial forecasts $Y^{if}{}_{i,s}$, i.e.

$$Y^{ff}{}_{i,s} = Y^{if}{}_{i,s} + \varepsilon^{p}{}_{i} \quad (3)$$

where, $Y^{ff}{}_{i,s}$ is the final forecast value of post crisis GDP, and s = 2007 to 2013 for both annual and quarterly data; $Y^{if}{}_{i,s}$ is the initial forecast value of post crisis GDP from the pre-crisis AR process

These predicted values capture an approximate pattern of the pre-crisis GDP, including the trend and cycle behavior, the same pattern that would exist in the post-crisis GDP pattern. This is in opposition to a trend-cycle decomposition which does not allow for a deviation from a trend in the post crisis period due to the impact of the crisis. This makes taking the difference between the post crisis estimates and the observed post-crisis values a more accurate measure of the impact of the crisis. As such, the impact of the crisis for observations after the crisis is given as;

$DLevel_{i,t} = Y^{ff}{}_{i,t} - Y^{A}_{i,t}$ (for GDP level) and (4)

$DGrowth_{i,t} = \Delta Y^{ff}{}_{i,t} - \Delta Y^{A}_{i,t}$ (for GDP growth) where Δ indicates first difference (5)

$DLevel_{i,t}$ is the difference between the predicted and observed level of GDP for country i at time t (measure of the impact on output)

$DGrowth_{i,t}$ is the difference in the predicted and observed growth rate of GDP for country i at time t (measure of the impact on growth)

1.2.2.1 Robustness checks for the measures of the impact of the financial crisis

1.2.2.1.1 Testing the significance of the measure

Now that I have established the AR specification and estimated the counterfactuals for the post-crisis period, I determine their signs and test that they are significantly different from zero. Since the output level and growth rates fell below the norm during the crisis, one would expect positive and statistically significant measures of $Dlevel$ and $DGrowth$[7]. Figures 3 through 6 below depict the average of the estimated variables $Dlevel$ and $DGrowth$ for all countries in this study over time for both the quarterly and annual datasets, i.e. I define the average of the measures $Dlevel$ and $DGrowth$ as μ_{it} such that

$$\mu_{1t} = \frac{1}{N_1}\sum_{k=1}^{N_1} Dlevel_{kt}$$, for t from 2008 to 2013, and N_1 = 50

$$\mu_{2t} = \frac{1}{N_1}\sum_{k=1}^{N_1} DGrowth_{kt}$$, for t from 2009 to 2013, and N_1 = 50

$$\mu_{3t} = \frac{1}{N_2}\sum_{k=1}^{N_2} Dlevel_{kt}$$, for t from first quarter of 2008 to the fourth quarter of 2013, and N_2 = 30

$$\mu_{4t} = \frac{1}{N_2}\sum_{k=1}^{N_2} DGrowth_{kt}$$, for t from second quarter of 2008 to the fourth quarter of 2013, and N_2 = 30

Figures 3 through 6 suggest that on average, countries have not returned to their pre-crisis paths of output[8], but have returned to, and may have even surpassed their pre-crisis growth rates[9]. Since

[7] Since they are defined as Counterfactual – Observed, where counterfactual is the estimate of the norm

[8] Positive measure of average $Dlevel$

[9] Negative measure of average $DGrowth$

output levels dropped, this accelerated growth is expected in order for countries to return to their pre-crisis paths of output. Next, I determine the statistical significance of these estimates. To do this, I simply test the following hypotheses:

$H_0 : \mu_{1t} = 0; H_A : \mu_{1t} \neq 0$ for t : 2008 to 2013

$H_0 : \mu_{2t} = 0; H_A : \mu_{2t} \neq 0$ for t : 2009 to 2013

$H_0 : \mu_{3t} = 0; H_A : \mu_{3t} \neq 0$ for t : Q1 of 2008 to Q4 of 2013

$H_0 : \mu_{4t} = 0; H_A : \mu_{4t} \neq 0$ for t : Q2 of 2008 to Q4 of 2013

Figure 3: Average *Dlevel* for Annual data

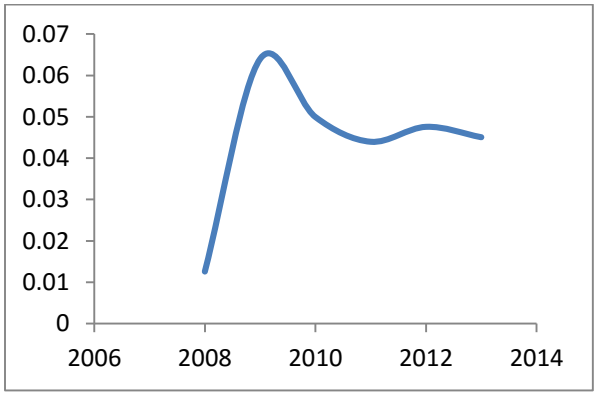


Figure 4: Average *DGrowth* for Annual data

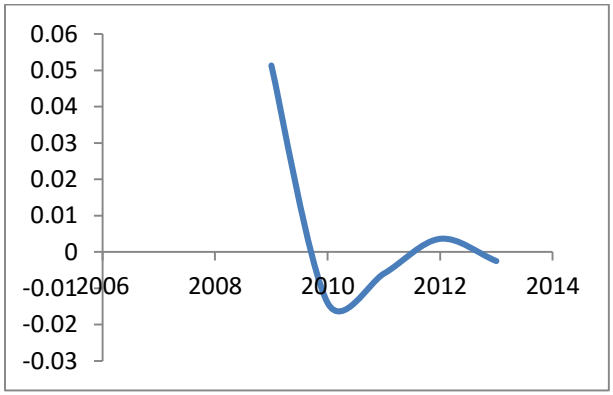


Figure 5: Average *Dlevel* for quarterly data

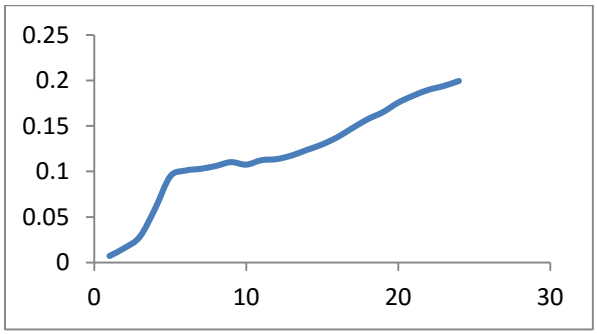
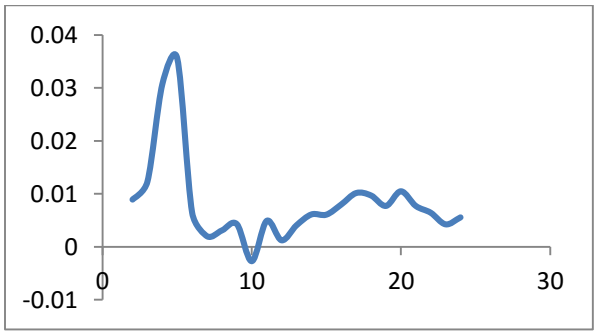


Figure 6: Average *DGrowth* for quarterly data



The results of the tests above are summarized in tables 1 and 2 below for Annual and quarterly data respectively.

Table 1: Significance tests of means for Annual dataset

year	Average of $Dlevel \equiv \mu_{1t}$	Average of $DGrowth \equiv \mu_{2t}$
2008	0.0125781***	
2009	0.0639665***	0.0513885***
2010	0.0499264***	-0.0140402*
2011	0.0439431**	-0.0059833
2012	0.0475517*	0.0036086
2013	0.0450365	-0.0025152

Table 1 above shows that on average, the *Dlevel* measure is significantly different from zero from 2008 to 2012, but not significantly different from zero in 2013. This coupled with the declining level of certainty levels for which the alternative hypothesis is preferred over the null, suggests that countries are indeed returning to their pre-crisis paths and may have finally done so in 2013.

Table 2: Significance tests of means for Quarterly data

Quarter	Average of $Dlevel \equiv \mu_{3t}$	Average of $DGrowth \equiv \mu_{4t}$
2008Q1	0.0072898**	
2008Q2	0.0161735***	0.0088837***
2008Q3	0.0284461***	0.0122726***
2008Q4	0.0591307***	0.0306846***
2009Q1	0.0946953***	0.0355646***
2009Q2	0.1010901***	0.0063948*
2009Q3	0.1030475***	0.0019575
2009Q4	0.1061131***	0.0030655**
2010Q1	0.1103523***	0.0042393*
2010Q2	0.1075974***	-0.002755
2010Q3	0.1124677***	0.0048703**
2010Q4	0.1136581***	0.0011903
2011Q1	0.1176826***	0.0040246*
2011Q2	0.1237616***	0.0060789***
2011Q3	0.1297985***	0.0060369***
2011Q4	0.1377528***	0.0079543***
2012Q1	0.1478687***	0.0101159***
2012Q2	0.1575301***	0.0096613***
2012Q3	0.1652186***	0.0076885***
2012Q4	0.1756748***	0.0104562***
2013Q1	0.1833594***	0.0076846***
2013Q2	0.1897645***	0.0064052***
2013Q3	0.1939742***	0.0042097*
2013Q4	0.1994969***	0.0055227***

For tables 2 and 3, *,**, and *** signify significance at the 10%, 5% and 1% level respectively. t tests

This implies that the financial crisis of 2008 lasted, at least in this group of countries till 2012 which I will abide by during my analysis of the annual dataset. The average *DGrowth* measure from Table 1 which is significant only in 2009 and 2010 suggests that this group of countries on average returned to their pre-crisis path of growth much quicker than output, implying that the financial crisis lasted till 2010, which is the general view adopted by others in the literature. Table 2 above shows stronger significance of both the *Dlevel* and *DGrowth* measures than the findings in Table 1, which suggests that on average, these countries are still yet to return to their quarterly pre-crisis paths of both output and growth, as both average measures are positive[10] and statistically significant. Tables 1 and 2 provide evidence that the effects of the financial crisis of 2008 lasted beyond 2010 for these countries under investigation, at least where the level of output is concerned.

1.2.2.1.2 Why trust these counterfactuals estimates?

The claim that these measures better capture the impact of the financial crisis on output and growth depends on how well the AR specification estimated for the progression of Output (and therefore growth) fits the observed data. An alternate approach would have been to use output and growth forecasts by recognized economic research institutions such as the International Monetary Fund (IMF) as post crisis counterfactual measures. The IMF in a particular year uses the observed growth rates for the two preceding years to predict the growth rates for each country over the next six years[11]. My claim is that my "in-sample" estimation yields a closer match to the actual progression of GDP than the IMF's out of sample forecasts. In essence, I cheat and in fact, suggest that cheating in this case gives rise to more accurate counterfactuals necessary for my analysis. To

[10] Recall that, a positive measure of *Dlevel* or *DGrowth* implies that the counterfactual estimate is greater than the observed.
[11] Theirs is also an AR(2) Model

examine the potential accuracy of my "retrospective" counterfactual, I determine how well my AR specification performs by comparing the forecasts of the IMF to my predicted estimates of annual[12] pre-crisis growth and the observed pre-crisis data. Since at the time of forecasting, the IMF had less information than I do now, I expect that my estimates – as they are obtained using in-sample observations – would better match the observed growth data than the IMF's Forecasts. It is useful to think of the IMF forecasts as the absolute lower bound that my model has to at least match to be useful in this analysis and the observed data as the absolute upper bound. As a result, I first compare estimates of growth rates for the following years: 1990 – 1995, 1995 – 2000, 2000 – 2005 to the observed data, and second, compare my estimates to those of the IMF. Figures 7, 8 and 9 below show the average predictions and observed growth rates for the three time periods examined.

Figure 7: 1990 – 1995 predictions

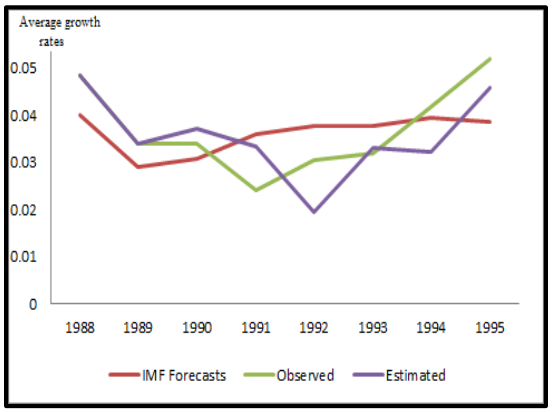
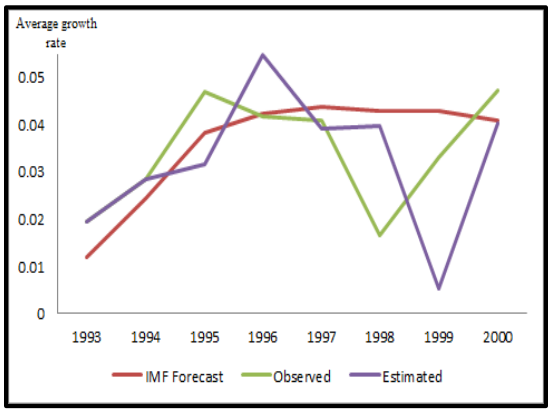
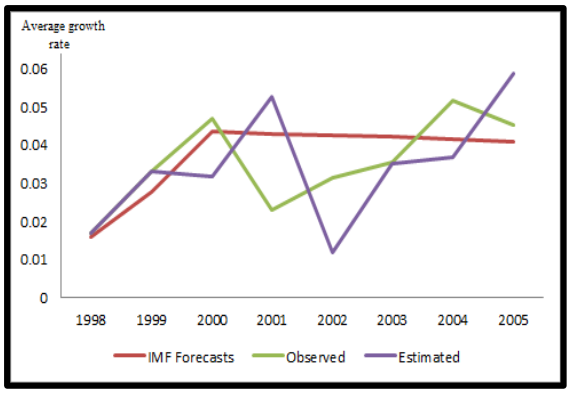


Figure 8: 1995 – 2000 predictions



[12] The IMF does not provide quarterly forecasts so we are limited to comparing just the annual estimates

Figure 9: 2000 – 2005 predictions



From the figures above, it appears that my estimates mimic the behavior of the observed growth rates better than the IMF forecasts, but to see if the difference is statistically significant, I test the correlation of the predictive models with the observed data and with each other, in order to determine which model does a better job of matching observed growth rates. If $g_{i,t}^{est}$ is my growth rate prediction, $g_{i,t}^{imf}$ is the IMF predicted growth rate and $g_{i,t}^{obs}$ is the observed growth rate, for country i at time t, the following table summarizes the accuracy of both models when predicting observed annual growth rates. A positive and statistically significant correlation coefficient closer to one (the 45-degree equality line) when compared with the observed growth rates will indicate a higher level of accuracy of the model while a negative or statistically insignificant correlation coefficient indicates poor performance.

From columns 2 and 3 of table 3, my model is positive and statistically significant (PSS) 13 out of the 18 years examined, while the IMF forecasts are PSS only 11 out of the 18 years forecasted. Of the 13 years my model is PSS, 10 of them show a higher correlation coefficient with the observed data than the IMF forecasts. Column 4 highlights the correlation between my forecasts and those of the IMF. This column indicates that about 50% of the time, my forecasts and those of the IMF

are correlated, all be it when both are more correlated with the observed data. These results suggest that my "in-sample" estimates on average do better at matching the observed pre-crisis data than the IMF's out of sample forecasts as expected and as suggested by figures 3 through 5.

Table 3: Predictive model analysis

Year	$Corr(g^{EST}, g^{OBS})$	$Corr(g^{IMF}, g^{OBS})$	$Corr(g^{EST}, g^{IMF})$	N
1990	0.6941*	0.7765*	0.6531*	41
1991	0.5887*	0.4907*	0.3614*	41
1992	0.6265*	0.4681*	0.4282*	41
1993	0.4894*	0.3920*	0.4153	41
1994	0.197	0.2979	0.3554*	41
1995	0.3888*	0.5459*	0.1648	41
1995	0.5537*	0.5741*	0.4354*	46
1996	0.3306*	0.2571	0.2721	46
1997	0.5891*	-0.01	0.0463	46
1998	0.3681*	-0.4486*	-0.0854	46
1999	0.2820	-0.0371	-0.4691*	46
2000	0.278	0.2383	-0.0403	46
2000	0.5222*	0.5148*	0.7242*	47
2001	-0.237	0.0395	0.1752	47
2002	0.2107	0.6404*	0.0808	47
2003	0.6183*	0.5022*	0.574*	47
2004	0.5770*	0.5295*	0.4495*	47
2005	0.5512*	0.5051*	0.4598*	47

* here represents a statistically significant correlation coefficient at the 95% level confidence interval

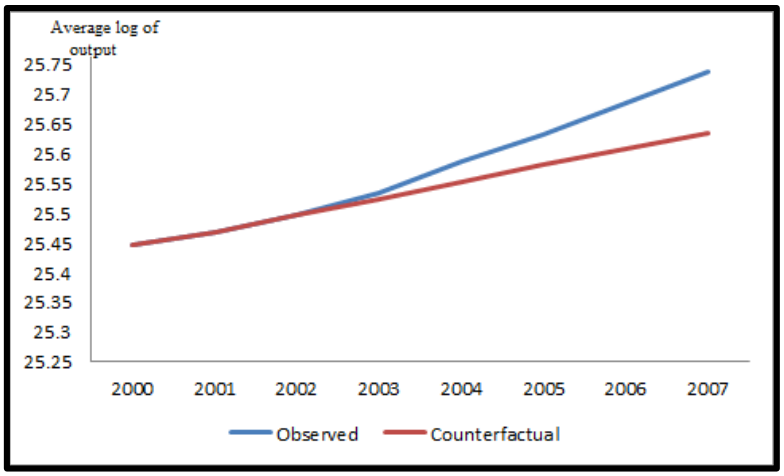
In addition, the fact that the AR specification employed by the IMF in predicting these growth rates is not readily available, therefore making post-crisis counterfactual estimation that much harder, makes my estimates the better choice for this analysis.

1.2.2.1.3 Why trust these as measures of the impact of a crisis?

Before this new measure is ratified as an improvement over the traditional measure, one question still remains: How certain is it that this deviation from the norm is due to the financial crisis of 2008 and not some random effect that is a result of left over prediction errors? In order to provide an answer to this question, I carry out a "falsification" test by assuming (erroneously, of course) that there was a financial crisis in 2003. I therefore follow the same process and estimate

counterfactuals for the post 2003 periods and compare my estimates to the observed data. If this procedure is truly representative of the impact of the crisis, I would expect to capture the "boom" that existed before the "bust" in 2008. This should manifest as higher observed output levels than the estimated counterfactuals, leading to negative estimates of *Dlevel* . Figure 10 below shows both the counterfactual estimates and the observed data under this erroneous assumption. I can clearly observe that the counterfactual estimates are consistently lower up till 2007, depicting evidence of the price boom.

Figure 10: Falsification tests



Lastly, I show that this difference between the counterfactuals and the observed data is negative and statistically significant.

Table 4: Significance of falsification tests

Year	Average Counterfactual	Average Observed	Average (Counterfactual – Observed)	N
2003	25.52304	25.53312	-0.0100758***	50
2004	25.55187	25.58544	-0.0335672***	50
2005	25.5802	25.63136	-0.0511539***	50
2006	25.60799	25.68331	-0.0753218***	50
2007	25.63522	25.73839	-0.1031708***	50

Table 4 above captures the tests of the differences between counterfactual and observed data across time and it can be observed that all differences are statistically significant at the 99% level. When I consider the fact that starting in 2008 the signs are positive and significant, it suffices to say that this measure indeed captures the impact of the 2008 financial crisis on the countries studied.

1.2.3 Annual Data Estimation Procedure

The following two regression equations are individually estimated for the annual panel dataset to capture the effect of both types of openness on the impact of a financial crisis, using both the level and the growth rate of GDP:

$$DLevel_{i,t} = \alpha_{1i} + \beta_1 TO_{i,t} + \beta_2 FO_{i,t} + \varepsilon_{i,t} \quad (6)$$

$$DGrowth_{i,t} = \alpha_{2i} + \beta_3 TO_{i,t} + \beta_4 FO_{i,t} + \varepsilon_{i,t} \quad (7)$$

Where,

α_{1i} & α_{2i} are the individual country specific fixed effects of country i with respect to GDP and growth respectively

$TO_{i,t}$ is the measure of trade openness for country i at time t and

$FO_{i,t}$ is the measure of financial openness for country i at time t

To eliminate the country fixed effects, the first difference of each equation is taken and given as

$$\Delta DLevel_{i,t} = \beta_1 \Delta TO_{i,t} + \beta_2 \Delta FO_{i,t} + \Delta\varepsilon_{1i,t} \quad (8)$$

$$\Delta DGrowth_{i,t} = \beta_3 \Delta TO_{i,t} + \beta_4 \Delta FO_{i,t} + \Delta\varepsilon_{2i,t} \quad (9)$$

The problem with estimating these equations as they are is that there is a potential for the violation of the orthogonality condition, i.e. $Cov\left(\Delta TO_{i,t}, \Delta\varepsilon_{i,t}\right) \neq 0$ and $Cov\left(\Delta FO_{i,t}, \Delta\varepsilon_{i,t}\right) \neq 0$. This potential violation is due to the fact that a change in openness could cause a change in the error terms $\Delta\varepsilon_{1i,t}$ & $\Delta\varepsilon_{2i,t}$, implying a correlation between the independent variable and the error term. Drawing again on the earlier agrarian economy example, a change in openness could result in the acquisition of sophisticated farming equipment that could lead to a boost in output and growth. This could in turn, close the gap between predicted and actual GDP much quicker, implying that there is a correlation between the change in openness and the change in the shock to GDP. To address this issue, I use the Arellano and Bond general method of moments (GMM) estimation procedure. It makes use of an instrument variable $z_{i,t}$, which consists of t-1 lags of the regressors such that $Cov\left(z_{i,t}, \Delta\varepsilon_{i,t}\right) = 0$. This provides better estimates of β_i's and avoids the problem of weak instruments. In this paper, I use the first lag of financial openness and trade openness only as instruments, as there is no weak instrument problem by definition. This also enables us utilize as much of the dataset as possible. I allow for heteroscedasticity across countries by using the weighting matrix suggested by Arellano and Bond. A positive and statistically significant coefficient on either openness measure would mean an increase in openness, increases $DLevel_{i,t}$ (or $DGrowth_{i,t}$), which implies a larger impact on the economy for both output level and growth, hence, a PSS coefficient implies a deleterious effect of openness on the economy, and a negative coefficient implies a positive contribution.

1.2.4 Quarterly data estimation

With the increased number of time observations in the quarterly dataset and the decrease in the interval between each observation when compared to the annual dataset, a different approach is called for to better examine the relationship between the deviation from the predicted values and the openness measures. I consider an autoregressive distributed lag (ARDL) specification, which is more suitable because, given the smaller interval between observations in this dataset; lags of both the dependent and independent variables might affect the present level of deviation. I simplify the analysis by once again considering just the first lag of both dependent and independent variables. I justify this with the fact that the data on GDP of the economies studied in this paper follow an AR (1) process[13], which implies that the ARDL specification should contain at most one lag of the dependent variable. This also provides an extra advantage that enables us to utilize as much of the data in the sample as possible with the loss of only one "time" observation. As a result, I estimate the following equation:

$$DLevel_{i,t} = \mu_{1i} + \lambda_{1i} DLevel_{i,t-1} + \delta_{10i} TO_{i,t} + \delta_{11i} TO_{i,t-1} + \delta_{20i} FO_{i,t} + \delta_{21i} FO_{i,t-1} + \varepsilon_{1i,t} \quad 10$$

$$DGrowth_{i,t} = \mu_{2i} + \lambda_{2i} DGrowth_{i,t-1} + \delta'_{10i}\, TO_{i,t} + \delta'_{11i}\, TO_{i,t-1} + \delta'_{20i}\, FO_{i,t} + \delta'_{21i}\, FO_{i,t-1} + \varepsilon_{2i,t} \quad 11$$

These yield the error correction re-parameterization estimation equations written as

$$\Delta DLevel_{i,t} = \phi_{1i} \left(DLevel_{i,t-1} - \theta_{0i} - \theta_{1i} TO_{i,t} - \theta_{2i} FO_{i,t} \right) + \delta_{11i} \Delta TO_{i,t} + \delta_{21i} \Delta FO_{i,t} + \varepsilon_{1i,t} \quad 12$$

$$\Delta DGrowth_{i,t} = \phi_{2i} \left(DGrowth_{i,t-1} - \omega_{0i} - \omega_{1i} TO_{i,t} - \omega_{2i} FO_{i,t} \right) + \gamma_{11i} \Delta TO_{i,t} + \gamma_{21i} \Delta FO_{i,t} + \varepsilon_{2i,t} \quad 13$$

[13] See table A.3 in Appendix 1

Where $\phi_{1i} = -(1-\lambda_{1i})$; $\theta_{0i} = \frac{\mu_{1i}}{1-\lambda_{1i}}$; $\theta_{1i} = \frac{\delta_{10i}+\delta_{11i}}{1-\lambda_{1i}}$; $\theta_{2i} = \frac{\delta_{20i}+\delta_{21i}}{1-\lambda_{1i}}$ $\phi_{2i} = -(1-\lambda_{2i})$; $\omega_{0i} = \frac{\mu_{2i}}{1-\lambda_{2i}}$;

$\omega_{1i} = \frac{\delta'_{10i}+\delta'_{11i}}{1-\lambda_{2i}}$ and $\omega_{2i} = \frac{\delta'_{20i}+\delta'_{21i}}{1-\lambda_{2i}}$

ϕ_{1i} & ϕ_{2i} are the error correction speed of adjustment parameters that signify a return to some equilibrium level (0 in this case). θ_{1i} and θ_{2i} are the long run coefficients of trade and financial openness respectively for deviation from output level and δ_{11i} and δ_{21i} are the short run coefficients of trade and financial openness respectively, for deviation from output level. ω_{1i} and ω_{2i} are long run coefficients of trade and financial openness and γ_{11i} and γ_{21i} are short run coefficients of trade and financial openness respectively for deviation from growth. If ϕ_{1i} and ϕ_{2i} are insignificant, it implies no adjustment on the part of the dependent variable with respect to changes in the independent variables, meaning no effect of openness on the deviations from output level and growth due to the financial crisis. The pooled mean group estimation procedure proposed by Pesaran, Shinn and Smith (1999) is used to estimate equations 12 and 13 above. The pooled mean group estimator allows for variability in the short term behavior in each country but assumes long run similarities. This is better suited to my needs as I accept the fact that countries are heterogeneous, but assume that all countries in the sample should eventually return to their pre-crisis paths of output and growth. The heterogeneity across countries is taken care off in the estimation of the constant terms θ_{0i} and ω_{0i} as they represent estimates of country fixed effects for *Dlevel* and *DGrowth* respectively. This PMG estimation method adds an extra dimensionality to my study. It is possible to observe the short run and long run effects of openness on the impact of a financial crisis to determine if there is a change in effect as time progresses.

1.3. Results

1.3.1 Annual data

For this dataset, I estimate the pre-crisis AR model using all 50 countries between 1980 and 2007. This process is used in the counterfactual estimation of GDP for 2008 to 2012[14]. Table A.3 in appendix 1 shows that the best fit for this dataset is an AR (2) process. Table 5 below summarizes the result of the regression estimates for equations 8 and 9. From table 5 below, an increase in trade openness reduces the DLevel and DGrowth measures, implying a positive impact of trade openness during the financial crisis. The de-facto financial measure of openness however, has a positive effect on growth and a negative impact on output during the financial crisis, while the de-jure measure has a positive impact on output but no effect on growth. This difference might be due to the fact that the de-jure measure captures the willingness of countries to allow foreign investments within their borders, while the de-facto measure is an overall measure of existing levels of integration (both within and outside their borders). I also account for possible policies which may change over time and might have an impact on a country's ability to overcome the negative effects of the financial crisis. I do this by introducing time fixed effects to capture both observed and unobserved factors that are specific to different time periods, which could have influenced the return to pre-crisis paths of output and growth. It stands to reason that changes in these policies over time are not consistent across economies and as such, I address this by assuming heteroscedasticity in the error term. The inclusion of time fixed effects (TFE) in the analysis do not alter the earlier findings, suggesting that the effect of trade openness and both measures of financial openness on the impact of the financial crisis is robust to these changing policies.

[14] We stop at 2012 as the annual data suggests that countries on average have converged to the pre-crisis output path by 2013, and as such is not included in the analysis

Table 5: Trade and Financial openness and the Economic Crisis: Annual data

	DLEVEL				DGROWTH			
	1	2	3	4	5	6	7	8
TO	-0.10***	-0.13***	-0.12***	-0.14***	-0.37***	-0.09**	-0.42***	-0.09**
FO	0.03***	0.016***			-0.07***	-0.04***		
FOC			-0.11***	-0.08**			0.02	0.07
TFE	NO	YES	NO	YES	NO	YES	NO	YES

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively
Estimating equations 8 and 9, using Arellano-Bond GMM estimation procedure
TO is trade openness, FO is de-facto measure of financial openness, FOC is the Chinn-Ito de-jure measure of financial openness and TFE signifies the inclusion of time fixed effects.

3.2 Quarterly data

For this dataset which consists of 30 countries with time periods between the first quarter of 2008 and the fourth quarter of 2013, I once again fit an AR model to the progression of GDP using data from the same set of countries between the second quarter of 1996 and the fourth quarter of 2007. Table A.3 of appendix 1 shows that this dataset is best described by an AR (1) process. Table 6 below summarizes the findings from the analysis of the quarterly data set.

Table 6: Trade and Financial openness and the Economic Crisis: Quarterly data

Variable	DLEVEL		DGROWTH	
ϕ	-0.095***	-0-091***	-0.817***	-0.813***
TO	0.057	0.141	0.013	0.0495**
FO	-0.0004***	-0.0004***	-0.00004	-0.00002
θ_0	0.017***	0.015***		
ω_0			0.004***	0.00066
ΔTO	-0.464***	-0.469***	-0.495***	-0.499***
ΔFO	-0.008	-0.008	-0.0095	-0.0092
TFE	NO	YES	NO	YES

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively
Estimating equations 12 and 13 using Pesaran et. al. Pooled mean group (PMG) estimation procedure
TO is trade openness, FO is de-facto measure of financial openness, ϕ is the speed of convergence, θ_0 and ω_0 are the estimated country fixed effects for DLevel and DGrowth respectively and TFE signifies the inclusion of time fixed effects

The results show convergence to the pre-crisis path, with evidence of trade openness in the short run encouraging a return to the pre-crisis path of output and growth. There is no initial long run trade openness effect on convergence to the pre-crisis path of growth, but an inclusion of time fixed effects reveals a negative impact of trade openness. This could be due to some unobserved factor working to nullify the negative effects of trade openness on growth, but when the time fixed effects are introduced, which accounts for this unobserved factor, the true relationship between trade openness and the impact of the crisis on growth is revealed. The results from table 6 above also indicate a robust positive long run effect of financial openness on a return to pre-crisis output path, and no short run relationship. There is however, no short or long run effect of financial openness on the growth rate. These results seem to suggest that post-crisis production was stimulated by both trade and financial openness while growth was primarily stimulated by trade alone and only in the short run, but is harmed by trade in the long run. The significance of the constant terms supports the assumption made earlier that there is a difference across countries, which accounts for country specific characteristics that influence the long run relationship between the deviation from the pre-crisis paths of both growth and output and the levels of openness. I can find evidence of the dual role of trade openness in the table above which puts the differing results in the literature into perspective, but more on this later. To provide a basis for comparison across the two datasets: annual and quarterly, the countries common to both datasets are obtained and regressions using the respective estimation procedure is carried out for both reduced datasets. The results of these regressions are shown in Table 7 below. The same pattern is observed in both these datasets suggesting a uniformity in the findings.

Table 7: Comparison across Annual and Quarterly datasets

	Annual		Quarterly	
	DLEVEL	DGROWTH	DLEVEL	DGROWTH
TO	-0.17***	0.01***	-0.54***	0.07***
FO	0.02	-0.017***	-0.001	-0.0013*
TFE	yes	yes	yes	yes
Countries	23	23	23	23

1.3.3 Robustness Checks

Taking a cue from previous works that have studied the differences in impact of financial crises across different countries, tables 8-13 establish the robustness of my results by introducing the following variables known to have influenced the degree of the impact of financial crises.

1.**3.3.1** **Bank Lending rates**: I expect that the lower the lending rates during a crisis, the more loans can be granted and ultimately, the higher the levels of both output and growth which implies lower Dlevel and DGrowth measures. This suggests that a positive coefficient is expected when lending rates are introduced to the analysis. Tables 8 - 11 show a consistently positive and strongly significant coefficient verifying my assumption. I find that trade openness is robust to the inclusion of this measure for both output and growth. I also find that the de-jure measure of financial openness is robust when considering output levels and consistently insignificant when considering growth, while the de-facto measure is robust for growth but not robust for output[15].

1.3.3.2 Net Reserves: Berkmen et. al (2009) find evidence that the higher the international reserves an economy possesses, the smaller the effect of the financial crisis. I would therefore expect that countries with higher net reserves would be affected less, which would suggest a

[15] The reduction in the number of countries for the quarterly dataset due to data availability rendered estimation impossible, so results for bank lending rates are only presented for the annual dataset.

negative coefficient for both output and growth. I find that for the group of countries studied in the annual dataset, this measure is only significant for growth rate measures using the de-facto measure of financial openness, but I find a different sign than what was expected suggesting a harmful role for the accumulation of reserves in the economy. Perhaps this is a reflection of economies that were too cautious and saved too much at the expense of growth. Measures of openness are however robust to the inclusion of the net reserves variable in this dataset. The quarterly dataset while having the expected sign is not significant for both output and growth. In addition, I find that the de-facto measure of financial openness is not robust to its inclusion, while the trade measure is.

1.3.3.3 Current Account Balance: Berkmen et. al (2009) also find evidence that lower current account deficits are associated with a lower impact of financial crisis and as such, I expect that the higher the current account balance (more positive), the lower the effect of the financial crisis suggesting a negative coefficient. I find in the annual dataset that while the expected sign was obtained, the coefficients were always insignificant and the trade and financial openness measures were robust to its inclusion. The quarterly dataset however shows a strong significance with the expected negative sign, confirming my hypothesis with only the trade openness measure being robust to its inclusion.

1.3.3.4 Domestic Financial development: I use the ratio of domestic credit to GDP for both the financial sector and the private sector as a proxy for this variable[16]. The assumption is that the more developed an economy's financial system, the higher the credit made available for sectors that need it. This would imply a lower reliance on international financial transactions thereby limiting the effects of the financial crisis. As a result, I expect that the higher the levels of domestic

[16] Quarterly Data on domestic credit to the financial sector could not be obtained, so only the estimates from the domestic credit to the private sector are reported

credit, the lower the impact of the crisis, suggesting a negative coefficient for both proxies. For the annual dataset, I find the expected sign and statistical significance with respect of output levels but no significance with respect to growth. I also find that both measures of openness are robust to the inclusion of this variable. For the quarterly dataset, I estimate a significant coefficient with a different than expected sign with respect to output and an insignificant coefficient with the expected sign with respect to growth, but both openness measures are robust to the inclusion of this variable.

1.3.3.5 Exchange rates: I use the real and nominal effective exchange rates for this measure in order to de-emphasize any advantage in exchange rates not originating from the country of interest. This feature is inherently built in to this measure due to the fact that this variable measures a currency against a weighted average of several foreign currencies. Unlike the standard bilateral exchange rate, an increase in the nominal or real effective exchange rate implies an appreciation of the local currency[17]. The overall effect of an increase in the exchange rate is difficult to pin down as it is due to the characteristics of the economy (export oriented or import reliant) as well as the price and quantity effect. In my annual dataset, I find that only nominal effective exchange rate is statistically significant with respect to output while both nominal and real effective exchange rates are statistically significant with respect to growth. All these coefficients carry a positive sign suggesting that an appreciation of an economy's currency increases the impact of the financial crisis. Also, trade openness is robust to the inclusion of these variables while financial openness is ambiguous[18]. In the quarterly dataset, I find consistently negative coefficients with only the nominal effective exchange rate's effect on output levels being statistically significant.

[17] The real effective exchange rate is the nominal divided by the price deflator
[18] See tables 8-11

Trade openness is once again robust to inclusion of these variables while financial openness is not robust with respect to output and remains insignificant with respect to growth.

1.3.4 Accounting for the impact of openness on the speed of convergence

Next, I examine the effect of openness (both through trade and finance) on the speed of convergence of each country to its pre-crisis paths of output and growth. To do this, I disaggregate the quarterly panel dataset into individual time series for each country, and estimate the ϕ parameter (speed of convergence) for each country. I therefore estimate

$$\Delta DLevel^{j}_{t} = \phi^{j}_{1}\left(DLevel^{j}_{t-1} - \theta^{j}_{0} - \theta^{j}_{1}TO^{j}_{t} - \theta^{j}_{2}FO^{j}_{t}\right) + \delta^{j}_{11}\Delta TO^{j}_{t} + \delta^{j}_{21}\Delta FO^{j}_{t} + \varepsilon^{j}_{1t} \qquad (14)$$

$$\Delta DGrowth^{j}_{t} = \phi^{j}_{2}\left(DGrowth^{j}_{t-1} - \omega^{j}_{0} - \omega^{j}_{1}TO^{j}_{t} - \omega^{j}_{2}FO^{j}_{t}\right) + \gamma^{j}_{11}\Delta TO^{j}_{t} + \gamma_{21}\Delta FO^{j}_{t} + \varepsilon^{j}_{2t} \qquad (15)$$

Where j is the index for each country in the sample, and other symbols are defined as above. Figure 11 below shows a chart of the different rates of speed at which each country converges to its pre-crisis paths for both growth and output. It is clear, as one would expect, that countries converge to the pre-crisis path of growth much faster than that of output. The absolute values of the estimated ϕ_1^j and ϕ_2^j [19]are plotted with the average measure of openness across the post crisis time periods observed for each country. To determine the relationship beetween the speed of convergence and the level of openness, I estimate the following two equations;

[19] Only the estimates which were negative, signifying convergence were included in the graphs. The positive values were omitted from the plots as the positive slopes could imply that the country's post crisis path has been permanently altered and the new path never converges to the old path, i.e. a permanent change in the trend of the GDP. There were no positive estimates for the growth rate suggesting a return to pre-crisis path of growth for all economies studied.

Table 8: Annual Dataset Robustness checks – DLEVEL/De-facto financial openness measure

Variable	DLEVEL								
Trade openness	-0.127***	-0.11***	-0.13***	-0.13***	-0.13***	-0.128***	-0.12***	-0.15***	-0.13***
Financial openness_De-facto measure	0.02***	0.007	0.02***	0.02***	0.02***	0.02**	0.03***	0.007	-0.016
Bank lending rates		0.007***							0.002
Net Reserves			-0.059						0.10
Current Account Balance				-0.03					-0.001
% domestic credit to Banks					-0.001***				
% domestic credit to Private sector						-0.0001***			-0.002*
Real effective exchange rates							-0.0001		
Nominal effective exchange rate								0.001**	0.001
Time fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of countries	50	37	50	50	49	49	37	38	26

Table 9: Annual Dataset Robustness checks – DLEVEL/De-jure financial openness measure

Variable	DLEVEL								
Trade openness	-0.14***	-0.11***	-0.14***	-0.14***	-0.14***	-0.13***	-0.14***	-0.16***	-0.14***
Financial openness_De-jure measure	-0.08**	-0.08**	-0.08**	-0.07**	-0.07*	-0.07**	-0.045	-0.056	-0.08*
Bank lending rates		0.006***							0.002
Net Reserves			-0.019						0.009
Current Account Balance				-0.02					-0.01
% domestic credit to Banks					-0.0006**				
% domestic credit to Private sector						-0.0009***			-0.002*
Real effective exchange rates							0.0004		
Nominal effective exchange rate								0.001***	0.002
Time fixed effects	yes	yes	Yes	yes	yes	yes	yes	yes	yes
Number of countries	50	37	50	50	49	49	37	38	26

Table 10: Annual Dataset Robustness checks – DGROWTH/De-facto financial openness measure

Variable	DGROWTH								
Trade openness	-0.09**	-0.21***	-0.07**	-0.10**	-0.12	-0.1	-0.14***	-0.16***	-0.18
Financial openness_De-facto measure	-0.04***	-0.06***	-0.03***	-0.04***	-0.05**	-0.04**	-0.05***	-0.04***	-0.06***
Bank lending rates		0.007***							0.006*
Net Reserves			0.2**						0.05
Current Account Balance				-0.08					0.04
% domestic credit to Banks					-0.0005				
% domestic credit to Private sector						0.0007			-0.001
Real effective exchange rate							0.004***		
Nominal effective exchange rate								0.004***	0.004**
Time fixed effects	YES	yes	yes	yes	Yes	yes	yes	yes	yes
Number of countries	50	36	50	50	49	49	37	38	25

Table 11: Annual Dataset Robustness checks – DGROWTH/De-jure financial openness measure

Variable	DGROWTH								
Trade openness	-0.1**	-0.2***	-0.1**	-0.1**	-0.1	-0.08	-0.14**	-0.2***	-0.12
Financial openness_De-jure measure	0.07	0.02	0.06	0.06	0.07	0.06	0.07	0.07	0.11
Bank lending rates		0.008***							0.01**
Net Reserves			0.12						0.07
Current Account Balance				-0.07					-0.14
% domestic credit to Banks					-0.0004				
% domestic credit to Private sector						0.0008			0.00002
Real effective exchange rate							0.005***		
Nominal effective exchange rate								0.004***	0.003*
Time fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of countries	50	36	50	50	49	49	37	38	25

Table 12: Quarterly Dataset Robustness checks – DLEVEL

Variable	DLEVEL						
Financial openness (long run)	-0.0004***	0.004	0.0008	-0.01***	-0.002	-0.002	-0.0006
Trade openness (long run)	0.141	-0.67***	-0.612***	-0.59***	-0.634***	-0.60***	-0.677***
Error Correction parameter	-0.09***	-0.147***	-0.143***	-0.166***	-0.138***	-0.140***	-0.17***
Net Reserves		-0.019					-0.037***
Current Account Balance			-0.396***				-0.673***
% domestic credit to private sector				0.059***			0.043***
Real effective exchange rates					-0.0005		
Nominal effective exchange rate						-0.001***	-0.002***
Financial openness (short run)	-0.008	-0.014	-0.013	-0.022	0.002	0.003	-0.002
Trade openness (short run)	-0.47***	-0.39***	-0.395***	-0.443***	-0.304***	-0.299***	-0.31***
Time fixed effects	yes	yes	yes	yes	yes	yes	yes
Number of countries	30	30	30	24	26	26	23

Table 13: Quarterly Dataset Robustness checks – DGROWTH

Variable	DGROWTH						
Financial openness (long run)	-0.00002	-0.00002	-0.00002	-0.00002	-0.00002	-0.00002	-0.00002
Trade openness (long run)	0.05**	0.05**	0.04**	0.06**	0.05**	0.05**	0.05
Error Correction parameter	-0.813***	-0.814***	-0.812***	-0.774***	-0.792***	-0.793***	-0.734***
Net Reserves		-0.003					0.0001
Current Account Balance			-0.168***				-0.176***
% domestic credit to private sector				-0.0006			0.006*
Real effective exchange rates					-0.00002		
Nominal effective exchange rate						-0.00002	-0.0002**
Financial openness (short run)	-0.009	-0.009	-0.009	-0.02	0.004	0.004	-0.002
Trade openness (short run)	-0.499***	-0.499***	-0.492***	-0.55***	-0.392***	-0.391***	-0.41***
Time fixed effects	yes	yes	yes	yes	yes	yes	yes
Number of countries	30	30	30	24	26	26	21

$$speedl_i = c_1 + \tau_1 ATO_i + \tau_2 AFO_i + \varepsilon_i \quad (16)$$

$$speedg_i = c_2 + \tau_3 ATO_i + \tau_4 AFO_i + \varepsilon_i \quad (17)$$

Where

$speedl_i$ is the magnitude of the speed of convergence to pre-crisis path of GDP for country i

$speedg_i$ is the magnitude of the speed of convergence to pre-crisis path of growth for country i

ATO_i is the average measure of trade openness in the sample period examined for country i

AFO_i is the average measure of financial openness in the sample period examined for country i

Figure 11: Speed of convergence to Pre-Crisis paths of GDP and Growth

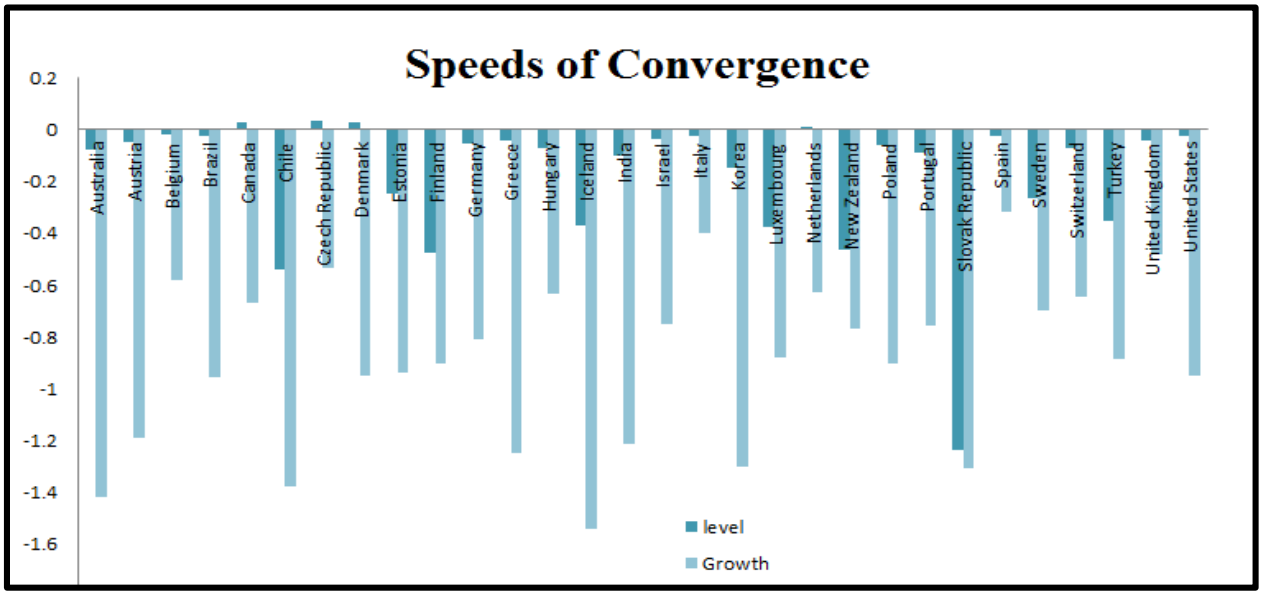


Table 14 below shows the results of the estimates of equations 16 and 17. The results from the table 14 below show that there is no statistically significant relationship between the level of openness and the speed of convergence to the pre-crisis paths of output and growth. This suggests

that country specific factors or other aggregate measures not captured here are responsible for determining the speed of convergence and not openness.

Table 14: Results showing the relationship between openness and speed of convergence

Dependent Variable	*speedl*			*speedg*		
	1	2	3	1	2	3
ATO	0.075		0.203	-0.358		-0.358
AFO		-0.009	-0.0112		-0.000002	-0.000002

*,**, and *** signify significance at the 10%, 5% and 1% level respectively
1, 2 and 3 are different regressions run with ATO alone, AFO alone and ATO and AFO together respectively
Estimating equations 16 and 17 using Ordinary least squares estimation procedure
Where ATO is the average trade openness and AFO is the average financial openness of each country in the post crisis time period studied (2008 – 2013)

1.3.5 Accounting for the impact of openness over time

Finally, I observe the relationship between the impact of the crisis and openness over time. I once again disaggregate the quarterly panel datasets into individual time series and estimate regression equations for each country in the sample. These regressions are similar to previous regressions run, with the added assumption that the estimated coefficients vary over time. This provides a better understanding of the relationship between the impact of a crisis and openness measures over time by providing a more accurate picture of the response of each country's economy to the financial crisis determining whether or not the role of openness is indeed asymmetric, ergo, I estimate the following regression equations and use the state space model with the Kalman filter approach to estimate the time varying parameters.:

$$DLevel^{j}_{t} = \beta^{j}_{0t} + \beta^{j}_{1t} TO^{j}_{t-1} + \beta^{j}_{2t} FO^{j}_{t-1} + \varepsilon^{j}_{1t} \quad 18$$

$$Dgrowth^{j}_{t} = \beta^{j}_{0}{}'_{t} + \beta^{j}_{3t} TO^{j}_{t-1} + \beta^{j}_{4t} FO^{j}_{t-1} + \varepsilon^{j}_{2t} \quad 19$$

Where j is the index for each country in the sample with other symbols defined as above. In this paper, I assume that coefficients follow a random walk over time. This is because I assume that countries would base future decisions of level of openness on the impact of the previous level of openness. As such, the coefficients evolve according to the following equation:

$$\beta_{it} = \beta_{it-1} + v_{i,t} \text{ for } i = 1,2,3 \text{ and } 4 \qquad 20$$

Where i is the index for each coefficient in equations 18 and 19, and $v_{i,t}$ is the shock to each coefficient.

The results of these estimates from the GAUSS statistical package are plotted for output and growth for each country in the appendix. From the graphs, it is clear to see first and foremost that countries are more responsive to trade openness than they are to financial openness, as suggested in the panel regressions above. Secondly, almost all countries experience a sharp increase in the relationship between trade openness and DLEVEL within the first few quarters, indicating the period of contraction of the crisis, showing the role of trade openness as a vector. However, the decline in the responsiveness to trade openness seems to suggest that, while trade openness still continued to increase the deviation from the predicted path, it did so at a decreasing rate, and in some cases, eventually reverted to a negative relationship suggesting a decline in the deviation. Third, it is also evident that financial openness does not contribute to the deviation as much as trade openness, and in some cases, helps to retard the magnitude of deviation from the predicted path, confirming trade openness' role as the major vector of propagation. The variation in effects of financial openness across countries might be due to the de-facto measure used, which does not capture different countries' attitude towards inflow of capital. The same initial spike in the relationship between the impact and trade openness is also observed with respect to growth, with

some countries also showing that downward trend suggesting positive benefits to becoming more open via trade after the contraction of a crisis, indicating its role as a cure.

1.4 Conclusion

In this paper, I set out to determine the role of openness in an economy during a crisis. Using two datasets: annual and quarterly, I examine different aspects of the relationship between openness and the impact of a crisis including: "distance", "speed", and "time". Distance is defined as the deviation from the pre-crisis paths of output and growth, speed is defined as the rate of return to the pre-crisis paths, and time deals with the relationship between the impact of a crisis and openness as time progresses. Taking the financial crisis of 2008 as a case study, my main result suggests that both trade and financial openness have different effects on the impact of the crisis depending on the length of time studied, i.e. short or long run. I also find a dual role for both types of openness acting as both a vector that negatively impacts the economy during a crisis and as a cure that also helps return the economy to its pre-crisis paths.

One major source of discrepancy in the literature addressed in this study is the variation in results obtained from utilizing different measures of financial openness[20], and as with other studies, I find that discrepancy here as well. The explanation might be the fact that the de-jure measure offers insight about an economy's tolerance for foreign participation in its domestic markets and makes no claim to its attitude towards local participation in foreign markets as the de-facto measure does. The consequence being, economies that rank higher on the de-jure measure, classified as more financially open, make it more palatable for foreigners to invest in their economy, especially during times of crisis. This in turn serves as a boost that increases the economy's performance,

[20] de-jure vs de-facto measures of financial openness

indicating a positive contribution of financial openness. The de-facto measure does not differentiate between foreign participation in local markets and local participation in foreign markets and as such, might capture an outflow of resources from an economy (more financially open), yielding a negative contribution of financial openness.

In examining the speed of recovery, I find that countries converge faster to their pre-crisis path of growth rates than they do to their pre-crisis path of output, giving more weight to the initial assumption in this paper, that a return to pre-crisis levels of growth does not imply a return to normalcy. I also find no evidence of a relationship between the speed of convergence and the level of openness. While preliminary evidence points to the possibility that countries that are more open via trade converge faster to their pre-crisis paths of output but slower to their pre-crisis level of growth, and that countries that are more financially open converge slower to pre-crisis paths of both output and growth, these relationships are however proven to be statistically unsubstantiated. I also disaggregate the panel structure to obtain individual time series for each country, and using a time varying parameter approach, allow the coefficients of trade openness and financial openness to vary over time[21]. This is perhaps the most convincing evidence of the dual roles of both types of openness during the financial crisis, as both the vector through which the contagion spreads and a tool through which the impact is lessened over time.

[21] Results in appendix 1.2

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Appendix 1.1

Table A.1 below is a list of all countries in the two main datasets used in this paper

Full Annual dataset
Albania, Argentina, Australia, Austria, Bahrain, Belgium, Botswana, Brazil, Bulgaria, Cabo Verde, Chile, Hong Kong, Denmark, Finland, France, Georgia, Germany, Greece, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Korea, Latvia, Luxembourg, Malaysia, Malta, Moldova, Namibia, Netherland, New Zealand, Pakistan, Peru, Philippines, Portugal, Romania, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, Tunisia, Turkey, United Kingdom, United States, Zambia.
Full Quarterly Dataset
Australia, Austria, Belgium, Brazil, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Iceland, India, Israel, Italy, Korea, Luxembourg, Netherlands, New Zealand, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States

Table A.2 below outlines the variables used in this study, as well as the sources of the data

Variable	Description	Source	
		Annual	Quarterly
GDP level	Gross domestic product of the country, every quarter or every year	World Bank development Indicator	OECD stats
Growth rate	First difference of GDP level measures for both quarterly and annual data	World Bank development Indicator	OECD stats
Trade openness	Summation of total exports and total imports as a fraction of GDP	World Bank development Indicator	International Financial Statistics
Financial openness: De-facto measure	Summation of country's international investment positions (Assets and Liabilities) as a fraction of GDP	International Financial Statistics	International Financial Statistics
Financial Openness: De-jure measure	Chinn-Ito measure of financial openness.	http://web.pdx.edu/~ito/Chinn-Ito_website.htm	N/A
Lending rates	Bank Lending rates	International Financial Statistics	International Financial Statistics
Net Reserves	Net Reserves (With Fund record)	IMF Balance of Payments database	IMF Balance of Payments database
Current Account Balance	Balance from Current and Capital account	IMF Balance of Payments database	IMF Balance of Payments database
Domestic Credit to Financial Sector	Domestic credit to financial institutions as a fraction of GDP	World Bank development Indicator	N/A
Domestic Credit to Private sector	Domestic credit to non-financial institutions as a fraction of GDP	World Bank development Indicator	Bank of International Settlements
Real Effective exchange rate	Real effective exchange rates index (2010 Base year)	International Financial Statistics	International Financial Statistics
Nominal Effective Exchange rate	Nominal Effective exchange rates (2010 Base year)	International Financial Statistics	International Financial Statistics

Table A.3 below shows the selected AR approximations of the different datasets

Dataset	Process	SIC value	Rejected coefficients (95% C.I)
Annual	AR(0)	0.883996	-
	AR(1)	-3.070718	-
	AR(2)**	-3.267185*	-
	AR(3)	-3.256608	AR(3)
	AR(4)	-3.228025	AR(3), AR(4)
Quarterly	AR(0)	-1.149958	-
	AR(1)**	-6.058698*	-
	AR(2)	-6.043402	AR(2)
	AR(3)	-6.039677	-
	AR(4)	-6.031011	AR(3), AR(4)

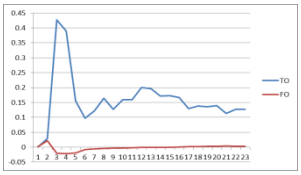
*signifies the smallest SIC value, **signifies the chosen AR process

Appendix 1.2

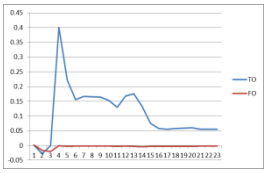
The following graphs depict the evolution of the response of the level of deviation from an economy's pre crisis GDP and growth paths to changes in their level of openness in the post-crisis periods for all 30 countries in the quarterly data sample studied.

Figures 1 & 2: Australia

Level

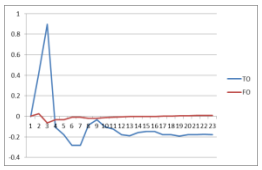


Growth

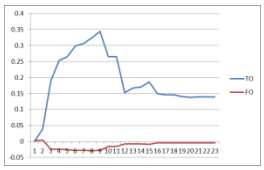


Figures 3 & 4: Austria

Level

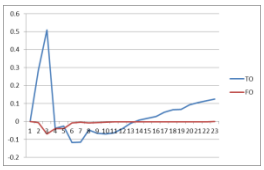


Growth

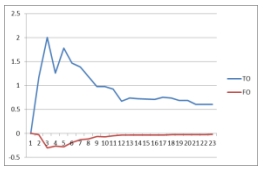


Figures 5 & 6: Belgium

Level

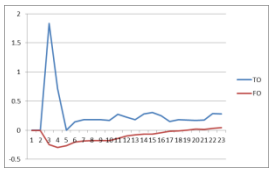


Growth

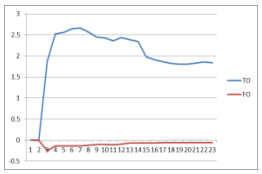


Figures 7 & 8: Brazil

Level

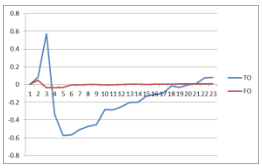


Growth

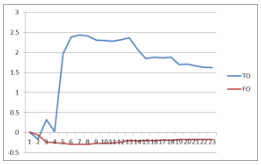


Figures 9 & 10: Canada

Level

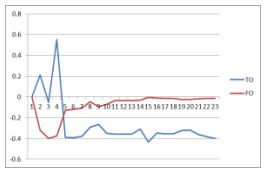


Growth

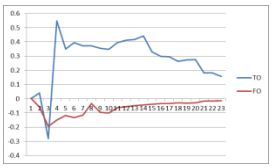


Figures 11 & 12: Chile

Level

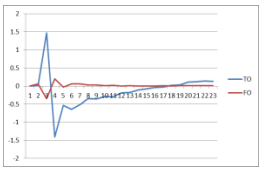


Growth

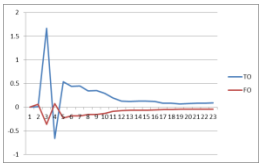


Figures 13 & 14: Czech Republic

Level

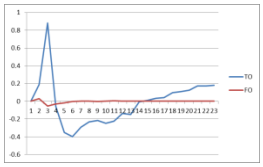


Growth



Figures 15 & 16: Denmark

Level



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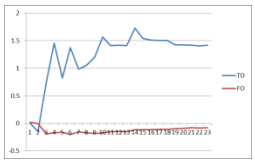
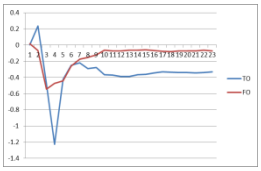


Figures 17 & 18: Estonia

Level



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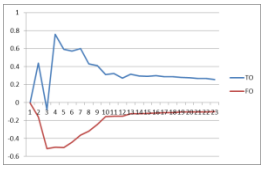
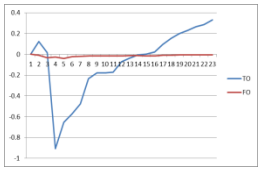


Figures 19 & 20: Finland

Level



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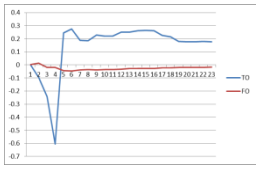


Figures 21 & 22: Germany

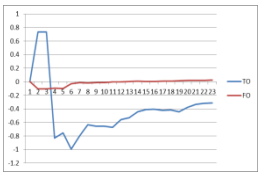
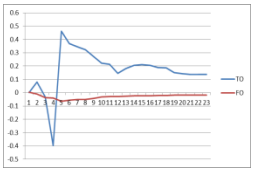
Level

Growth

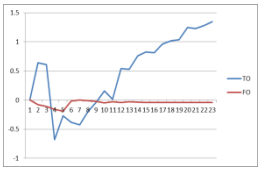
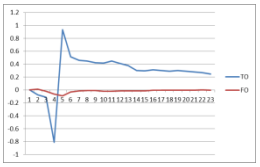
Figures 23 & 24: Greece

Level

Growth

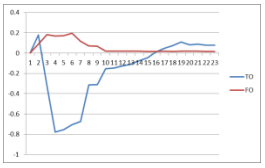
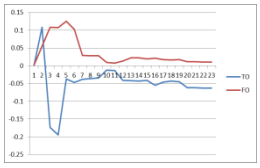



Figures 25 & 26: Hungary

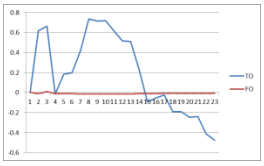
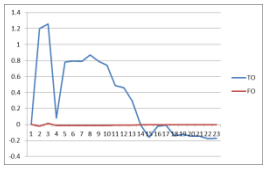
Figures 27 & 28: Iceland

Level Growth

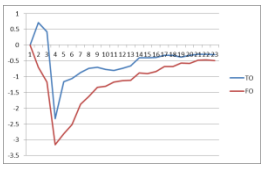
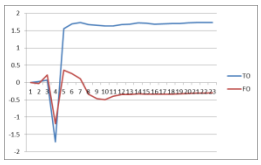
Figures 29 & 30: India

Level Growth

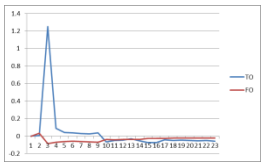
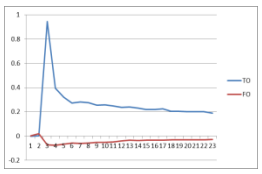
Figures 31 & 32: Israel

Level Growth

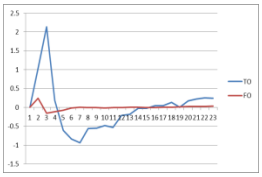
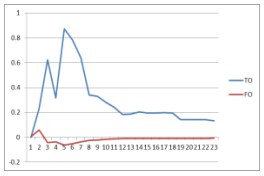
Figures 33 & 34: Italy

Level Growth

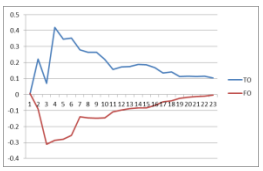
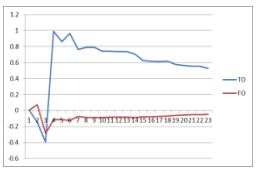
Figures 35 & 36: Korea

Level Growth

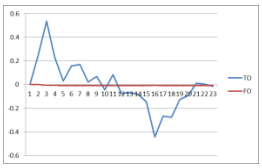
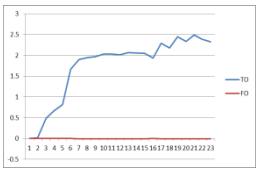
Figures 37 & 38: Luxembourg

Level Growth

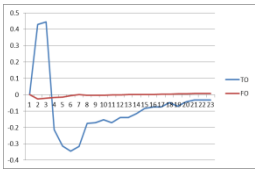
Figures 39 & 40: Netherlands

Level Growth

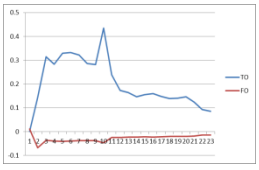
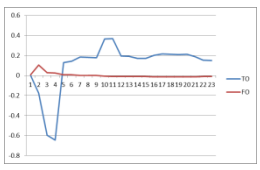
Figures 41 & 42: New Zealand

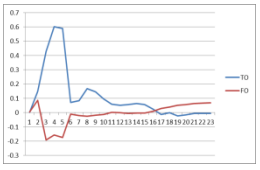
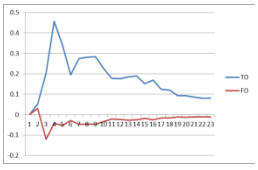
Level Growth




Figures 43 & 44: Poland

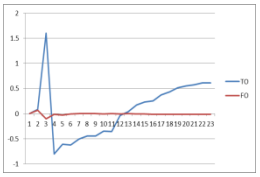
Level Growth

Figures 45 & 46: Portugal

Level



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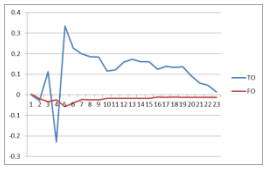
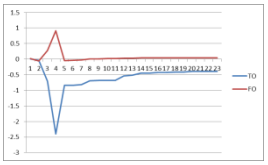


Figures 47 & 48: Slovak Republic

Level



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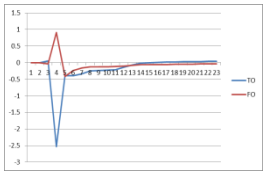
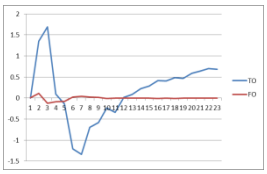


Figures 49 & 50: Spain

Level



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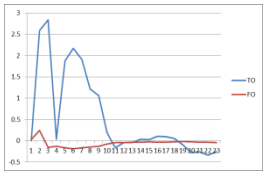
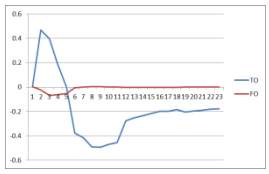


Figures 51 & 52: Sweden

Level



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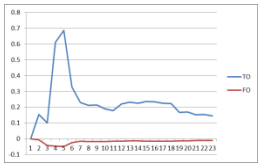

Figures 53 & 54: Switzerland

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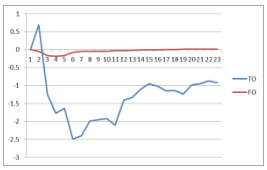

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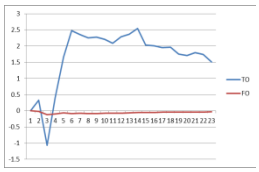
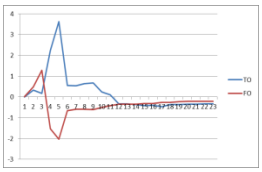


Figures 55 & 56: Turkey

Level



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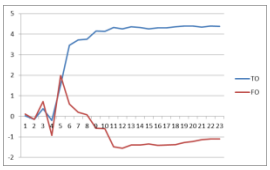
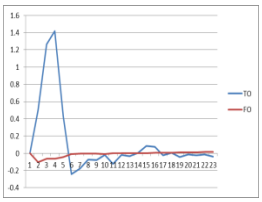


Figures 57 & 58: United Kingdom

Level



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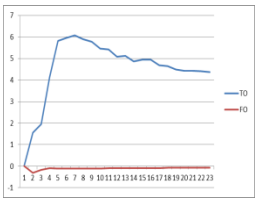
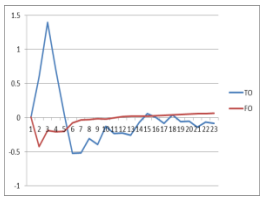


Figures 59 & 60: United States

Level



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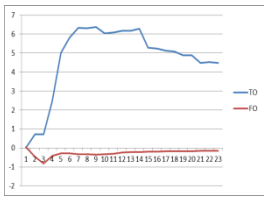


Chapter 2

The Role of Risk in Bilateral Trade

2.1 Introduction

As is well known, distance in the discourse of international trade and gravity models is a proxy for transportation costs, as illustrated by the familiar iceberg shipping cost principle: if an iceberg is sailed across the ocean from a given origin point to a given destination point, the melted ice lost along the way is viewed as transport cost, hence the association between distance and cost. Let us now add to this familiar principle, the varying weather conditions between the origin and destination. The amount of ice arriving at the destination would then undoubtedly vary even though the distance remains the same. The unpredictable nature of the weather in this case produces a new dimension in the size of ice reaching the destination, that of uncertainty. Such uncertainty gives rise to perceived risk, therefore accounting for the role of risk in trade flow determination is potentially as relevant as the role of distance. Risk here is generally defined as the uncertainty associated with any potential event that could result in an alteration of a previously agreed upon volume of exports (or imports). Specifically, I use the World Governance Indicator measure of political instability and the presence of terrorist activities proposed by Kaufmann et al. (2010) as a proxy for risk. This measure is an aggregate of household perceptions from surveys about Government stability as well as measures of internal and external conflicts and ethnic tensions. It also encompasses statistics including frequencies of political killings, disappearances and tortures. All of which make this an ideal measure to capture perceptions about the risk rating of a country in order to determine if these perceptions influence trading decisions.

Several theories have been developed over the course of time that attempt to explain the existence of bilateral trade. These theories range from the Ricardian theory, which proposes that trade is

generated by differences in cross country technological endowments[22], to the Heckscher-Ohlin-Samuelson theory, which suggests that trade is a result of differences in country factor endowments, to Paul Krugman's theory that trade is a result of consumers' preferences for variety and economies of scale in production. While these theories and their numerous derivatives or extensions have been validated at some point or another, they mainly determine which goods are traded and the reasons why these goods emerge as import or export goods in each country. But once a country determines its export capabilities and its import needs based on its level of technology, factor endowments or consumer preferences, the final decision of which country with whom to engage in trade still remains. These theories, however, do not extend to a country's choice in trading partners as the theoretical assumptions restrict the number of available trading partners such that, when a country decides to trade, there is only one available option. In reality though, this is not the case. There are many potential trading partners and these models do not provide any insight on how a country chooses its trading partner from the available choices; it is this missing link in trade theory that has given rise to the gravity equation.

The gravity equation is a very successful empirical finding that shows that the value of bilateral trade between countries is positively correlated with the sizes of their economies (GDP) and is negatively correlated with the distance between them. Essentially, a country chooses its trading partners based on similar production capacities and the distance between them. While one of the earliest criticisms of the gravity model after its inception by Tinbergen (1962) was its lack of theoretical foundations, recent research has incorporated the basic theoretical foundations in international trade into the gravity model. These studies have eliminated the initial concern and

[22] This leads to comparative advantage in the production of a particular good, which in turn leads to specialization and exportation of that good.

have led to a wider acceptance of this empirical finding (Anderson, 2011). For example, Evenett and Keller (1998) investigate possible theoretical validations of the gravity equation by examining the Heckscher-Ohlin-Samuelson theory and the theory of increasing returns to verify whether either theory has significant explanatory power to account for the success of the gravity model. They find that both models explain various components of the differences in trade volumes between countries and that these various components have implications for productivity growth and labor. Their findings support the gravity equation's proposed relationship between trade and GDP, but shed no light on the trade - distance relationship.

Feenstra and Markusen (2001) also try to reconcile the existing theoretical models of international trade with the empirical success of the gravity equation. They argue that different theories in international trade predict differences in key parameter values generated by the gravity model. These differences arise if goods are either differentiated or homogenous across trading partners and whether or not there is a barrier to trade (high tariffs or sanctions).

A survey of the literature on the gravity equation shows just how successful this empirical model has been in describing trade flows. Studies such as the one carried out by Baier and Bergstrand (2001) provide some insight into the reasons for increased international trade, using the gravity model as their empirical tool. They investigate the relevance of a reduction in transportation costs, multilateral and bilateral trade liberalization, income growth and convergence in growth to changes in trade flows. Using data from OECD countries between the 1950s and the 1980s, they find that income growth accounts for about 67% of the increase in international trade, with 25% being explained by liberalization (reduction in trade tariffs), and about 8% due to decline in transportation costs. They find that convergence in growth has little to no effect on the increase in trade. This suggests that the gravity equation provides an explanation for at most 75% of the

increase in international trade. Crucially, however, this does not shed any light on the pre-existing trade flows between any given pair trading partners.

Subsequently, Baier and Bergstrand (2004) tested the effects of country pair variables that encourage the formation of Free Trade agreements. They consider distance between the trading partners, remoteness of trading partners compared to the rest of the world, similarities in production (GDP), the size of the trading partners compared to the size of other countries, and relative factor endowments. They find that these factors accurately predict 85% of the 286 Free trade agreements in place as at 1996 and 97% of the other countries who do not have free trade agreements. While these results indicate the success of gravity model, and in particular the role of distance, in forming free trade agreements, they do not shed any further light on the accuracy of the gravity models in predicting actual trade flows.

Chaney (2011) in his attempt to explain the success of the gravity model establishes a theory to explain the validity of the trade-distance relationship proposed by the gravity model. He asserts that firms can only export (or import) from markets to which they have access. He suggests that these firms acquire more access based on the connections that they had previously acquired, and distance initially is a hindrance to access of these markets and as such, bilateral trade is inversely proportional to the distance between trading partners. This finding of "path-dependence" of trade based on initial distance highlights perhaps a major reason why distance continues to be a major determinant of trade flows, even as transportation costs have decreased significantly over time and trade has liberalized immensely.

Kimura and Lee (2006) extend the success of the gravity model to include trade in services as well as goods. They assess the impact of various factors on bilateral trade in services as opposed to

trade in goods with data from 10 OECD countries in 1999 and 2000. They find that the gravity model fits the data for bilateral trade in services even better than that of bilateral trade in goods. They also find that there is a positive correlation between goods exports and imports of services. This implies that data on trade flows can encompass both goods and services when running gravity model equations.

Despite the success of the gravity model, a few limitations have emerged in several recent studies. A description of these limitations highlight the reasons why this study is relevant to the literature on gravity models of trade. Thus, an exposition of these limitations is followed by that of my own contribution. Helpman et. al. (2007) who focus on firm heterogeneity and differences in the number of exporting firms across countries, decompose total trade value into trade per exporting firm and the number of exporting firms. They discover a bias of the traditional estimates based on the gravity model, primarily due to the fact that the number of exporting firms in each country is not separately accounted for and in effect is inherently assumed *not* to vary. Essentially, the fact that the number and type of firms differ across countries might in itself, be the very reason for trade between these countries, a fact that is not explicitly captured in the gravity equation.

In the same vein as Helpman et. al., Rose and Spiegel (2002) argue that there is a relationship between international trade and Country lending choices suggesting yet another factor that might influence trade flows between countries. They show theoretically that countries do not default on their debts to avoid sanctions that will diminish international trade, and as such, suggest that creditors should lend to countries that have close ties via trade. As a result of this, it is clear that there are other cross country relationships that could influence the choice in trading partners or amount of trade between country pairs not captured in the standard gravity model. Furthermore, a country's commitment to debt repayment sends a signal of credibility to a potential trading partner

and as such, could bias countries to engage in trade. This finding highlights a potential measure of a country's risk measure. Countries that default on their debt payments could potentially be viewed as high risk trading partners for the exact same reasons they are not able to make their debt payments (low productivity, negative shocks, unsustainable debts, etc.)

Paramount among all the recent critiques of the gravity model is the finding by Brun et. al. (2003), as this study casts doubt on the distance-trade relationship, which is central to the gravity equation. They show that the efficiency of the distance measure in predicting trade flows has decreased with the passage of time. Using a time varying parameter approach on 130 countries between 1962 and 1996, they measure the impact of distance as a determinant of bilateral trade over time. They initially discover that the elasticity of the absolute value of bilateral trade with respect to distance increases over the years. They attribute this to a decline in transportation costs not related to distance such as handling fees, but an increase in distance related costs such as oil prices. They then find that if an "augmented[23]" barrier-to-trade function is introduced, there is an 11% decline in the elasticity in the same set of countries over the 30 year period investigated. They also note that this decline is prominent in trade between developed countries. This finding gives support to the idea that with increasing technology, transportation costs decline which minimizes the importance of distance as a predictor for bilateral trade creating room for the introduction of a new determinant of bilateral trade.

It is these critiques, especially the last, that pave the way for my contribution. In particular, the critiques imply that the gravity equation in its present formulation, and particularly the role of distance may be losing its explanatory power of global trade flows due to factors ranging from

[23] They augment the standard specification of the gravity model by introducing an index for quality of infrastructure, the cost of oil and a proxy for freight costs between primary products and manufactures to the transport cost function that is the basis of distance-trade relationship in the gravity equation.

globalization, to technological advances, and reduced transportation costs. These factors have allowed countries to begin to overcome the initial distance barrier that once hampered trade.

Thus, new determinants of trade flows must be sought and new variables investigated and incorporated in the standard gravity model. This is where my contribution lies. I suggest a "risk-augmented" approach to the original iceberg shipping cost model that led to the inclusion of distance, as summarized earlier. So far, the literature has considered two major sources of risk that can influence trade; wars and exchange rate fluctuations. These two variables can impact trade flows through the degree of risk that they impose on both the supply (Exports) side and demand (Imports) side: wars through uncertainty due to supply shocks or export disruptions and currency fluctuations through importer uncertainty and difficult contract negotiations.

There have been several studies carried out on the effects of wars on trade flows. For the most part, economists have suggested a negative correlation between trade and wars. Most recently, Karam and Zaki (2015) introduce a dummy variable to the standard gravity model which indicates the presence of war, in order to determine what effect wars have on trade flows in countries in the Middle East and North Africa. They find that the presence of wars in these regions have a significantly negative impact on trade flows. They also find that this negative impact is on manufactured goods and wars have little to no effect on the trade in services. This finding is a corroboration of the work by Bayer and Rupert (2004), who find that civil wars not only negatively impact trade in afflicted countries, but in partners who take sides in these conflicts. There are however, other findings that seem to suggest a positive impact of war on trade flows. Gholz and Press (2001), suggest that the effects of wars might be over exaggerated particularly when looking at the impact of wars on Neutral countries. The argument for a negative impact of wars on neutral states is the loss of trade partnerships with countries now devoting their resources to fighting these

wars. They suggest that this loss is only just a decline in the efficiency from moving from the old best choice to a new best choice, and that these neutral countries as a result of the war can benefit by exporting goods to the warring countries, and expanding export activities to markets previously dominated by the warring states.

The dual nature of the effects of wars on trade is not the biggest issue with this as a proxy measure for risk in determining trade. Apart from the fact that war is a realization of an extreme that is only present in a few countries and only at certain times, and as such does not account for trade flows for a majority of countries for a significant amount of time, there is also the potential for reverse causality between war and trade. Jackson and Nei (2015) theoretically show that trade agreements decrease the likelihood of interstate wars and thus, trade has a stabilizing effect in regions. They also attribute the decline in conflicts post 1950, to trade agreements and show that this is also consistent with their model.

The second way in which risk has been introduced in the literature as a determinant of bilateral trade is through currency fluctuations. There is a consensus that currency fluctuations can impact trade flows either through the exchange rate volatility or currency misalignment. Auboin and Ruta (2012) suggest that the mechanism through which exchange rates impact trade is the level of uncertainty that it instills in traders, while currency misalignments; which is a deviation from the equilibrium exchange rate, can lead to inefficient allocation of resources between tradable and non-tradable goods which ultimately has an impact on export growth. Eichengreen and Irwin (1995) study the impact of commercial and financial policies on trade in the 1930s. They find that commercial policies weakened the relationship between income and trade and that exchange rate volatility negatively impacted trade. This finding was also supported by Tenreyro and Barro (2003) who find that common currencies increase trade between partner countries. Broll and Eckwert

(1999) however, theoretically postulate a situation through which exchange rate volatility could have a positive impact on trade flows, but only in firms that have access to wide local markets and can adapt quickly to these short term fluctuations in order to capitalize on them. Baron (1976) suggests that the effects of exchange rate volatility on trade can be minimized by exchange rate hedging, but Auboin and Ruta (2012) counter that argument by suggesting that the increased cost of exchange rate hedging, will lead to more expensive imports, and will still have a negative impact on trade. Auboin and Ruta (2012) also state that there is mixed empirical evidence of the effects of exchange rate volatility on trade in the literature, a view also supported by Bearce and Fisher (2002). They observe that the effect of volatility on trade is small and not robust. This conclusion is strengthened by Broda and Romalis (2003) who show the existence of reverse causality between trade and exchange rates and state that accounting for this reverse causality reduces the impact of exchange rate volatility on trade. They find evidence that exchange rate volatility affects trade in differentiated products, but has no effect on where a commodity gets sold and that trade in all products affects the exchange rate volatility. These two results not only show the reverse causality between trade and exchange rate volatility, but also serve to identify a way to resolve this issue. They posit that since commodity trade is only affected by the price levels and not by volatility, the one-way effect of volatility on trade is only on differentiated products. They find that adjusting for this reduces the estimated effect of currency unions on trade from 300% to between 10 and 25%. Furthermore, Nicita (2013) looking at trade flows in 100 countries between 2000 and 2009 find that currency misalignment is more important than exchange rate volatility when looking at the impact on trade.

In general, when considering uncertainty (risk) as a determinant of trade, there is a potential for reverse causality between risk and trade flow. Certain types of country idiosyncratic risks could

be the reason why countries engage in trade in the first place. Kanniainen and Mustonen (2010) study international trade agreements from a risk management perspective. They suggest that countries engage in trade agreements to compensate for unforeseen negative shocks to productivity, in essence, countries mitigate idiosyncratic (Country specific) risk by "insuring" against those negative shocks to production. Using bilateral trades in Finland, they conclude that international trade has provided more efficient risk management mainly through diversification. This finding seems to point to a reverse causality between bilateral trade and risk. On the one hand, trade is used to mitigate idiosyncratic risk, and on the other, risk is a driving force that might determine trade volume. It would be useful to distinguish between the different sources of risk, in order to determine which could influence trading decisions and which could be caused by trade so as to eliminate the reverse causality problem.

Given the fact that previous measures of risk in bilateral trade flows have been subject to reverse causality and endogeneity, I propose an exogenous and more encompassing variable to measure risk and study its effects on bilateral trade: The level of political stability and the absence of terrorist attacks proposed by Kaufmann, Kraay and Massimo (2010). A higher ranking signifies a less risky trade partner, and a lower ranking signifies a riskier partner. This measure is perhaps the most exogenous measure of within country source of risk, as the variables captured within it as mentioned above, tend to be very unpredictable and as such, cannot be influenced by trade. It should be noted that this measure is more general and also encompasses the presence of wars in any region. A country such as Nigeria is not presently engaged in any official wars, but the presence of the terrorist group Boko Haram and the government's efforts to eliminate this threat, presents a significant level of risk captured by this measure but not by that of the war indicator variable. Furthermore, countries currently at war are also captured by this variable when

considering the level of political instability in these regions. To illustrate the potential of these perceptions of risk to influence trade flows, consider the following figures illustrating annual trade flows in India, Nigeria and the United States:

Figure 12: Risk and Trade: Nigeria's trade flows

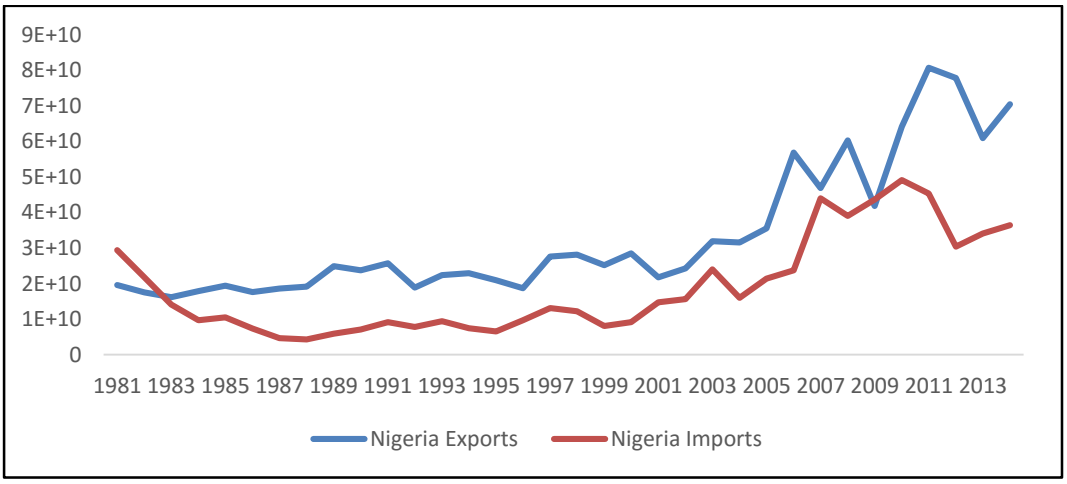
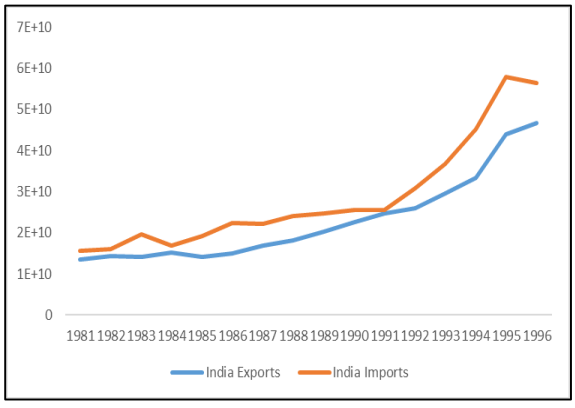
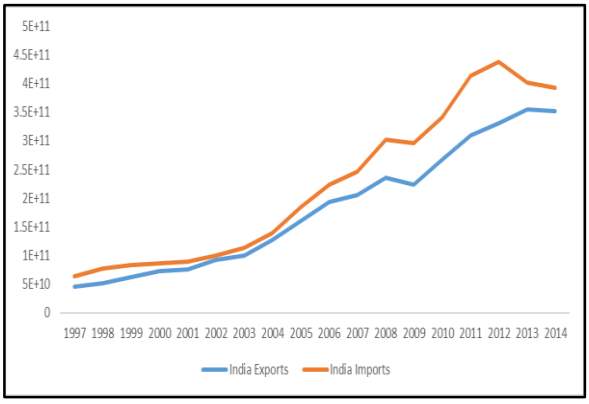


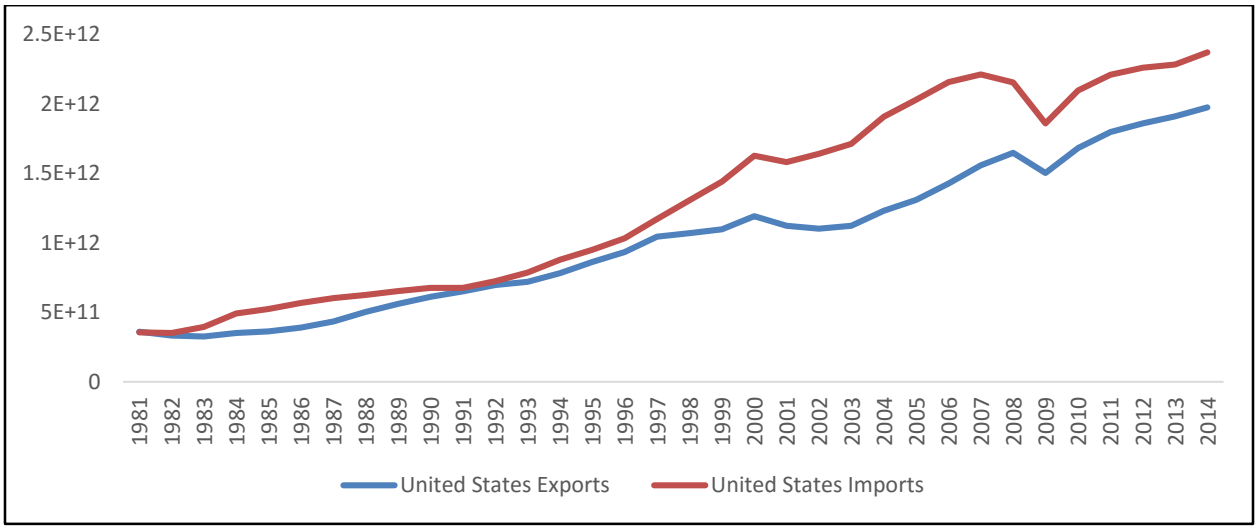
Figure 13a & b: Risk and Trade: India's trade flows[24]





[24] India is split into these two graphs in order to better illustrate the decline in trade pre 2000, as trade flows are much higher than they were in the 90s.

Figure 14: Risk and Trade: United States' trade flows

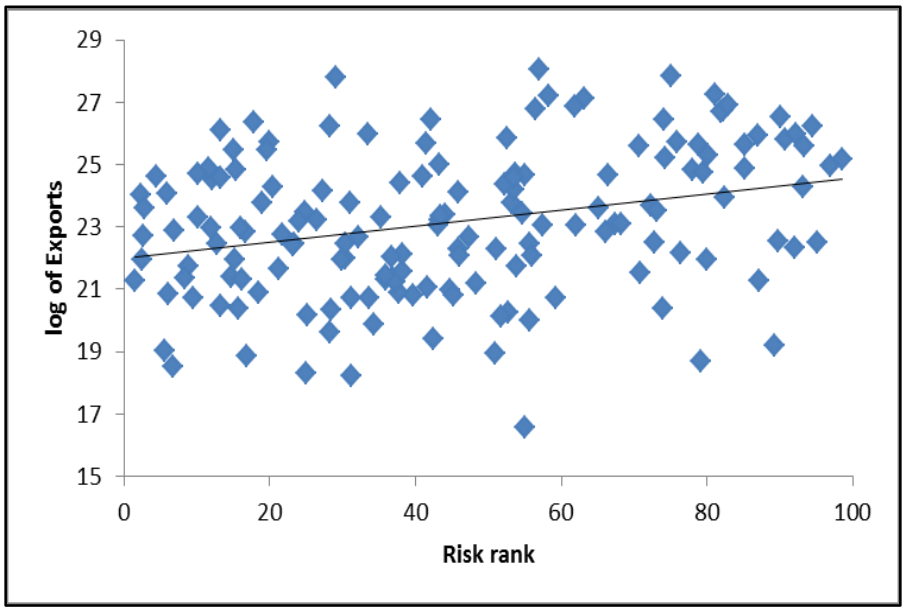


Ignoring the effects of diminished trade during the financial crisis, periods of unrest in these countries are often accompanied by a decline in either imports or exports. Figure 1 which shows the trade flows of Nigeria, depict slumps in trade during periods corresponding to the Jos Riots in 2001 and the increase in Boko Haram activities post 2010[25]. Figures 2a and 2b which depict the trade flows for India, capture reductions in imports in 1984 and 1991 respectively corresponding to the assassinations of the Indian Prime Ministers of the time[26], as well as in 2013 following Militant attacks in Srinagar, Explosions in Hyderbad and riots in Muzaffarnagar[27]. Even a global power house like the United states is not exempt from this trend, as a noticeable decline in both imports and exports is observed post 2001 after the world trade center bombing. While these may be purely coincidental, it warrants a thorough investigation into the effect of the perceived risk (uncertainty) generated by these events on trade flows.

[25] http://www.cnn.com/2014/02/27/world/africa/nigeria-year-of-attacks/
[26] http://news.bbc.co.uk/onthisday/hi/dates/stories/may/21/newsid_2504000/2504739.stm
[27] http://www.mapsofindia.com/events/2013-major-events.html

In order to do this, an empirical model of the gravity equation featuring risk is estimated using data from 169 exporting countries trading with 178 partner countries between 2002 and 2013[28] to determine whether this assumption of a role for risk in bilateral trade can be generalized, Figure 5 shows a scatter plot of the log of the average exports the countries in the dataset and the average of their risk rating in the time period studied.

Figure 15: Export-Risk Rank Scatter plot



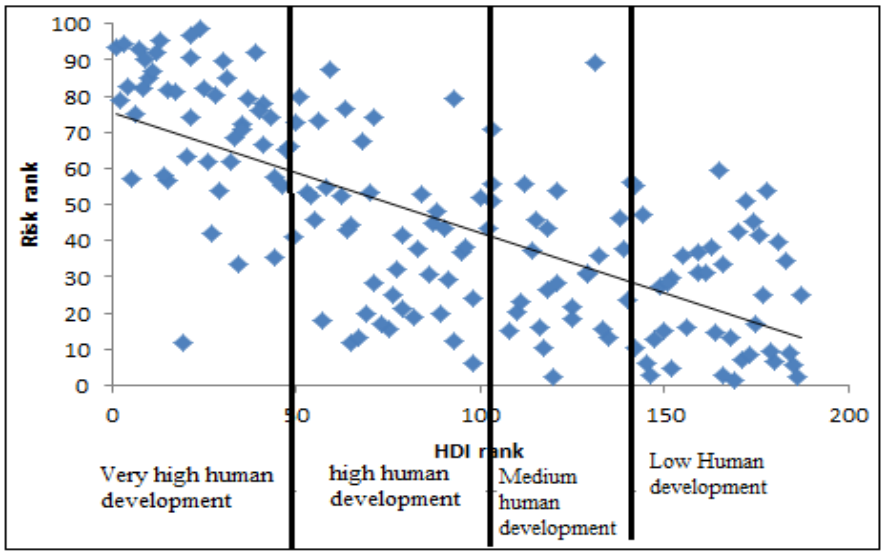
There is an observable upward trend in the scatterplot indicating that the higher the risk ranking of the country (implying less risk), the higher the exports from that country. While this is not conclusive proof of the role of risk in trade, it suggests an inverse relationship between the level of risk and trade, which I verify empirically.

Determining the reasons for a country's choice in trading partners has several advantages, the first of which is a more accurate prediction of trade flows. The ability to better predict trade flows

[28] yielding 30,241 partnerships over a 12-year period

between countries can potentially increase the accuracy in predicting GDP of which trade flows is a major component. It can also lead to more accurate trade policies instituted by policy makers in countries to either nurture burgeoning industries or provide needed goods and services to the consumers within their borders. Another benefit would be to gain insights into other reasons for the discrepancy in levels of development. It has been established that there are benefits from trade. These benefits are only realized as long as countries enter into a trading agreement and agree to provide each other with goods and services. This then begs the question; is specialization and subsequent production alone sufficient to attract countries to enter into a trading agreement with a particular country or are there other considerations that determine trading partnerships and flows? There is always the possibility that the goods being produced are scarce or indispensable, and as such, trading partners might overlook any other shortcomings to engage in trade. This is the best case scenario and is still subject to certain drawbacks. As a result of the relative value of the good in question, the exporting country could possibly suffer from a resource curse, or the debilitating effects of the "Dutch" disease phenomenon, both of which yield lower than optimal rates of growth. Figure 2 below shows the scatter plot of the average risk measures of the countries studied in this paper between 2002 and 2013 and their ranks according to their levels of development captured by the human development index measures in 2013.

Figure 16[29]: Risk rank – HDI rank scatter plot



From this plot, the obvious downward trend suggests that the countries with a lower risk rank (riskier) are developing countries, and those with the higher risk rating (less risky) are developed countries. A possible conclusion that can be drawn from figures 1 and 2 could be that if the risk rating does in fact affect the level of trade flows between countries, and by extension, trade partnership choice, it becomes quite clear that developing countries will not be able to trade as much with their developed counterparts, possibly reducing the potential gains from exports that could have otherwise bridged the gap between developed and developing countries, thus partially accounting for the continued discrepancy between them.

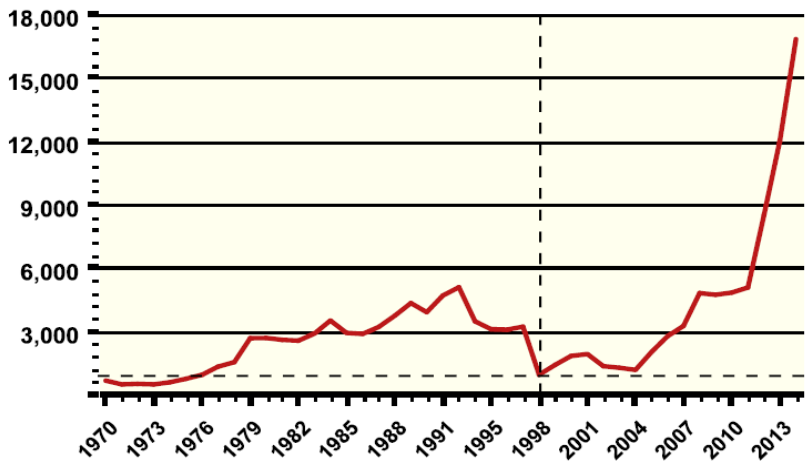
The traditional gravity model suggests that the only way for a country to alter trade flows is to increase its level of production, since nothing can be done about its geographical distance from its trading partner. In reality though, increasing production does not necessarily translate into increased trade flows if there are fundamental issues causing potential trading partners to refuse

[29] The United Nations Development Program classifies countries ranked between 1 and 49 as having a very high level of human development, 50 to 102 as having just a high level, 103 to 144 as having a medium level, and 145 to 199 as having a low level of human development.

entry into trading agreements. The introduction of risk however, suggests that if policy makers address the sources of country specific risk that potential trading partners find off-putting, interest in trade will be generated increasing trade flows and ultimately, enhancing growth. The closest study to this was one carried out by deGroot et al, in 2004 (Henceforth called DEA). In their bid to test the effect of institutions on trade, they use an earlier version of the risk measure which I propose and determine that there is positive effect of both partners' risk measure (which they interpret as a measure of institution) on trade flows[30]. This study differs significantly than the earlier version of DEA's in the following ways. First, the measure used in this chapter has been improved and now encompasses 31 underlying sources as opposed to the 17 sources in the version used in the DEA 2004 paper, yielding more accurate measures (Kaufmann et al. 2010). Secondly, the DEA study is a cross sectional study for a hundred countries' exports in 1998, while this chapter is a panel data set of 168 countries between 2002 and 2013. Perhaps, the most significant difference is captured by world attitude to risk post 1998. Consider figure 17 below which depicts the number of terrorist attacks between 1970 and 2013. There were relatively fewer number of attacks in 1998 as compared to the time period studied in this chapter. Due to the drastic increase in terrorist activities, the effect of risk on trade flows is expected to be much more pronounced than is observed in DEA. Ultimately, the method of transmission from this measure to trade is fundamentally different, while DEA suggests that the actual occurrence of these factors affect the ability of a country's firms to export, I suggest that the perception of risk due to the presence of these factors affects firm decisions with regard to trade volumes and partnership choice.

[30] The findings in this study defer significantly as it pertains to the relationship between exports and partner country risk. See results in Table 15 below.

Figure 17: Number of terrorist incidents from 1970 to 2014[31]



The rest of this paper is organized as follows; section two provides some intuition behind the introduction of risk in bilateral trade as well as the empirical method and data used in this analysis. Section three discusses the results of the analysis and interpretations, while section four concludes.

2.2 Intuition and Empirical approach

The iceberg shipping cost assumption that relates greater distance to greater transportation costs can be augmented to allow for the introduction of risk as a determinant of trade flows as highlighted earlier. With the introduction of uncertainty, a case can be made for a relationship between the risk posed by a trading partner and the trade flows between those partners. These sources of risk include within country sources like productivity shocks to the exporting country, nationwide strikes that halt production or hampers the processing rates at shipping ports, political and social instability, epidemics and natural disasters, as well as external sources such as accidents during transportation, or wanton acts of piracy. In general, I expect to find a significant and

[31] Source: Global Terrorism Database

negative correlation between trade flows and trading partners' levels of risk in an empirical analysis.

For this analysis however, the country specific measure of risk used is the level of political stability and the absence of violence and terrorism in a country. This measure captures the likelihood that the government of the country will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism. This is a World Governance indicator that provides a percentile ranking system between 0 and 100% where the safer (riskless) countries have a higher score and the less safe (riskier) countries have a lower score. This implies that if the risk rating of the country is high, it is less risky and would suggest a higher level of exports from that country. Therefore, a positive coefficient of this measure of risk expected in the regression. With the balanced trade hypothesis or a less stringent variation of it which supposes a positive correlation between exports and imports, this finding would imply that both imports and exports between trading partners depend on not just distance, but the risk associated with a particular trading partner.

The literature on the gravity models has been divided with regard to the correct specification of the empirical model applied in the panel data estimation: fixed effect versus random effect models. According to Gomez Herrera and Baleix (2012), the fixed effects approach would be ideal as this requires a potential correlation between the unobserved fixed effects and the other country specific regressors. The estimation of this process however eliminates all time-invariant regressors that are key determinants of trade such as distance, contiguity and other dummy variables, due to collinearity. On the other hand, the use of the random effects approach requires a stronger zero correlation assumption between the unobserved fixed effects and the other regressors. However, advocates of the approach argue that the use of country partner fixed effects instead of country

fixed effects decreases the likelihood of correlation between these unobserved fixed effects and the other regression variables, i.e. while specific unobserved country fixed effects will be highly correlated with the output and risk measures of that country, the unobserved partner fixed effects will have less to do with the individual country and as such, is more likely to be uncorrelated. This assumption is in line with the findings of Fratianni and Oh (2007) who test both these approaches on a panel dataset of 143 countries between 1980 and 2003 and determine that the random effect model is preferred to that of the fixed effect model. With this background, I adopt a random effects approach in estimation.

2.3 Empirical Analysis

2.3.1 Estimation and Results

The empirical model estimated is shown below:

$$\exp_{ijt} = \beta_0 + \beta_1 GDP\exp_{it} + \beta_2 GDPpart_{jt} + \beta_3 dist_{ij} + \beta_4 risk\exp_{it} + \beta_5 riskpart_{jt} + \beta_6 contig_{ij}$$

$$+ \beta_7 comlang_{ij} + \beta_8 comcol_{ij} + \beta_9 col45_{ij} + \beta_{10} colony_{ij} + \beta_{11} curcol_{ij} + \varepsilon_{ijt} \qquad (21)$$

Where

$\exp_{ijt}$ is the value of exports from country i to partner j at time t

$GDP\exp_{it}$ is the natural log of GDP of exporting country i at time t

$GDPpart_{jt}$ is the natural log of GDP of the partner country j at time t

$dist_{ij}$ is the natural log of the distance between partner countries

$risk\exp_{it}$ is the risk measure of the exporting country i at time t

$riskpart_{jt}$ is the risk measure of the partner country j at time t

$contig_{ij}$ is a dummy variable indicating whether countries i and j are contiguous (share a border)

$comlang_{ij}$ is a dummy variable indicating whether countries i and j share a common language

$comcol_{ij}$ is a dummy variable indicating whether countries i and j have had a common colonizer after 1945

$colony_{ij}$ is a dummy variable indicating whether countries i and j have ever had a colonial relationship

$col45_{ij}$ is a dummy variable indicating whether countries i and j have had a colonial relationship after 1945

$curcol_{ij}$ is a dummy variable indicating whether both countries are currently in a colonial relationship

Columns 1 2 and 3 of Table 15 below show the regression results derived from equation 21.

In the first column, the standard gravity model is estimated in order to test the validity of the selected sample. The findings of the traditional gravity model are verified implying that the selected sample conforms to the findings in other studies. The second column tests the validity of determining trade flows based on risk measures alone. There is a positive and statistically significant relationship between exports and the risk measure of the exporting country and a negative but statistically insignificant relationship between exports and the risk rating of the partner country. This finding supports the hypothesis in as much as trade seems to be influenced by risk, but this however does not align with the prediction of how trade is impacted. In the third column, the full empirical model is tested, with exports regressed on distance and risk measures. The coefficients of distance and the risk measures are significant with distance being negatively correlated, the exporting country's measure of the risk being positively correlated and the risk

measure of the trading partner being negatively correlated (and now statistically significant at the 5% level). These findings imply that, an increase in the distance between trading partners decreases, consistent with the traditional gravity model. I however add that an increase in a country's own measure of risk, increases its exports, while an increase in a trading partners risk measure decreases exports to that country. Keeping in mind that an increase in the risk measure implies a less risky partner, the last result seems contradictory at first glance. To resolve this contradiction, it is prudent to analyze what happens when a trading partner becomes less risky. Suppose country A is the exporting country and Country B is the importing country. If the increase in the risk measure of country B causes it to become much less risky than country A, from country B's point of view, it would seek out a less risky country to trade with, thus reducing the imports from country A (which will be country A's exports to B). This will manifest as a decline in exports from country A to country B as a result of country B becoming less risky, as is observed in the empirical findings.

2.3.2 Introducing country pair risk measures

The observation above suggests that the changes in individual risk measures alone cannot fully account for changes in trade patterns, but a more relative risk measure is called for, i.e. the changes in the risk measure of country A relative to country B. To account for this, a new interaction term; $relrisk_{ij}$ is introduced to equation 1 to yield the following;

$$\exp_{ijt} = \beta_0 + \beta_1 GDP\exp_{it} + \beta_2 GDPpart_{jt} + \beta_3 dist_{ij} + \beta_4 risk\exp_{it} + \beta_5 riskpart_{jt} + \beta_6 relrisk_{ijt}$$

$$\beta_7 contig_{ij} + \beta_8 comlang_{ij} + \beta_9 comcol_{ij} + \beta_{10} col45_{ij} + \beta_{11} colony_{ij} + \beta_{12} curcol_{ij} + \varepsilon_{ijt} \qquad (22)$$

Table 15: Regression results of Export value on Distance and Risk Measures

	Ln Exports					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln GDP of	1.410***	1.403***	1.405***	1.405***	1.405***	1.410***
Exporter	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln GDP of	1.051***	1.062***	1.054***	1.054***	1.054***	1.051***
Partner	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Distance	-1.346***		-1.346***	-1.346***	-1.344***	-1.345***
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
Exporter		0.00161***	0.00169***	0.00181***	0.00171***	
Risk		(0.001)	(0.000)	(0.000)	(0.000)	
Partner		-0.000625	-0.000992**	-0.00124***	-0.00103**	
Risk		(0.157)	(0.020)	(0.004)	(0.016)	
Relrisk				-0.00199***		
				(0.000)		
Abrisk					-0.00140***	-0.00136***
					(0.001)	(0.001)
comlang	0.841***	1.048***	0.842***	0.842***	0.843***	0.842***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
col45	1.119***	0.808***	1.119***	1.119***	1.123***	1.123***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
contig	1.149***	3.809***	1.158***	1.154***	1.145***	1.138***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
comcol	1.330***	1.547***	1.330***	1.329***	1.327***	1.327***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
curcol	-3.091**	-1.428	-3.094**	-3.097**	-3.100**	-3.096**
	(0.021)	(0.266)	(0.021)	(0.021)	(0.020)	(0.020)
colony	0.139	0.395**	0.140	0.140	0.133	0.132
	(0.335)	(0.038)	(0.330)	(0.332)	(0.355)	(0.360)
_cons	-34.45***	-46.32***	-34.43***	-34.41***	-34.38***	-34.41***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	218946	218946	218946	218789	218946	218946

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively
Estimating variations of equations 21 and 22 using random effects estimation procedure
See appendix for a description of the indicator variables "Col45", "Comcol", and "Curcol".
"Relrisk" is a ratio of partner country risks and "Abrisk" is the absolute value of the difference in their risk ratings
N is the number of data points used in each column.

Where $relrisk_{ij} \equiv \frac{risk\ \exp}{riskpart}$, is the ratio of the risk measures of both trading partners, and everything else is defined as above. Column 4 in Table 15 above summarizes the regression results based on equation 22.

Column 4 from Table 15 above shows a greater statistical significance of the risk factors on trade flows as all three risk measures are now statistically significant at the 1% level. The coefficient of the risk interaction term itself is negative. This suggests that a general increase in the relative risk rating of the trade partners i.e. either a relative increase in the exporting country's rating or a relative decrease in the importing country's rating, implies a decrease in trade flows between them. Specifically, I examine the total impact of a change in each partner's risk measure on the value of exports the exporting country sends to the partner.

First, the total impact of a change in the exporting country's risk rating on the export value is examined. This change given as $\frac{\partial \exp}{\partial risk \exp} = \beta_4 + \frac{\beta_6}{riskpart_j}$ depends on the risk rating of the partner country alone. For an increase in the exporting country's risk measure to lead to an increase in the exports to a partner country, $\beta_4 + \frac{\beta_6}{riskpart_j} > 0$. This implies that $riskpart_j > -\frac{\beta_6}{\beta_4}$. This suggests that there exists a certain threshold level of a partner's risk measure below which, an increase in the risk measure of the exporting country leads to a decrease in trade flows and above which, leads to an increase in trade flows. This threshold level in the sample of countries studied is 1.099[32]. This implies that for trading partners who are ranked below 1.099 (which according to the measure of risk used implies very risky trading partners), an increase in the exporting country's risk measure will lead to a decrease in exports to the partner country. For countries ranked above 1.099, an increase in the exporting country's measure of risk will lead to an increase in exports to that country.[33]

[32] This risk measure only applies to Iraq between 2003 and 2007, Sudan between 2009 and 2001, and the entire duration of study for Somalia

[33] This figure will be different as it is dependent on the countries studied and the time period examined.

Next, the total impact of a change in the partner country's risk rating on the export value is examined. This change given as $\frac{\partial \exp}{\partial riskpart} = \beta_5 - \frac{\beta_6 risk\exp_i}{riskpart_j^2}$. This implies that for an increase in a trading partner's risk measure to lead to an increase in exports from the exporting country, $\beta_5 - \frac{\beta_6 risk\exp_i}{riskpart_j^2} > 0$, which implies that $risk\exp_i > \frac{\beta_5}{\beta_6} riskpart_j^2$. For the estimated data set, $\frac{\beta_5}{\beta_6} = 0.623$. As a result, an increase in a trading partner's risk rank leads to an increase of exports from the exporting country only if $risk\exp_i > 0.623 riskpart_j^2$. The existence of these threshold values suggest that countries are stratified into groups, with positive trade growth only occurring within each group and not across, ceteris paribus (perhaps with the exception of high value commodities, like oil and precious metals).

2.3.3 Accounting for differences in partner risk rankings

The existence of the above threshold values also suggest that countries might be reluctant to trade with partners that are below a particular risk rating. This might imply that countries ranked farther apart might do less trade than countries ranked closer together. To test this likelihood, the following regression is run

$$\exp_{ijt} = \beta_0 + \beta_1 GDP\exp_{it} + \beta_2 GDPpart_{jt} + \beta_3 dist_{ij} + \beta_4 risk\exp_{it} + \beta_5 riskpart_{jt} + \beta_6 abrisk_{ijt}$$

$$\beta_7 contig_{ij} + \beta_8 comlang_{ij} + \beta_9 comcol_{ij} + \beta_{10} col45_{ij} + \beta_{11} colony_{ij} + \beta_{12} curcol_{ij} + \varepsilon_{ijt} \quad (23)$$

Where *abrisk* is defined as the absolute value of the difference between the risk ranking of the trading partners and everything else is defined same above. This measure captures just how much more risky a country is, compared to its trading partner. Column 5 in table 15 above summarizes

the results of regression equation 3 and column 6 tests its robustness to the exclusion of the individual risk measures.

In column 5 of table 15 above, there is a negative and statistically significant correlation between the exports to a partner country and the difference in their risk rankings. This suggests that the greater the difference in risk rankings of trading partners, the lower the trade flows between them. This implies that countries ranked closer together according to their risk measure will tend to trade more than countries ranked further apart. In light of the relationship established above in figure 16, this finding would mean that more developed countries would trade with other developed countries as they are ranked similarly, while the developing countries would only have each other with whom to trade. This implies that the assumption of the role of risk in trade lowering potential growth and development of countries might be valid and is something that deserves a closer look.

2.3.4 Robustness checks

There are two potential arguments that could be levied against the results thus far. The first is that the analysis has at yet, not accounted for the relationship between "within country" or internal trade and external trade. The classic argument resulting from the fact that the larger the economy, the more the internal trade is carried out in opposition to external trade, suggesting a negative correlation between internal trade measures and exports. This issue is addressed by Frankel and Romer (1999) who suggest that the size of internal trade can be instrumented for by the size of the population or the geographical area of the country. I adopt this methodology and test the robustness of the previous estimates to the inclusion of internal trade. The second argument is that the risk measure used in this analysis might be a reflection of the countries' institutions and as such, can be generalized beyond just risk, but as the effect of the institutions in general on trade. To test this,

I include other institutional measures of both partner countries and it is expected that the better the institutional qualities the more trade is done suggesting a positive correlation between institutional measures and exports. These measures - also provided by the world governance indicators - capture corruption, rule of law and government effectiveness. If this assertion is true, and the risk-trade relationship established in the study so far is just the effect of institutions, then the inclusion of these institutional measures should alter the coefficients estimated for the risk measures (resulting in either a change in magnitude or reduction of significance), implying correlation between these measures and the risk measures. Tables 16 and 17 below capture the results of these robustness checks. Table 16 shows the results using the "abrisk" measure. The expected negative coefficients for population and area are observed suggesting that increases in internal trade lead to less external trade between partners. The inclusion of these internal trade proxies render the risk rankings insignificant[34] but the "abrisk" measure is still significant implying a robust risk-trade relationship. All measures of institutions considered are positive and statistically significant as expected, but only the robustness of the exporter country risk measure is affected, the measures of partner country risk and "abrisk" remain significant. This, combined with the fact that the signs of these institutional variables are in opposition to those of risk, suggest that the mechanism through which risk affects trade is different from the other measures of institutions. This demonstrates that the risk-trade relationship is not just a reflection of the levels of institution.

[34] When area is introduced, partner country risk is still significant but export country risk is insignificant.

Table 16: Robustness checks (with "abrisk" measures)

	Ln Exports				
	(1)	(2)	(3)	(4)	(5)
Ln GDP of	1.436***	1.436***	1.396***	1.378***	1.376***
Exporter	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln GDP of	1.043***	1.079***	1.045***	1.047***	1.038***
Partner	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Distance	-1.340***	-1.319***	-1.332***	-1.332***	-1.322***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exporter	0.000917	0.000553	-0.0000382	-0.000504	-0.00165***
Risk	(0.103)	(0.277)	(0.945)	(0.361)	(0.006)
Partner	-0.000791	-0.00194***	-0.00171***	-0.00142***	-0.00232***
Risk	(0.117)	(0.000)	(0.001)	(0.004)	(0.000)
Abrisk	-0.00142***	-0.00149***	-0.00147***	-0.00146***	-0.00141***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
Ln population	-0.0556***				
Exporter	(0.000)				
Ln population	0.0155				
Partner	(0.272)				
Ln area		-0.0780***			
Exporter		(0.000)			
Ln area		-0.0663***			
Partner		(0.000)			
Corruption of			0.00441***		
exporter			(0.000)		
Corruption of			0.00185***		
partner			(0.001)		
Gov. effectiveness				0.00641***	
Exporter				(0.000)	
Gov. effectiveness				0.00132**	
Partner				(0.042)	
Rule of Law					0.00821***
Exporter					(0.000)
Rule of Law					0.00337***
Partner					(0.000)
Constant	-34.24***	-34.18***	-34.25***	-33.95***	-33.83***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	218946	218946	214279	214279	214279

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively
Estimating variations of equation 23 using random effects estimation procedure
Full specification of equation 23 was estimated but only the relevant variables were reported
"Abrisk" is the absolute value of the difference in their risk ratings
N is the number of data points used in each column

Table 17: Robustness checks (with "relrisk" measures)

	Ln Exports				
	(1)	(2)	(3)	(4)	(5)
Ln GDP of	1.435***	1.436***	1.396***	1.378***	1.376***
Exporter	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln GDP of	1.043***	1.079***	1.046***	1.049***	1.038***
Partner	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Distance	-1.342***	-1.321***	-1.335***	-1.335***	-1.324***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exporter	0.00103*	0.000667	0.0000716	-0.000402	-0.00155**
Risk	(0.067)	(0.191)	(0.897)	(0.468)	(0.011)
Partner	-0.000991*	-0.00214***	-0.00190***	-0.00155***	-0.00249***
Risk	(0.051)	(0.000)	(0.000)	(0.002)	(0.000)
Relrisk	-0.00198***	-0.00199***	-0.00202***	-0.00198***	-0.00194***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln population	-0.0548***				
Exporter	(0.000)				
Ln population	0.0161				
Partner	(0.253)				
Ln area		-0.0775***			
Exporter		(0.000)			
Ln area		-0.0658***			
Partner		(0.000)			
Corruption of			0.00440***		
exporter			(0.000)		
Corruption of			0.00179***		
partner			(0.001)		
Gov. effectiveness				0.00642***	
Exporter				(0.000)	
Gov. effectiveness				0.00109*	
Partner				(0.094)	
Rule of Law					0.00821***
Exporter					(0.000)
Rule of Law					0.00329***
Partner					(0.000)
Constant	-34.27***	-34.21***	-34.29***	-34.00***	-33.87***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	218789	218789	214122	214122	214122

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively
Estimating variations of equation 22 using random effects estimation procedure
Full specification of equation 22 was estimated but only the relevant variables were reported
"Relrisk" is a ratio of partner country risks
N is the number of data points used in each column

Table 17 above capture the same regressions with the "relrisk" measure have the same results as observed in table 16.

2.3.5 Accounting for the impact of the 2008 financial crisis on the Risk-Trade relationship

The time frame studied in this paper includes a period during which risk was a very prominent issue at the forefront of international relations. Given the potential relationship between trade and inter country financing established by Rose and Spiegel (2002), it stands to reason that this strong statistical finding might have been influenced by the onset of the financial crisis in way of a response of now very risk averse trading partners to the potential consequences of risk. This necessitates an investigation into the pre-financial crisis relationship between trade flows and risk. To this end, equation 1 is re-estimated for two subsets of the full sample; pre and post 2008 for the same set of trading partnerships. Table 18 below captures the results of the regression from equation one for both sub samples.

The even numbered columns in table 18 below correspond to the post crisis subsample while the odd numbers correspond to the pre-crisis subsample. Columns 1 and 2 estimate the traditional gravity model for both subsamples again confirming that each subsample provides similar results to the full sample and other works in the literature. Columns 3 and 4 estimate the gravity model with the risk measures alone. Here, I find a positive and statistically significant relationship between exports and the risk measure of the exporting country for both the pre and post financial crisis, as was the case for the full sample. The magnitude of the relationship however doubled after the onset of the financial crisis, implying that there was a higher response to risk after the onset of the financial crisis. The relationship between the exports and the risk measure of the partner country makes an even stronger case in support of this point. The pre-crisis coefficient was

statistically insignificant, while the post crisis coefficient is negative and statistically significant at the 5% level, similar to the findings in the full sample. Columns 5 and 6 which capture the results of regression with both distance and risk measures, shows the same increase from the pre-crisis to the post crisis periods.

Table 18: Effect of financial crisis on the Risk-Trade relationship ("relrisk and "abrisk" excluded)[35]

	Exports					
	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis
Ln GDP of	1.349***	1.378***	1.334***	1.346***	1.343***	1.363***
Exporter	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln GDP of	0.987***	0.977***	0.986***	0.973***	0.989***	0.984***
Partner	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Distance	-1.302***	-1.355***			-1.299***	-1.352***
	(0.000)	(0.000)			(0.000)	(0.000)
Exporter			0.00256***	0.00595***	0.00242***	0.00566***
Risk			(0.000)	(0.000)	(0.000)	(0.000)
Partner			0.000239	-0.00113**	-0.000340	-0.00187***
Risk			(0.608)	(0.029)	(0.445)	(0.000)
comlang	0.787***	0.756***	0.973***	0.942***	0.790***	0.759***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
col45	1.111***	0.954***	0.800***	0.611***	1.112***	0.953***
	(0.000)	(0.000)	(0.000)	(0.007)	(0.000)	(0.000)
contig	1.181***	1.202***	3.752***	3.896***	1.205***	1.240***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
comcol	1.246***	1.278***	1.467***	1.511***	1.250***	1.282***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
curcol	-2.751**	-3.305**	-1.171	-1.648	-2.764**	-3.322**
	(0.018)	(0.025)	(0.279)	(0.255)	(0.017)	(0.025)
colony	0.363***	0.346**	0.632***	0.673***	0.363***	0.348**
	(0.004)	(0.019)	(0.000)	(0.000)	(0.004)	(0.018)
Constant	-31.78***	-31.69***	-42.82***	-42.82***	-31.80***	-31.71***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	106174	112772	106174	112772	106174	112772

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively
Estimating variations of equation 21 using random effects estimation procedure
See appendix for a description of the indicator variables "Col45", "Comcol", and "Curcol".
N is the number of data points used in each column.

[35] Pre and post crisis periods are estimated for the same country pairs. The difference in the number of observations N is due to data limitations for the pre-crisis periods

Table 19 below shows the effect of the financial crisis on the trade-risk relationship paying particular attention to the effect of the "relrisk" and the "abrisk" measures. Columns 1 and 2 in the table show the effect from the inclusion of the relative risk measure. I still observe the same pattern of increase in the individual risk measures, but find no statistical relevance of the relative risk measure in the post crisis period. This suggests that the threshold which might have existed in the pre-crisis period has been eliminated in the post crisis period, implying the elimination of the restrictions placed on existing and perhaps new trading partners. Columns 3 and 4 in the table 19 show the effect from the inclusion of the "abrisk" measure[36]. Here, I do not observe a difference between the pre and post crisis periods, suggesting that countries that are farther apart with regard to their risk ranking still tend to trade less with each other. A combination of these two findings suggests that while countries in the post crisis period might be willing to alter their trading agreements as a result of higher aversion to fluctuating risk levels, they are still wary of the risk rating of potential trade partners, and are risk averse enough to still consider trading partners with similar risk measures for new partnerships.

2.3.5: Model Performance tests

Figures 1 to 18 in the appendix that follows this chapter show different graphical representations corresponding to different country pairs, comparing different fitted data to the actual bilateral trade data to determine which model fits the observed data better. The observed data (labeled "lnexp") is compared to predictions based on the standard gravity model featuring the distance measure alone ("model 1"), an augmented version of the gravity model with risk measures alone ("model 2") and finally, a combination of both models 1 and 2 featuring risk and distance measures together

[36] Columns 5 and 6 of table 3 show that the "abrisk" measures for both the pre and post crisis periods respectively are robust to the exclusion of the individual risk measures

("model 3"). It is clear to see that the combination of risk and distance measures does a better job of explaining the actual bilateral trade flows than either measure alone, which validates the empirical findings. It should be noted however that certain country pairs' bilateral trade is better predicted using risk measures alone (United States and Afghanistan, United States and Barbados, Russia and Iraq, Hong Kong and United States, China Mainland and the United States and Nigeria and Cameroon). This could be either because some countries are already putting more weight on risk measures over distance or that the farther away the trading partner; the more emphasis is placed on risk. A comparison across the different country pairs seems to mostly suggest the latter. The "take away" from the graphs in the appendix is that risk definitely has a role to play in determining the extent of bilateral trade.

2.4 Conclusion

In this paper, the role of risk in international bilateral trade is empirically tested and subsequently verified. There is evidence that suggests that the riskier a trading partner, the less likely it is for trade to occur. It is also found that a combination of distance and risk measures provide a better explanation of trade decisions than either variable alone. Despite this, there is reason to believe that these estimates for the relevance of risk is understated, as the empirical model used in this paper considers only one exogenous source of risk[37]. Other sources of risk not captured in the analysis include, but are not limited to; measures of risk associated with financial stability and production shocks, exchange rate volatility and currency misalignment, which are most likely to increase the relevance of risk in bilateral trade in the same direction with riskier countries trading less than their less risky counterparts.

[37] The political stability of a country and the absence of violence and terrorism

Table 19: Effect of financial crisis on the Risk-Trade relationship ("relrisk" and "abrisk" included)

	Ln Exports					
	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis
Ln GDP of	1.343***	1.363***	1.343***	1.364***	1.350***	1.379***
Exporter	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln GDP of	0.990***	0.984***	0.990***	0.986***	0.988***	0.978***
Partner	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Distance	-1.299***	-1.352***	-1.294***	-1.349***	-1.297***	-1.352***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exporter	0.00254***	0.00571***	0.00256***	0.00567***		
Risk	(0.000)	(0.000)	(0.000)	(0.000)		
Partner	-0.000590	-0.00195***	-0.000290	-0.00194***		
Risk	(0.197)	(0.000)	(0.513)	(0.000)		
Relrisk	-0.00198**	-0.000806				
	(0.017)	(0.168)				
Abrisk			-0.00273***	-0.00273***	-0.00261***	-0.00267***
			(0.000)	(0.000)	(0.000)	(0.000)
comlang	0.791***	0.760***	0.792***	0.763***	0.789***	0.760***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
col45	1.112***	0.954***	1.119***	0.965***	1.117***	0.965***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
contig	1.202***	1.239***	1.185***	1.213***	1.159***	1.175***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
comcol	1.249***	1.282***	1.246***	1.279***	1.243***	1.276***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
curcol	-2.766**	-3.323**	-2.792**	-3.321**	-2.776**	-3.304**
	(0.017)	(0.025)	(0.015)	(0.024)	(0.016)	(0.024)
colony	0.361***	0.347**	0.346***	0.326**	0.347***	0.325**
	(0.005)	(0.019)	(0.007)	(0.027)	(0.006)	(0.027)
_cons	-31.81***	-31.71***	-31.77***	-31.70***	-31.74***	-31.68***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	106017	112772	106174	112772	106174	112772

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively
Estimating variations of equations 22 and 23 using random effects estimation procedure
See appendix for a description of the indicator variables "Col45", "Comcol", and "Curcol".
"Relrisk" is a ratio of partner country risks and "Abrisk" is the absolute value of the difference in their risk ratings
N is the number of data points used in each column.

These factors were omitted due to endogeneity issues in the empirical analysis. Finally, an attempt is made to highlight the effect of the onset of the financial crisis on the risk-bilateral trade relationship. From the results of the analysis, there is evidence to suggest that while risk had a significant role to play in determining trade flows before the onset of the financial crisis of 2008

and has become even more important. The persistence of distance as a determinant of trade flows over the years should not be underestimated either. Distance is no longer just a measure of the difference in spatial coordinates or a proxy for transportation costs with respect to international trade. Distance also represents trading agreements and partnerships that where initially formed when physical distance was much more of a barrier to trade, and these partnerships still persist to this day. Distance also has a risk component via insurance costs of transportation. It could be argued that the farther the distance between trading partners, the more likely the loss of the goods being transported and as such, the higher the cost to insure the goods during transport. Both these points offer explanations as to why distance is still a valid component in determining trade flows.

A potential significance of the risk measure on the growth rate of an economy through the avenue of trade is also highlighted. It is found that there is a threshold country risk measures that determine the pattern of trade flows between partners. This is because the countries prefer to trade with a partner as safe, if not safer. The effect of the difference between trade partners risk ranking on trade flows is also tested, and it is found that the larger the difference in risk rankings, the lower the trade flows. These two results point to the fact that countries will tend to do more trade with other countries of similar risk measures. This provides an alternative explanation as to why similar countries engage in trade as opposed to the theory of similar production capacities. This ultimately suggests that the risk measure of developing countries could potentially dissuade growth enhancing trade opportunities with more developed countries, accounting for part of the continued discrepancy between developed and developing countries.

In conclusion, in the event of "true" globalization, economists would have to update their thinking about factors that influence bilateral trade. This will completely render the concept of borders null and void, and as a result, will completely restructure the very basis for choice in international

trading partners. The growth of technology and current work being done by scientists in the area of information dissemination and 3-D printing which indicate that transportation costs will soon become independent of distance, seems to suggest that while this future is far off, it is more likely every day and with the advent of these developments, economists would do well to come up with better predictors of bilateral trade as distance will no longer offer any information about trade, but a country's idiosyncratic risk measure most definitely will.

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Appendix 2.1:

Table B: Data description and source

Variable	Description	Source
Bilateral Exports	Value of total exports from a country to each trading partner	International Monetary Fund Database. data.imf.org
Total Exports	Value of total exports from a country	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators
Distance	Arial distance between trading pairs	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8
GDP	Gross Domestic Product of each Country	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators
Risk Measure	Political stability of the Governments and the presence of terrorism in each country	World Bank World Governance Indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=worldwide-governance-indicators
HDI Ranking	Human development index ranking countries in descending order from most developed to least developed	United Nations Development Program http://hdr.undp.org/en/content/human-development-index-hdi
Common language	0 if no common language and 1 if both countries in a pair speak the same language	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8
Contiguous	1 if both countries share a border and 0 if they do not	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8
Col45	1 if both countries have had a colonial relationship after 1945 and 0 if they do night	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8
Comcol	1 if both countries have been colonized by the same country and 0 if they do not.	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8
Curcol	1 if trading partners are currently in a colonial relationship 0 otherwise	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8

Table 2.1 cont.

Variable	Description	Source
colony	1 if one country in a pair was colonized by the other, and 0 otherwise	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8
Population	Number of people in each country	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators
Area	Surface area is a country's total area, including areas under inland bodies of water and some coastal waterways	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators
Rule of Law	Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence	World Bank World Governance Indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=worldwide-governance-indicators
Corruption	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests	World Bank World Governance Indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=worldwide-governance-indicators
Government effectiveness	Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies	World Bank World Governance Indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=worldwide-governance-indicators

Appendix 2.2

For Figures 1 through 18, "lnexp" is the actual data of value of exports between partner countries, "Model 1" is the predicted export using distance measures alone, "Model 2" is the predicted measure using Risk measures alone and "Model 3" is the predicted export using a combination of distance and risk measures.

Figure 1: Sri-Lankan Exports to Bangladesh

Figure 2: United States' Exports to Afghanistan

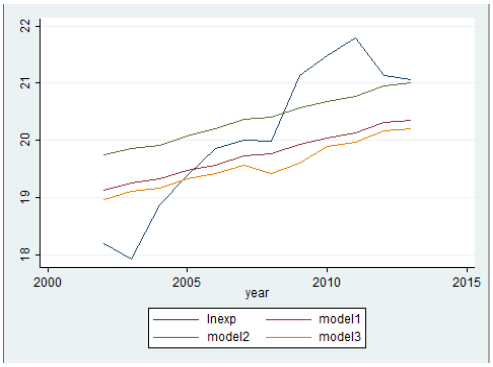


Figure 3: United States' exports to Armenia

Figure 4: United States' exports to Barbados

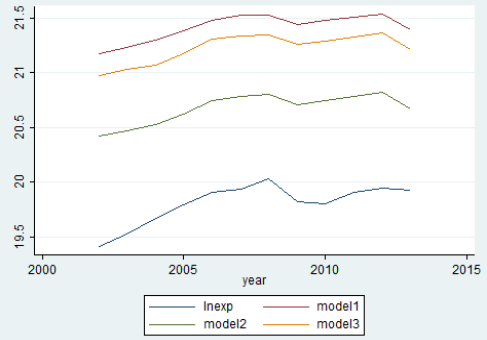


Figure 5: United states' Exports to Botswana

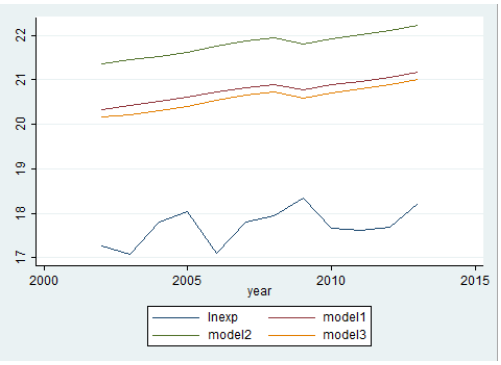


Figure 6: United States' exports to Nigeria

Figure 7: Nigeria's exports to Cameroon

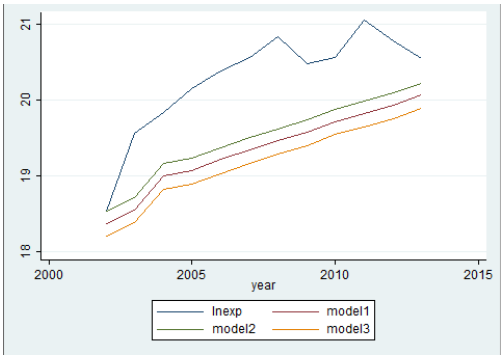


Figure 8: Luxembourg's Exports to Canada

Figure 9: Russia's exports to Iran

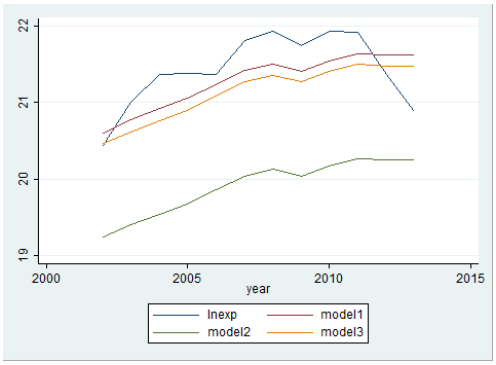


Figure 10: Russia's exports to Iraq

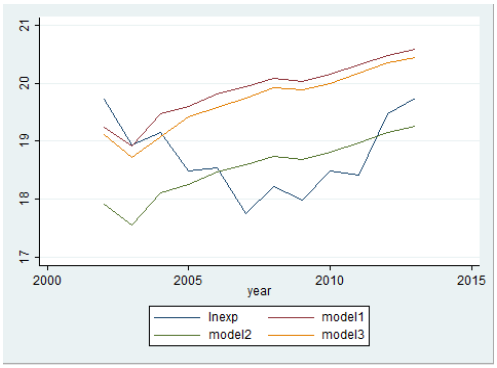


Figure 11: United States' exports to Iran

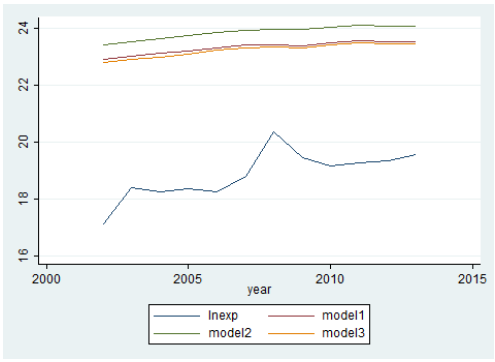


Figure 12: United states' exports to Iraq

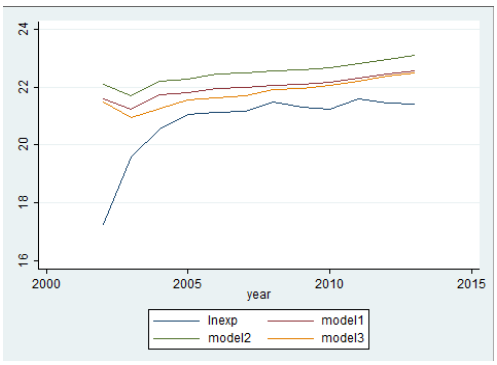


Figure 13: Hong Kong's exports to the US

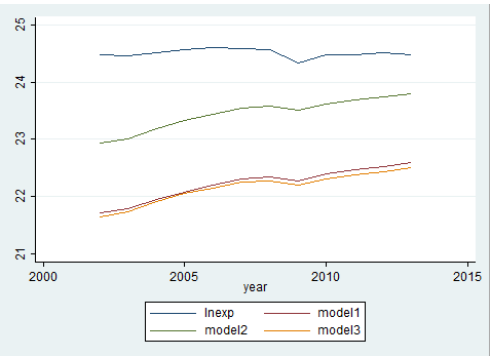


Figure 14: Macao's exports to the US

Figure 15: China Mainland's exports to the US

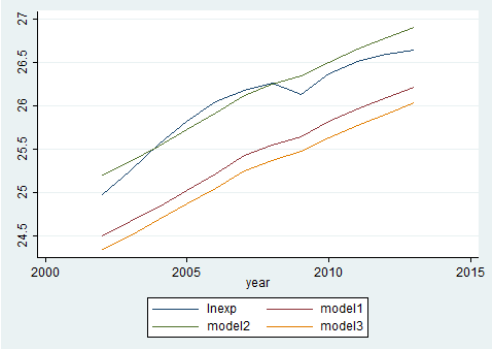


Figure 16: United states' exports to Hong Kong

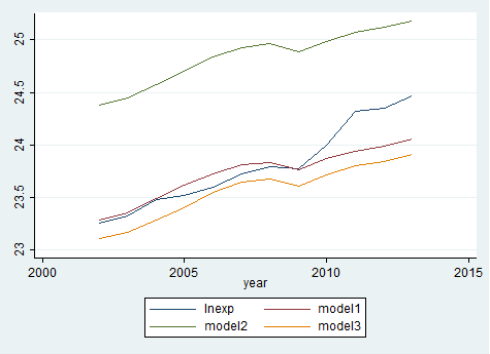


Figure 17: United States' exports to Macao

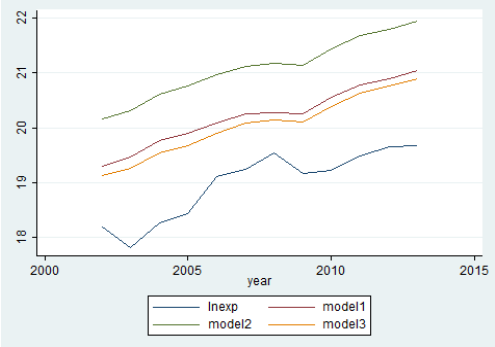


Figure 18: United States' exports to china mainland

Chapter 3

The Path from Risk to Growth, through Trade

3.1 Introduction

The role of risk in international economic relations has been at the forefront of many studies in recent times due in large part to the fallout from the most recent financial crisis. While the majority of these studies focus on the effect of risk on growth through the channel of international finance, the effect of risk on growth via international trade flows has been largely neglected, especially given the role of trade in propagating systemic risk during the crisis of 2008. This paper thus focuses on the effect of risk on growth through this trade nexus. The precedence for such a study has been set in the literature by others that have evaluated the influence of different types of risks on bilateral trade. These include measures of risk such as political risk defined by policy uncertainty[38] (Anderson and Marcoullier, 2002; Oh and Reuveny, 2010), political instability defined by regime instability and presence of terrorism (chapter two)[39] or volatility from exchange rate fluctuations as in Thursby and Thursby (1987) and Broll and Eckwert (1999)[40]. Admittedly, risk can be both the cause and the effect. To avoid circularity of the cause and effect, I focus on "exogenous risks", particularly, the measure of risk suggested in chapter 2 which is a measure of political instability and the presence of terrorism in a country. This may be justified due to the unlikely possibility of reverse causality between growth and this risk measure[41].

[38] Specifically, risk associated with policies that affect successful business practices (trade) captured through survey indicators on contract enforcement, impartiality and transparency of Economic policies, police quality, and crime and resolution of disputes locally (Oh and Reuveny, 2010)

[39] For a more thorough review on other measures on risk in trade see chapter 2

[40] The literature on the impact of exchange rate volatility is vast. For a concise summary see McKenzie (1999)

[41] I acknowledge the sociological argument that a low growth environment may produce political instability or terrorism. But to date, no rigorous empirical study has been able to demonstrate this link and anecdotal evidence seems to suggest increases in inequality is the more likely culprit that triggers social unrest as opposed to general growth decline. Furthermore, the components of this measure such as frequency of disappearances, politically

These findings suggest that due to the impact of risk on trade flows, the contribution of trade to growth may have been incorrectly estimated. In addition, when risk has been used in growth regressions and the results been attributed to the contribution of risk through the finance nexus, the contribution of risk to trade has inadvertently been attributed to finance, possibly overestimating the deleterious effects of finance on growth. The comparative effect of the financial impact to trade impact during the financial crisis highlighted in chapter one, seems to point to this conclusion as well. This study therefore examines the role of trade on growth accounting for the difference in its effect in the absence and presence of risk, with the aim of accounting for the role of risk on growth, through the trade nexus. A secondary consequence of my study is its contribution to the debate as to the efficiency of outward oriented trade policies on growth. With the fact that risk is a factor in trade flow determination, outward oriented policies alone cannot promote growth; they have to be supported by stabilization policies, which in turn generates more trade.

The relevance of this study cannot be overstated due to the well-known relationship between trade and growth. It has been suggested that trade contributes to growth either through capital accumulation or its effect on innovation and technological spill over (Lopez, 2005). Theoretically, Santacreu (2015) proposes that trade enters growth via research and development increasing the chance of success and leading to higher output. Trade is estimated to be responsible for about 65% of the increase in growth in developing countries. Empirically, increased output has been shown to be a direct result of trade in technology through increased domestic innovation (Schneider, 2005). It therefore stands to reason that factors that impact trade should also impact growth. To this end, I model the impact of the exogenous determinants of trade (distance and risk) on growth

motivated assassinations and ethnic conflicts reinforce the one-way causality from this measure to growth, as growth is not a sufficient condition for these outcomes.

and empirically test their validity. While a broader definition of risk spans a variety of sources of uncertainty in the delivery of previously agreed amount of goods, the problem of reverse causality suggests that this definition of risk be limited to more exogenous variables indicating that the estimates generated in this study are lower bounds. In this paper, political instability and the presence of terrorism in import partner countries are used as exogenous sources of risk stemming from a supply shocks. In addition, I also consider risk factors associated with the export partner's demand (e.g., demand fluctuations measured by their risk ratings and their previous period's growth rate) and determine their effect on growth rates of the country of concern.[42]

An overview of the literature indicates some ambivalence on the impact of trade on growth. For example, Lopez's (2005) extensive review of the literature suggests a mixed record of success in trade promoting policies. One explanation for this, under the purview of the "new new" trade theory, is that the impact of trade on growth can have both pro and anti-growth effects when considering heterogeneous firms (Baldwin and Robert-Nicoud, 2008). On a more macroeconomic level which is more in line with this study, the arguments for the mixed growth performance of countries engaged in trade promotion can be split into two primary camps: the first is that success is due to macroeconomic stability (Rodriguez and Rodrik, 1999); the second suggests that a commitment to outward-oriented policies, rather than macroeconomic stability drives the success of these countries (Bhagwati and Srinivasan, 2002).[43] The approach in this paper is, however, more in line with Rodriguez and Rodrik (1999) that macroeconomic stability determines the

[42] While political instability and terrorism are likely to be generally exogenous to trade and growth, demand driven risk factors may or may not be independent of factors contributing to growth in the primary country of concern, for example, if they are associated with systemic factors such as global slowdown. In the empirical section, I address this issue by introducing time fixed effects to capture the economic downturn of 2008.

[43] See also Kreuger (1990) who viewed the success stories in East Asia as solely due to a shift in trade strategy to outward-oriented policies in these countries.

success of outward – oriented trade policies. In chapter 2, I empirically show that countries self-select themselves into strata based on political stability and terrorism rankings and as such, tend to trade more with countries that have similar levels of stability. This suggests that the success of outward oriented policies may only serve to increase trade flows as long as the trading partner is less risky (more macro-economically stable by the standards of any of the risk measures discussed earlier).

This introduction of risk also casts doubt on the solutions that have been suggested to help developing countries grow faster through trade. For example, once risk is allowed in, it is no longer clear whether a reduction of trade barriers in advanced countries would expand imports from the developing countries. Rather, such a policy is likely to mainly increase trade among advanced economies primarily due to the risk factor posed by their developing counterparts which acts as a deterrent to increased trade flows. Therefore, policy makers in these risky countries will need to take this into account when formulating plans designed to promote growth through trade. What follows is therefore a rigorous analysis to both theoretically and empirically provide evidence to support this assertion.

To address these questions, I model a dynamic trade relationship in which a particular country engages in trade with multiple partners. The country first imports capital goods from its trading partners and uses them in the production process. It then consumes, saves and exports from said output. I make the added assumption that the capital imports augment the local capital, which implies that the higher the capital imports, the higher the output. This is in line with Hallward-Driemeier et. al (2002) who find that increase in imports of capital goods led to productivity gains in a dataset of five Asian countries. I also account for the role of export growth on economic growth, both through the balanced trade assumption and potential externalities leading to increase

in technology that ultimately enhances growth. In this paper, the volume of trade however, depends not only on traditional factors that impact trade, such as output and distance, but also on measures of risk. Distance is modelled in the traditional sense, with an increase in distance implying an increase in transportation costs ultimately leading to less trade.

Empirically, this study draws inspiration from Frankel and Romer (1998) from here on FR, who estimate a country's bilateral trade using the geographical measures in the gravity model (excluding GDP of both partners due to reverse causality between GDP and growth) and then aggregate the estimated bilateral trade estimates for each country over all the partners to obtain an exogenous measure of trade (exogenous to the growth rate). Here, I follow the same process but estimate this for a panel dataset as opposed to the cross sectional dataset by FR, this is because cross country empirical studies are not robust and offer no evolving mechanism by which trade affects growth (Lopez, 2005). As a result, I opt for a panel data set as the time series component provides that added dimensionality (Dollar and Kraay, 2003). I extend the FR paper by adding the risk measure to the individual estimates of trade of both partners before aggregating and obtaining the estimates of trade. The study proposes to highlight the difference (if any) that the inclusion of risk in trade may have on the impact of trade on growth. It does so, by comparing both models (with and without the risk measure) for the same set of countries for the same time period.

The rest of this paper is organized as follows: section two discusses the theoretical set up and validation of my premise, as well as the consequences I intend to test empirically. Section 3 discusses the data, empirical analysis and results, while section four concludes.

3.2 Theoretical Validation

3.2.1 The standard Model

Consider the following open production economy, infinite horizon, representative agent model. For ease of exposition and without loss of generality, I assume no population growth and no depreciation. Agents maximize lifetime utility by choosing consumption and savings over time. In addition, they also import capital goods (raw materials) which are used to augment the production process. The country incurs transportation cost of τ , which is defined as an average cost per unit per distance of transporting goods, i.e. it costs τ to transport one unit of an import good one unit of the distance travelled, so to transport j units across k miles, the total cost to the importing country will be τ kj. This is analogous to the iceberg shipping cost assumption that relates greater distance to greater transportation costs. Importers then make contractual agreements based on future expected export revenues. Given the incompleteness of capital markets however, particularly those in less developed countries where such forms of risk are predominant, it is often not possible to hedge such risks. This is compounded by the unexpected nature of the events, such as terrorism or social unrest which will potentially cause trading partners to be cautious when entering into contracts and as such, the potential for contract cancellation is factored into this analysis.

The agents in this economy choose the volume of imports to purchase from their import trading partners, and a possibility that this contract is not upheld is accounted for. The weight assigned to each trading partner that represents the belief of the agents in the country of concern that the contract is upheld by the partner (between 0 and 1) is modelled as a function of the trading partner's risk measure such that, the riskier a trading partner, the lower the weight assigned to the receipt of imports. On the demand side, the exporting agents also face the same threat of contract failure and

assigns weights to the export trading partners based on their risk rating as well. As such, the weights assigned have the following properties

$$0 \le \theta_j(R_j), \phi_k'(R_k) \le 1, \text{ such that } \theta_j'(R_j) < 0 \text{ and } \phi_k'(R_k) < 0 \quad (24)$$

θ and ϕ are weights assigned to import and export partners respectively, indicating the potential for a negative unexpected shock. As a result, agents in this country enter into contracts expecting that the contractual volume of trade will be met (i.e. $\theta_i = \phi_i = 1$) but plan for unexpected shocks (the possibility that $\theta_i < 1, \phi_i < 1$) when deciding the extent of trade with each partner country, given passed behavior. The closer the weight assigned to a country is to 1, the more trade with that country[44].

R is the risk rating of import partner j and export partner k.

This implies that observed imports at time t is

$$M_t = \sum_j \theta_j(R_j) m_j(1 - \tau d_j) \equiv \Theta_t(R) C(D^M) m_t \quad (25)[45]$$

Where

M_t is the observed imported capital at time t

θ_j is the weight assigned to partner country j

R_j is the risk rating of risk partner j

τ is the transportation cost

[44] In essence, agents will engage in trade if $E(\theta) = E(\phi) = 1$

[45] See appendix for proof of aggregation

d_j is the distance between the importing country and trading partner j

$\Theta_t(R)$ is the aggregated weight assigned to all import trading partners such that $\Theta_t'(R) < 0$

m_t is total imports at time t specified by contract

D^M is the sum of distances between country i and all J import trading partners

$C(D^M) = N^M - \tau D^M$ [46] is the fraction remaining after transportation costs are deducted from all import partners such that $C'(D^M) < 0$, and N^M is the number of import trading partners

Implying that $\frac{\partial k_t^F}{\partial D^M} < 0$ and $\frac{\partial k_t^F}{\partial R} < 0$ (26)

Similarly, Observed exports at time t is given as

$$X_t = \Phi_t(R) C(D^X) x_t \quad (27)$$

Where $\Phi_t(R)$ is aggregated weight assigned to all export trading partners such that $\Phi_t'(R) < 0$

D^X is the sum of distances between country i and all K export trading partners

And x_t is the total export at time t specified by contract

This also implies that $\frac{\partial X_t}{\partial D^X} < 0$ and $\frac{\partial X_t}{\partial R} < 0$ (28)

This implies that the production function is of the form

$$f(k_t^D, M_t) \quad (29)$$

[46] See appendix

Where k_t^D and M_t are domestic and imported capital respectively

Given the well-established "benefits from trade" argument and the consequence of specialization that is inherent within it, it is reasonable to expect countries to specialize in the production of capital goods for which they have comparative advantage and import those which they do not, making the relationship complementary in the production process. As a result, I make the following assumptions about the production function

$$f_1\left(k_t^D, M_t\right) > 0 \tag{30}$$

$$f_{11}\left(k_t^D, M_t\right) < 0 \tag{31}$$

$$f_2\left(k_t^D, M_t\right) > 0 \tag{32}$$

$$f_{12}\left(k_t^D, M_t\right) > 0 \tag{33}$$

where subscripts 1 and 2 indicate partial derivatives with respect to the first and second arguments respectively.

Equations 7 and 8 highlight the usual assumption of diminishing marginal returns to capital. Equation 9 shows the positive role of adding imported capital goods to augment production. Equation 10 captures the benefit of trade to the returns to capital, due to the fact that these imported capital goods improve productivity predicated on the complementarity assumption[47]. With these

[47] This is in line with previous studies in the literature, particularly Lee (1995) and Kasahara and Rodrigue (2008) who suggest that importing intermediate (capital) goods lead to higher productivity.

specified, output in period t, is allocated to consumption, investment and the rest is intended for the contractual exports, thus the budget constraint is given below[48]

$$f\left(k_t^D, M_t\right) = k_{t+1}^D - k_t^D + c_t + X_{t+1} \tag{34}$$

where, c_t is consumption at time t, X_{t+1} is observed exports. The weights assigned to each trading partner are based on previous behavior and is known at time t, and as such, the agents choose the import and export contract volume, given these weights, resulting in a deterministic production function[49].

Since the timing adopted in this study implies that imports take place before exports and as such is observable before the export decision is made, the balanced trade assumption introduced in this study implies that observed imports are equivalent to the expected exports, i.e.

$$m_t = X_{t+1} \tag{35}$$

Which implies that $M_t = \Theta_t(R)\Phi_t(R)C\left(D^M\right)C\left(D^X\right)x_{t+1}$ (36)

Therefore, agents in this economy maximize expected lifetime utility[50] $\sum_{t=0}^{\infty}\beta^t u\left(c_t\right)$ subject to equations (27), (34) and (36)

[48] All variables in per capita terms

[49] The expectation of observed imports and exports are equal to the contractual agreements, i.e. $E(M_t) = m_t$ and $E(X_{t+1}) = x_{t+1}$. Therefore, making the decision of how much to trade using the belief that the contract will be upheld, only serves to limit trade with riskier trading partners with a higher probability of experiencing a negative shock.

[50] With the utility function satisfying the usual assumptions of concavity and Inada conditions

Next, I solve the intertemporal problem

$$L = \max_{c_t, k_{t+1}^D, x_{t+1}} \sum_{t=0}^{\infty} \beta^t \left\{ u(c_t) + \lambda_t \left[f\left(k_t^D, M_t\left(x_{t+1}\right)\right) - c_t - k_{t+1}^D + k_t^D - X_{t+1}\left(x_{t+1}\right) \right] \right\} \quad (37)$$

First order conditions

$$\frac{\partial L}{\partial c_t} = 0 \Rightarrow u'(c_t) - \lambda_t = 0 \quad (38)$$

$$\frac{\partial L}{\partial k_{t+1}^D} = 0 \Rightarrow \lambda_t = \beta \lambda_{t+1} \left[f_1\left(k_{t+1}^D, M_{t+1}\right) + 1 \right] \quad (39)$$

$$\frac{\partial L}{\partial x_{t+1}} = 0 \Rightarrow 1 = f_2\left(k_t^D, M_t\right) \Theta_t(R) C\left(D^M\right) \quad (40)$$

From equation 17

$$f_2\left(k_t^D, M_t\right) = \frac{1}{\Theta_t(R) C\left(D^M\right)} \quad (41)$$

From equations 38 and 39

$$\frac{u'(c_t)}{u'(c_{t+1})} = \beta \left[f_1\left(k_{t+1}^D, M_{t+1}\right) + 1 \right] \quad (42)$$

Suppose $u(c_t) = \ln c_t \Rightarrow u'(c_t) = \frac{1}{c_t}, u'(c_{t+1}) = \frac{1}{c_{t+1}}$, equation 19 is resolved to yield the growth rate of the economy $g(c)$

$$g(c) \equiv \frac{c_{t+1} - c_t}{c_t} = \beta \left[f_1\left(k_{t+1}^D, M_{t+1}\right) + 1 \right] - 1 \quad (43)$$

This implies that the effect of a change in risk or distance on growth rates is given by the following equations

$$\frac{\partial g(c)}{\partial D} = \beta f_{12}\left(k_{t+1}^{D}, M_{t+1}\right)\Theta_t(R)\Phi_t(R)x_{t+1}\left\{C\left(D^{M}\right)C'\left(D^{X}\right)+C'\left(D^{M}\right)C\left(D^{X}\right)\right\} < 0 \quad (44)$$

$$\frac{\partial g(c)}{\partial R} = \beta f_{12}\left(k_{t+1}^{D}, M_{t+1}\right)C\left(D^{M}\right)C\left(D^{X}\right)x_{t+1}\left[\Theta_t(R)\Phi_t{}'(R)+\Theta_t{}'(R)\Phi_t(R)\right] < 0 \quad (45)$$

Equations 21 and 22 above suggest that the determinants of trade have an effect on the growth rate of an economy. Increases in the factors that deter trade negatively impact the rate of growth, further highlighting the assertion that increase in trade is beneficial for growth. The fact that risk is shown above to have an effect on the growth rate suggests that the effect of trade may have indeed been incorrectly estimated in previous empirical studies.

3.2.2 Theoretical extension: Accounting for trade externalities

Due to the findings of positive spillover effects or externalities from trade[51], I incorporate the contribution of exports to productivity either through learning-by-doing or technological externalities by introducing a function "g" of exports to the production function, such that, an increase in exports leads to an increase in externalities ($g'(X) > 0$), which ultimately increases output. This implies that the production function is of the form

$$f\left(k_t^{D}, M_t, g(X_t)\right) \quad (46)$$

Such that

$$f_1\left(k_t^{D}, M_t, g(X_t)\right) > 0 \quad (47)$$

$$f_{11}\left(k_t^{D}, M_t, g(X_t)\right) < 0 \quad (48)$$

$$f_2\left(k_t^{D}, M_t, g(X_t)\right) > 0 \quad (49)$$

$$f_3\left(k_t^{D}, M_t, g(X_t)\right) > 0 \quad (50)$$

[51] See Lopez (2005) for a detailed list of studies

$$f_{12}\left(k_t^D, M_t, g\left(X_t\right)\right) > 0 \tag{51}$$

$$f_{13}\left(k_t^D, M_t, g\left(X_t\right)\right) > 0 \tag{52}$$

where subscripts 1, 2 and 3 indicate partial derivatives with respect to the first, second and third arguments respectively.

Equations 47 and 48 once again highlight the usual diminishing returns to capital. Equations 49 and 50 show the benefit of adding imported capital goods to the production process as well as the positive externalities from exports. Equations 51 and 52 capture the benefit of trade to the returns to capital, due to the fact that these imported capital goods and externalities improve productivity. Similar to the standard model above, agents in this economy maximize expected lifetime utility $\sum_{t=0}^{\infty} \beta^t u\left(c_t\right)$ subject to the budget constraint $f\left(k_t^D, M_t, g\left(X_t\right)\right) = k_{t+1}^D - k_t^D + c_t + X_{t+1}$

This yields the following first order conditions

$$u'\left(c_t\right) - \lambda_t = 0 \tag{53}$$

$$\lambda_t = \beta\lambda_{t+1}\left[f_1\left(k_{t+1}^D, M_{t+1}, g\left(X_{t+1}\right)\right) + 1\right] \tag{54}$$

$$\lambda_t = \frac{\beta}{\frac{\partial X_{t+1}}{\partial x_{t+1}}}\lambda_{t+1}\left[f_2\left(k_{t+1}^D, M_{t+1}, g\left(X_{t+1}\right)\right)\frac{\partial M_{t+1}}{\partial x_{t+1}} + f_3\left(k_{t+1}^D, M_{t+1}, g\left(X_{t+1}\right)\right)g'\left(X_{t+1}\right)\frac{\partial X_{t+1}}{\partial x_{t+1}}\right] \tag{55}$$

Equations 31 and 32 imply that

$$\left[f_1\left(k_{t+1}^D, M_{t+1}, g\left(X_{t+1}\right)\right) + 1\right] = \left[\frac{\partial X_{t+1}}{\partial x_{t+1}}\right]^{-1}\left[f_2\left(k_{t+1}^D, M_{t+1}, g\left(X_{t+1}\right)\right)\frac{\partial M_{t+1}}{\partial x_{t+1}} + f_3\left(k_{t+1}^D, M_{t+1}, g\left(X_{t+1}\right)\right)g'\left(X_{t+1}\right)\frac{\partial X_{t+1}}{\partial x_{t+1}}\right] \tag{56}$$

Also assuming the same utility function

$$g(c) \equiv \frac{c_{t+1} - c_t}{c_t} = \beta\left[f_1\left(k_{t+1}^D, M_{t+1}, g\left(X_{t+1}\right)\right) + 1\right] - 1 \qquad (57)$$

This then implies that

$$\frac{\partial g(c)}{\partial D} = \beta f_{12}\left(k_{t+1}^D, M_{t+1}, g\left(X_{t+1}\right)\right)\frac{\partial M_{t+1}}{\partial D^M} + \beta f_{13}\left(k_{t+1}^D, M_{t+1}, g\left(X_{t+1}\right)\right) g'\left(X_{t+1}\right)\frac{\partial X_{t+1}}{\partial D^X} < 0 \qquad (58)$$

$$\frac{\partial g(c)}{\partial R} = \beta f_{12}\left(k_{t+1}^D, M_{t+1}, g\left(X_{t+1}\right)\right)\frac{\partial M_{t+1}}{\partial R} + \beta f_{13}\left(k_{t+1}^D, M_{t+1}, g\left(X_{t+1}\right)\right) g'\left(X_{t+1}\right)\frac{\partial X_{t+1}}{\partial R} < 0 \qquad (59)$$

Equations 58 and 59 show that the findings are robust to the inclusion of externalities form trade as the same relationship is also obtained as in the standard model above.

In order to corroborate the theoretical hypothesis, I test for the potential error in estimating the effect of trade on growth by looking at the effects of two trade instruments (one with risk and one without) on the rate of growth.

3.3 Data and Methodology

3.3.1 Data

For the empirical analysis, I have annual data for 169 countries with 179 trading partners each, between 2002 and 2013. The measure of import risk (supply side shocks) used is the measure of political stability and absence of terrorist attacks of the importing partners, while the measure of export risk (demand side shocks) is the measure of political stability and absence of terrorist of the exporting partners as well as the lagged growth rate of the exporting partner countries. These measures send signals to partner countries and they are able to make trade decisions given these

parameters. Growth rates are measured typically as the annual percentage change in real GDP, while trade share is the summation of exports and imports as a fraction of GDP[52].

3.3.2 Methodology

Typically, when the question of the role of trade in growth is analyzed, an instrument is used in place of actual trade flows due to the potential reverse causality between growth and trade. The accuracy of this instrument to properly capture the effect of trade and yet side step the problem of reverse causality is key to an accurate depiction of the role of trade on growth. In this study, I will put the instrument into a weak and strong instrument test by considering two things: first is the correlation between the instrument and trade flows and the second is the degree of exogeneity of the variables that constitute my instruments. The analysis that follows is split into two stages: the first stage predicts and subsequently selects appropriate instruments for trade flows[53] using the traditional gravity model as a starting point, while the second stage shows the effect of the selected instruments on the rate of growth[54].

3.3.2.1 Stage 1

Taking a page from FR, I generate estimates for trade flows using purely exogenous factors that influence trade but are not influenced by growth rates. This implies that GDP levels are eliminated from the standard gravity model, but my analysis differs from FR in that I add my exogenous measures of risk to generate other instruments for trade. Furthermore, FR points out that

[52] A full description of all variables used and sources can be found in the appendix
[53] I use the test suggested by Stock, Wright, and Yogo. (2002) of an F-Statistic greater than 10 in the first stage regression to judge the strength of the potential trade instruments
[54] The fact that bilateral estimates (trade from country *i* to partner *j* at time *t*) are obtained in the first stage which are then aggregated for use in the second stage (all trade from country *i* at time *t*) prohibits the use of standard IV methods, where both stages are estimated together because the indexes do not match. Hence the two stage approach that is taken here.

international trade is influenced by the level of internal trading in each country and suggests that the area of the country and the population within should be used as proxies to measure the level of internal trade. As a result, I estimate the following equation:

$$\ln trade_{ijt} = \beta_0 + \beta_1 \ln dist_{ij} + \beta_2 xrisk_{it} + \beta_3 prisk_{jt} + \beta_4 gro_{jt-1} + \beta_5 \ln area_{it} + \beta_6 \ln area_{jt} + \beta_7 \ln pop_{it}$$

$$+\beta_8 \ln pop_{jt} + \beta_9 contig_{ij} + \beta_{10} comlang_{ij} + \beta_{11} comcol_{ij} + \beta_{12} col45_{ij} + \beta_{13} colony_{ij} + \beta_{14} curcol_{ij} + \varepsilon_{ijt}$$ [55] (60)

Where

$trade_{ijt}$ is the sum of country i's exports and imports from its trading partner j at t

$\ln dist_{ij}$ is the natural log of the distance between partner countries i and j

$xrisk_{it}$ is the risk measure of the exporting country i at time t

$prisk_{jt}$ is the risk measure of partner country j at time t

gro_{jt-1} is the growth rate of partner country j at time $t-1$

$\ln area_{it}$ is the natural log of the area of exporting country i at time t

$\ln area_{jt}$ is the natural log of the area of partner country j at time t

$\ln pop_{it}$ is the natural log of the population of exporting country i at time t

$\ln pop_{jt}$ is the natural log of the population of partner country j at time t

$contig_{ij}$ is a dummy variable indicating whether countries i and j are contiguous (share a border)

$comlang_{ij}$ is a dummy variable indicating whether countries i and j share a common language

$comcol_{ij}$ is a dummy variable indicating whether countries i and j have had a common colonizer after 1945

[55] Other variations of this model are also estimated and the results are reported in section 3.3

$colony_{ij}$ is a dummy variable indicating whether countries i and j have ever had a colonial relationship

$col45_{ij}$ is a dummy variable indicating whether countries i and j have had a colonial relationship after 1945

$curcol_{ij}$ is a dummy variable indicating whether both countries are currently in a colonial relationship

Estimates of trade flows for different variations of this model are then generated and used as instruments for trade flows. Correlation coefficients are provided to determine how closely each of these instruments matches the actual trade flow data.

3.3.2.2 Stage 2

In this stage, I use the estimates of trade flows with the highest correlation coefficients generated in stage one as instruments of trade and determine the effect of the selected instruments (one with risk measures and one without) on growth for the same set of countries and hence, determine the more accurate effect of trade on growth. The inherent assumption that the degree of growth of technology is in part dependent on the degree of trade in a country follows directly from the theoretical model above (either through accumulation of capital imports or through technological spillover) and is also in line with other works in the literature (Frimpong and Oteng-Abayie (2006) and Lopez (2005)). So the standard output formula generally given as

$$Y_{it} = A_t K_t^{\alpha} L_t^{\beta} \tag{61}$$

Where K is capital stock, L is labor and A_t is the indicator for technology, can be extended to introduce measures of trade and other potential factors that drive growth.

$$\ln Y_{it} = \ln A_t + \alpha \ln K_t + \beta \ln L_t \tag{62}$$

$$\Delta \ln Y_{it} = \Delta \ln A_t + \alpha \Delta \ln K_t + \beta \Delta \ln L_t \tag{63}$$

Where $\Delta \ln Y_{it}$ is the growth rate of countries i at time t

$\Delta \ln A_t$ is the change in technology

$\Delta \ln K_t$ is investment

$\Delta \ln L_t$ is change in labor

In this study, I use the rate of savings as a fraction of GDP as a proxy for investment and the change in the total population as a proxy for the change in labor. Finally trade shares via A_t and as a result, in stage two I run the following regression

$$gro_{it} = \gamma_0 + \gamma_1 \Delta \ln pop_t + \gamma_2 sav_{it} + \gamma_3 \ln ts_{it} + \nu_{it} \quad (64)$$

Where

gro_{it} is the growth rate of country i at time t

$\Delta \ln pop_t$ is the population growth rate of country i at time t

sav_{it} is the savings rate of country i at time t

$\ln ts_{it}$ is the natural log of the instrument of trade share of country i at time t

Finally, the average contribution of trade to growth over time, according to the selected instruments of trade, is then estimated and compared to determine the differences between the effects of the inclusion and exclusion of risk measures. The results of both stages are presented in the following subsection.

3.3.3 Empirical results and analysis

3.3.3.1 Stage I results

The results for equation (60) are given in table 20 below. The expected signs for distance, population and the area of each country are obtained and are robust to the inclusion of other parameters in columns 1 through 6. Columns 1 and 2 highlight the importance of introducing the

exogenous measures of risk to the gravity model, as I find that both risk measures are statistically significant with an increase in this particular measure of risk leading to an increase in trade flows.[56] Columns 3 and 5 which include the measure of risk from demand side shocks suggest that the risk rating of the exporting country i is more robust since its inclusion (column 3) renders the lag of partner country j's growth rate insignificant. Furthermore, the introduction of the "relrisk" and "abrisk"[57] measures yield the expected negative signs as in chapter two, suggesting that the farther apart countries are ranked according to their risk rating, the less they trade. The final measure "correlation" captures the correlation coefficient between the estimates of trade from each model in and the observed trade flows. It is observed as was reported in chapter two that the models with risk factors match the observed trade flows more than the model with just distance. As a result of the correlations, I select the model with the highest correlation coefficient (model from column 3) to use in instrumenting trade flows in stage two. The model from column 1 is used as the standard with which I compare the effect of trade on growth when I introduce risk.

[56] It is important to note that with measure of risk used in this study, the higher the rating the lower the risk of the country. Therefore, a positive slope implies that the safer a country, the more it trades.

[57] $relrisk_t = \frac{xrisk_t}{prisk_t}$ and $abrisk = |xrisk - prisk|$

Table 20: Estimating Trade Flow Instruments using the gravity model

Variable	Ln Trade					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln Distance	-0.853***	-0.852***	-0.860***	-0.860***	-0.861***	-0.859***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Population (partner j)	1.365***	1.316***	1.161***	1.159***	1.205***	1.161***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Population (Country i)	1.553***	1.524***	1.409***	1.408***	1.407***	1.408***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Area (Country i)	-0.566***	-0.511***	-0.430***	-0.430***	-0.477***	-0.431***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Area (Partner j)	-0.640***	-0.586***	-0.488***	-0.487***	-0.519***	-0.488***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Country i Risk		0.00816***	0.0105***	0.0106***		0.0105***
		(0.000)	(0.000)	(0.000)		(0.000)
Partner j Risk		0.00341***	0.00460***	0.00446***	0.00425***	0.00460***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lag Growth Partner j			0.000683	0.000288	0.000980*	0.000688
			(0.188)	(0.586)	(0.058)	(0.184)
Relrisk				-0.00114*		
				(0.077)		
Abrisk						-0.000876**
						(0.038)
_cons	-9.175***	-9.761***	-7.560***	-7.527***	-6.793***	-7.528***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Correlation	0.3659	0.3917	0.4118	0.4121	0.3830	0.4116
N	259528	257641	231473	231242	232158	231473

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively
Estimating variations of equations 60 using random effects estimation procedure
The full of variables including the indicator variables are included but not reported
"Relrisk" is a ratio of partner country risks and "Abrisk" is the absolute value of the difference in their risk ratings
Correlation indicates the correlation between the estimated trade flows in each model.
N is the number of data points used in each column.

Table 21: Estimating Trade flows and accounting for risk mitigation

	Ln Trade			
	(7)	(8)	(9)	(10)
Ln Distance	-0.867***	-0.863***	-0.825***	-0.853***
	(0.000)	(0.000)	(0.000)	(0.000)
Country i	0.00908***	0.0116***	0.0115***	0.0114***
Risk	(0.000)	(0.000)	(0.000)	(0.000)
Partner j	0.00264***	0.00390***	0.00369***	0.00373***
Risk	(0.000)	(0.000)	(0.000)	(0.000)
Lag Growth	0.00293***	0.00405***	0.00419***	0.00454***
Partner j	(0.000)	(0.000)	(0.000)	(0.000)
Abrisk	-0.000720*	-0.00171***	-0.00147***	-0.00131***
	(0.095)	(0.000)	(0.001)	(0.004)
DCP	0.00934***			
country i	(0.000)			
DCP	0.00893***			
Partner j	(0.000)			
LL		0.0117***		
country i		(0.000)		
LL		0.00906***		
Partner j		(0.000)		
PPD			0.00942***	
country i			(0.000)	
PPD			0.00822***	
Partner j			(0.000)	
PPDF				0.00906***
country i				(0.000)
PPDF				0.00819***
Partner j				(0.000)
_cons	-4.223***	-4.949***	-4.968***	-4.374***
	(0.000)	(0.000)	(0.000)	(0.000)
Correlation	0.4995	0.4909	0.4986	0.502
N	201189	192000	186497	187694

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively. Table shows estimates of variations of equations 60 using random effects estimation procedure. All variables from equation 60 are included in the regression but only relevant variables are reported."Relrisk" is a ratio of partner country risks and "Abrisk" is the absolute value of the difference in their risk ratings. DCP is domestic credit to the private sector, LL is liquid liabilities, PPD is private credit by domestic money banks and PPDF is private credit by domestic money banks and other financial institutions. Correlation indicates the correlation between the estimated trade flows in each model and N is the number of data points used in each column

With the introduction of risk, I will be remiss if I did not consider certain aspects of the economy that have been put in place to mitigate risk. Since to the best of my knowledge there are currently no credit-markets designed to deal with the potential issues of the type of shocks I am suggesting, I turn to the financial markets for a possible solution at least, to combat price fluctuations as

discussed earlier[58]. As a result, I use the level of financial depth as a proxy for risk mitigation. The idea is that countries with a higher level of financial depth are more likely to come up with instruments that can eliminate at least some of the risk associated with trade[59]. Table 2 above introduces 4 measures of financial depth in order to estimate which one leads to the best instrument for trade flows. These measures are domestic credit to the private sector as a percentage of GDP (DCP), liquid liabilities as a percentage of GDP (LL), private credit by domestic money banks as a percentage of GDP (PPD) and finally, private credit by domestic money banks and other financial institutions as a percentage of GDP (PPDF). All measures of financial depth yield positive and statistically significant coefficients, suggesting that the higher the level of financial depth in the country, the higher the trade flows. The correlations between the measures of trade generated by the addition of these new measures are higher than the measures with just risk alone, suggesting a better match with the observed trade flows. As a result, the estimates from model 10 (column 4 in table 2 above) is chosen as the third instrument of trade accounting for risk mitigation, for analysis in stage 2.

3.3.3.2 Stage 2 Results

In this stage, using the three selected estimates of trade flows from stage 1 as instruments for trade, I examine the true nature of the impact of trade on growth. In addition to the correlations however, I perform the Stock, Wright, and Yogo. (2002) test to determine instrument strength and obtain the following results[60]

[58] While this is not expressed in the theoretical justification, the data will no doubt reflect risk owing to price and currency fluctuations and the introduction of financial depth measures will suppress some of this risk.
[59] An example of this would be the introduction of derivatives designed to mitigate exchange rate fluctuations.
[60] Initial tests of endogeneity confirm that trade is in fact endogenous to growth as hypothesized earlier.

Table 22: Instrument variable strength test

Instrument	R-squared	Adjusted R-squared	F-Statistic	P value
Model 1 (distance only)	0.02	0.01	1.503	0.2204
Model 4 (distance & Risk)	0.02	0.02	8.582	0.003
Model 10 (distance, Risk and financial depth)	0.03	0.02	18.576	0.000

Table 22 above suggests that while all three models have relatively low explanatory power for trade flow determination[61], the standard model for instrumenting trade flows using just distance measures alone is not an appropriate instrument of trade. This is evidenced by the p value which leads to a rejection of the alternate hypothesis that the coefficient from the regression of this instrument on observed trade flows is significantly different from zero. Models 4 and 10 however show a level of significance suggesting better explanatory power for trade flows with Model 10 passing the F-stat >10 condition suggested by Stock, Wright, and Yogo. 2002. These results back up the earlier conclusions based on correlations that Model 10 does the best job explaining trade flows, followed closely by Model 4.

The assumption is that the measure from stage one that best matches the observed trade flows will provide the most accurate relationship between trade and growth. To test this, equation (64) is estimated and table 23 below provides the estimates[62]. From table 23, I find the expected signs for the change in population, area and savings rate, all of which suggest that an increase in either will lead to an increase in the rate of growth. All instruments of trade flows show a positive and statistically significant effect of trade on growth. Columns 1 and 2 use predicted trade flows from stage 1 of my analysis based on models 1 and 4 corresponding to benchmark case with no risk

[61] Which is to be expected as GDP, a major driving force of trade flows has been removed from the analysis due to reverse causality concerns

[62] We also account for the area of a country with the assumption that the larger the area the more room for expansion, hence the higher the rate of growth.

measure and the case and full measure of risk, respectively. Both models indicate strong positive role of trade in growth but the inclusion of risk measures (model 4) performs better as indicated by the higher coefficient size and significance. To bring in financial depth as indicator of risk mitigation, predicted trade flows from model 10 of stage 1 are also included (column 5). However, here I face small loss of observations due to more limited data. Therefore, to make the comparison with models 1 and 4 meaningful, I re-estimate those models with the more limited data (columns 3 and 4). The results confirm the risk mitigating role of finance in addressing the adverse trade effects on growth. This is seen by the smaller coefficient of trade when it is constructed by including financial depth. Notice also that the same pattern is observed for models 1 and 4 as in the previous case.

Table 23: Role of trade on growth

	Growth				
	(1)	(2)	(3)	(4)	(5)
Population Growth	26.77***	26.94***	22.23***	22.36***	26.63***
	(0.001)	(0.001)	(0.005)	(0.005)	(0.001)
Ln Area	0.241***	0.254***	0.198***	0.212***	0.193**
	(0.000)	(0.000)	(0.004)	(0.002)	(0.011)
Savings Rate	0.0471***	0.0491***	0.0526***	0.0544***	0.0517***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Trade Share (M1)	0.658***		0.617***		
	(0.000)		(0.000)		
Ln Trade Share (M4)		0.781***		0.735***	
		(0.000)		(0.000)	
Ln Trade Share (M10)					0.549***
					(0.000)
_cons	1.257	1.376*	1.685*	1.780**	1.882**
	(0.131)	(0.098)	(0.054)	(0.041)	(0.043)
N	1515	1515	1408	1408	1408

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively

Estimating variations of equations 64 using random effects estimation procedure with the inclusion of time fixed effects for all columns

Ln Trade share (*Mi*) is the natural log of the estimated instrument of trade as a fraction of GDP from model *Mi* in the first stage. N is the number of data points used in each column

The coefficient alone is not enough to determine the contribution of trade to growth due to the fact that different specifications yield different trade estimates. I will address this issue in section 3.3.4 by estimating the share of each trade instrument on growth over time.

3.3.3.3 Stage 2 Robustness Checks

3.3.3.3.1 Accounting for Institutions

One could argue that since the risk measure of a country is another measure of its institutional quality, the added benefit observed so far is just a reflection of the contributions of institutional quality to growth and not the trade connection, due to the correlation between general institutional quality and the risk-infused trade measure. To address this, I carry out robustness checks that control for other institutional measures namely level of corruption, rule of law and government efficiency.

Table 24: Robustness checks for the effects of trade on growth (Institutional quality)

	Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Population Growth	26.10*** (0.001)	26.16*** (0.001)	26.63*** (0.001)	26.64*** (0.001)	25.82*** (0.001)	25.72*** (0.001)
Ln Area	0.224*** (0.002)	0.234*** (0.001)	0.231*** (0.002)	0.235*** (0.001)	0.195*** (0.007)	0.200*** (0.006)
Savings Rate	0.0478*** (0.000)	0.0498*** (0.000)	0.0473*** (0.000)	0.0494*** (0.000)	0.0484*** (0.000)	0.0504*** (0.000)
Ln Trade Share (M1)	0.615*** (0.000)		0.635*** (0.000)		0.557*** (0.000)	
Ln Trade Share (M2)		0.725*** (0.000)		0.735*** (0.000)		0.653*** (0.000)
Government Efficiency	-0.00458 (0.537)	-0.00512 (0.484)				
Corruption			-0.00218 (0.773)	-0.00394 (0.589)		
Rule of Law					-0.0107 (0.143)	-0.0122* (0.082)
Constant	1.633 (0.113)	1.788* (0.079)	1.453 (0.176)	1.723 (0.101)	2.177** (0.036)	2.405** (0.018)
N	1515	1515	1515	1515	1515	1515

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively
Estimating variations of equation 64 using random effects estimation procedure (controlling for Institutions)
Ln Trade share (*Mi*) is the natural log of the estimated instrument of trade as a fraction of GDP from model *Mi* in the first stage.
N is the number of data points used in each column

The expectation is that the inclusion of other institutional variables will eliminate or at least, significantly decrease the relationship between the growth rate and the instrument of trade with risk measures (i.e. an elimination of the significance or a significant reduction of the coefficient). Table 24 above shows the results of these robustness checks. I observe a fairly robust measure of trade with a reduction coming from the inclusion of the rule of law measure of institution. The reduced coefficient still statistically significant, is larger than that of the instrument with distance alone, suggesting that the improved relationship due to the introduction of the risk measures is not just a consequence of the effect of institutional quality on growth.

3.3.3.3.2 Accounting for Human Capital Accumulation

It has been well established that human capital development is essential to growth and productivity (Mankiw, Romer and Weil, 1992). Data on this factor however for the time period examined is not as comprehensive, as the inclusion of measures of this variable reduce the sample size by half. In order to generalize the conclusions in this study as much as possible, human capital accumulation is not introduced in the main regression analysis, but the impact of human capital inclusion on the effect of the trade share instruments on growth is estimated in this section, in order to determine if the inclusion would significantly change the findings. I use three proxies for human capital accumulation to test this: Government expenditure on tertiary institutions as a fraction of government expenditure on education (GET), Government expenditure on Education in Total as a fraction of total government expenditure (GEE) and net enrolment of secondary school students as a fraction of the total population of children of secondary school age, (NE). Table 25 below shows the results of this robustness check. From table 5, none of the measures of human capital accumulation significantly alters the estimates of the effect of trade shares on growth rates. As a result, I go ahead and estimate the contribution of these instruments of trade on growth over time,

using the results from estimations without human capital accumulation measures.

3.3.3.4 Estimating the contribution of trade to growth

Next, I estimate the contribution of the different trade instruments to growth over time. To do this, I re-estimate equation (64) using the natural log of one plus trade share as opposed to the natural log of trade share[63]. Each trade instrument is multiplied by its coefficient, and the ratio of this multiple to growth is taken and averaged over all countries for each year. The variable obtained is the contribution of the different instruments of trade shares to growth rates. Figure 18 below shows a plot of these contributions over time, comparing models 1 and 4 from stage one, while figure 19 shows the plot over time comparing models 1, 4 and 10 from stage one[64].

Figure 18

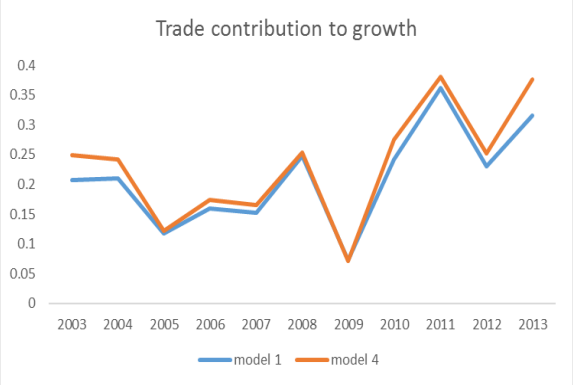
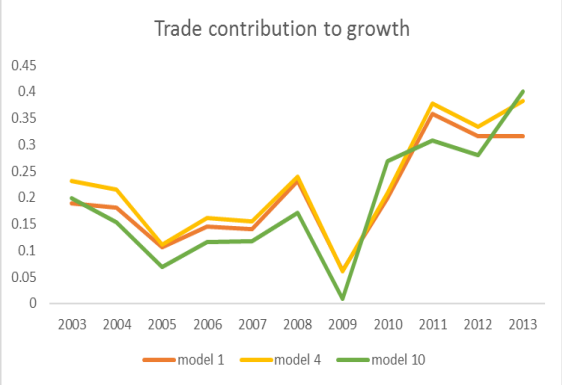


Figure 19



[63] This simply makes the calculation of the share easier as adding one to the trade shares before taking logs creates positive entries (as opposed to log of proper fractions which are negative). The results we obtain from the regression analysis are not significantly different and can be found in table C-1 of the appendix to this chapter.

[64] This is done to ensure accurate comparisons between measures due to the fact that data is unavailable for some countries in some time periods. Figure one has 1515 observations while figure 2 has 1408 observations.

Table 25: Robustness check for effects of trade on growth (Human capital Accumulation)

	Growth Rates											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Population Growth	17.40 (0.217)	18.63 (0.188)	13.66 (0.327)	15.22 (0.274)	39.11*** (0.001)	40.02*** (0.001)	18.21 (0.192)	19.62 (0.160)	14.82 (0.288)	16.45 (0.237)	40.61*** (0.000)	41.62*** (0.000)
Ln area	0.231*** (0.003)	0.221*** (0.005)	0.168** (0.041)	0.172** (0.035)	0.225*** (0.001)	0.226*** (0.001)	0.252*** (0.001)	0.240*** (0.002)	0.181** (0.033)	0.184** (0.030)	0.239*** (0.001)	0.239*** (0.001)
Savings Rate	0.103*** (0.000)	0.104*** (0.000)	0.0847*** (0.000)	0.0844*** (0.000)	0.0738*** (0.000)	0.0708*** (0.000)	0.107*** (0.000)	0.108*** (0.000)	0.0870*** (0.000)	0.0868*** (0.000)	0.0767*** (0.000)	0.0740*** (0.000)
Ln Trade Share (M1)	0.685*** (0.000)	0.669*** (0.000)	0.681*** (0.000)	0.689*** (0.000)	0.601*** (0.000)	0.640*** (0.000)						
Ln Trade Share (M2)							0.819*** (0.000)	0.801*** (0.000)	0.800*** (0.000)	0.808*** (0.000)	0.723*** (0.000)	0.766*** (0.000)
GET		-0.0224 (0.291)						-0.0275 (0.190)				
GEE				-0.0867** (0.017)						-0.0860** (0.019)		
NE						0.00973 (0.228)						0.00935 (0.242)
_cons	0.123 (0.908)	0.638 (0.586)	1.273 (0.234)	2.584** (0.031)	-0.0878 (0.925)	-0.669 (0.525)	0.119 (0.910)	0.746 (0.519)	1.432 (0.192)	2.753** (0.025)	0.0293 (0.976)	-0.518 (0.626)
N	742	742	875	875	752	752	742	742	870	870	743	743

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively

Estimating variations of equations 64 using random effects estimation procedure

Ln Trade share (*Mi*) is the natural log of the estimated instrument of trade as a fraction of GDP from model *Mi* in the first stage. GET is Government expenditure on tertiary institutions as a fraction of government expenditure on education, GEE is Government expenditure on Education in total as a fraction of total government expenditure and NE is the net enrolment of secondary school students as a fraction of the total population of children of secondary school age. N is the number of data points used in each column

Both figures show first and formost that the trade instrument with risk shows a higher level of contribution to growth than the measure without, suggesting that the contribution of trade to growth has been underestimated due to the fact that the trade instrument with risk, better matches observed trade. Figure 19 however, shows that the inclusion of risk mitigating factors points to an overestimation of the trade contribution to growth. The introduction of model 10 depicts a lower contribution during the initial periods of the financial crisis when the very financial instruments designed to mitigate these risks generated risks of their own, leading to distrust of these financial instruments and as such, a decline in the contribution of trade to growth. But, as is observed from 2009, the return of trust to the financial system once again increases the share of trade in growth.

3.3.3.5 Addressing the role of trade in developing and developed countries

In chapter 2, it is suggested that fact that poorer countries tend to be riskier, the effect of trade on growth may differ between developed and developed countries, as potential trading opportunities between developed and developing countries might not happen due to the risky nature of the developing countries. To test this hypothesis, a dummy variable is introduced and interacted with the risk measure of country i. Using the Human Development Index (HDI), the dummy variable takes a value of "0" if the country is ranked in the top 50 and a value of "1" if it is ranked below 50. In essence, I run the following regression

$$gro_{it} = \gamma_0 + \gamma_1 \Delta \ln pop_t + \gamma_2 sav_{it} + \gamma_3 \ln ts_{it} + \gamma_4 Dev * \ln ts_{it} + \nu_{it} \quad (65)$$

Where "Dev" is the development level indicator described above and everything else is same as in equation 64. Table 26 below captures the results of the regressions.

Table 26: Role of trade on growth (Development-Trade instrument interaction)

	Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Population Growth	22.74***	22.79***	27.25***	23.24***	23.45***	27.08***
	(0.003)	(0.003)	(0.001)	(0.002)	(0.002)	(0.000)
Ln of Area	0.286***	0.302***	0.309***	0.288***	0.293***	0.279***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Savings Rate	0.0426***	0.0438***	0.0402***	0.0437***	0.0455***	0.0440***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln of trade share M1	0.602***			0.726***		
	(0.000)			(0.000)		
Ln of trade share M4		0.685***			0.837***	
		(0.000)			(0.000)	
Ln of trade share M10			0.525***			0.731***
			(0.000)			(0.000)
Dev*Ln of trade share M1				-0.365***		
				(0.008)		
Dev*Ln of trade share M4					-0.407***	
					(0.003)	
Dev*Ln of trade share M10						-0.485***
						(0.001)
_cons	0.796	0.814	0.719	0.727	0.818	0.803
	(0.363)	(0.352)	(0.439)	(0.392)	(0.331)	(0.362)
N	1397	1397	1397	1397	1397	1397

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively
Estimating variations of equation 65 using random effects estimation procedure
Ln Trade share (*Mi*) is the natural log of the estimated instrument of trade as a fraction of GDP from model *Mi* in the first stage. *Dev* is the indicator variable with 0 for countries ranked in the top 50 according to the Human development index and 1 for those ranked below 50. N is the number of data points used in each column

Columns 1, 2 and 3 in table 26 above serve as bench marks with which to compare the introduction of the interaction term. Columns 4, 5 and 6 show the regression results with the interaction term included. The most obvious observation is that all models carry a negative sign when the interaction term is introduced. This implies that

$$\frac{\partial^2 growth}{\partial Dev \partial Lntrade} = \frac{\partial}{\partial Dev}\left[\frac{\partial growth}{\partial Lntrade}\right] < 0$$

Suggesting that the closer to one the dummy variable "*DEV*" (meaning the less developed), the lower the impact of trade on growth. This indicates that the developing countries benefit less from trade than their developing counterparts. Furthermore, comparing models 1 and 4 in columns 4 and 5 of Table 26, it is observed that the absolute value of the coefficient of the interaction term increases as we introduce risk. This is an indicator that the risky nature of developing countries contributes to the reduced effect of trade on growth, providing evidence in support of the hypothesis that risk impacts trade more negatively in developing countries than in developed countries. The same trend is observed when financial depth is introduced in column 6, as it is well established that developing countries tend to have lower financial depth and hence, cannot provide sufficient hedging against risk as is the case for their developed counterparts. This also suggests that the effect of trade on growth diminishes with the level of development.

3.3.3.6 Addressing the role of imports and exports respectively on trade.

Finally, as was highlighted in earlier sections in this chapter, trade has been shown to be beneficial to growth rate of an economy, however it is still unclear what portion of this is due to export or imports. In this subsection, I disaggregate trade into its components (exports and imports) and repeat stages one and two above for each, in order to highlight the contribution of exports and

imports respectively to growth. Tables C-2 and C-3 in the appendix capture the stage one results which are used to generate instruments for exports and imports, while table C-4 in the appendix captures the stage two results of the impact of imports and exports on growth. Figures 20 and 21 below show the differences in export and import contributions when considering distance alone and when risk is introduced. The same misspecification is observed in both figures similar to those in the total trade graphs above.

Figure 20: Import contribution to growth

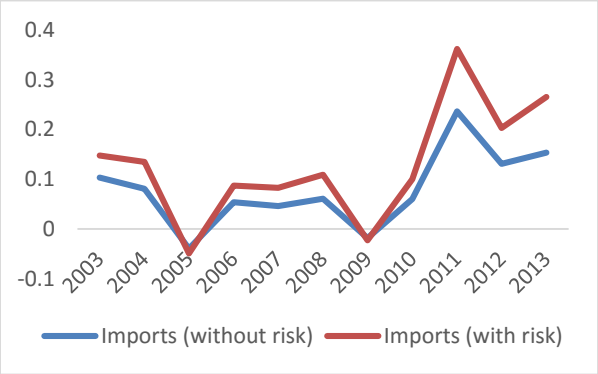
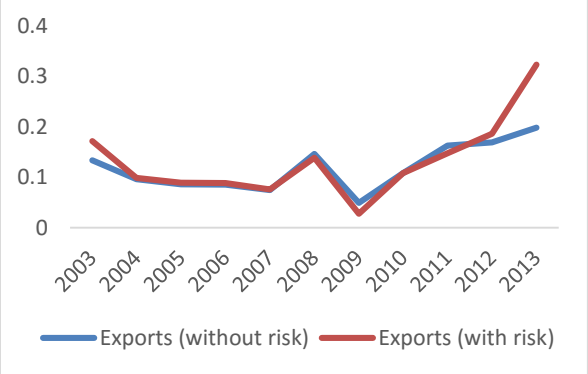


Figure 21: Export contribution to growth



Figures 22 and 23 below highlight the contribution of each component of trade as well as the total trade contriubution wth each model specification respectively. We find that in both model specifications, trade contributions are driven primarily by imports, as declines and increases in import contribution to growth are mirrored by the total trade contribution to growth, with exports contribution being relatively smooth over time, with the exception of the financial crisis. It is also observed in light with earlier findings, that the introduction of risk measures, imply that the contribution of trade to growth has been underestimated.

Figure 22: Import and Export contribution to growth (Without Risk)

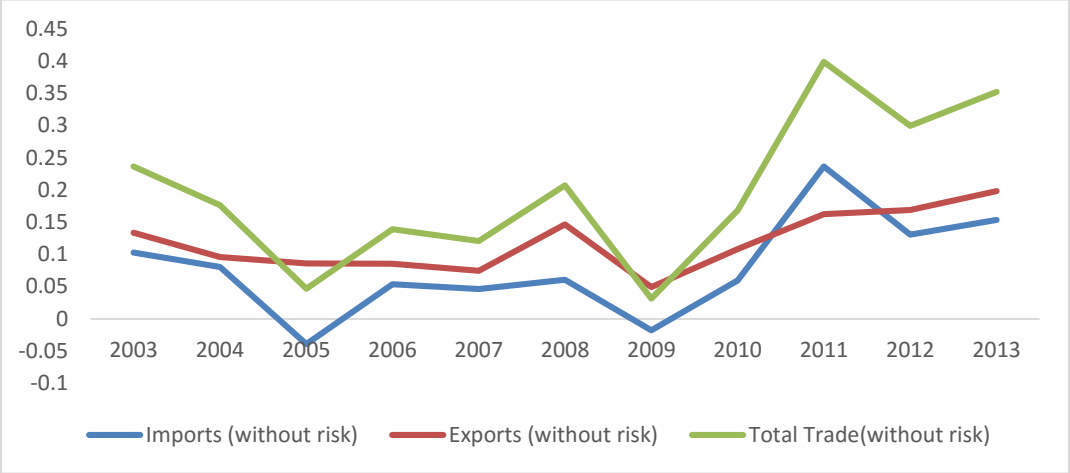
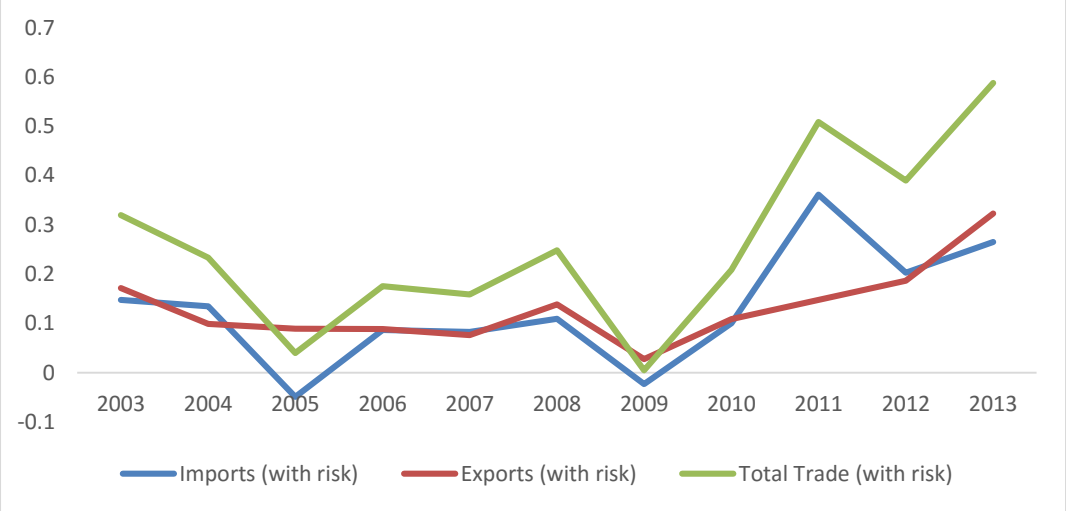


Figure 23: Import and Export contribution to growth (Without Risk)



3.4 Conclusion

In this paper, I set out to determine the effect of the introduction of exogenous measures of risk in trade flows on the role of trade in growth. This is first theoretically estimated and it is observed that the determinants of trade flow impact the rate of growth. Focusing primarily of distance (as a proxy for transportation costs) and risks form supply and demand shocks (proxied by the measures of political stability and the presence of terrorist attacks and growth rates of partner countries in

the empirical analysis), I find that an increase in risk or distance measures negatively impacts the growth rates of economies. Furthermore, this effect is tested empirically by comparing the effect of two intrusments for trade flows (one with risk measures and one without) on growth rates. I find, in line with the results of the theoretical study, that the both measures yield significantly different responses to growth with the contribution of the instrument with risk to growth being significantly larger than the instrument without. With the instrument containing risk being the most correlated with observed trade flows, I conclude that previous empirical estimates of the role of trade in growth have been underestimated. I however findcause for caution upon introducing measures for risk mitigation (proxied by measures of financial depth). The inclusion of these measures give rise to instruments that match observed trade flows even more closely than just risk measures alone, and sometimes show a smaller (or larger) role for trade in growth than estimated by the instrument with risk measures and the instrument with just distance. This points to the partial elimination of price related risk in a financially developed environment that could potentially hinder trade and the effect of the collapse of the global financial system during the geat recession of 2008. This finding of the relevance of risk in detremining trade flows and subsequently growth is important as it ties directly to potential growth enhancing policies geared towards developing countries that have been suggested in the past. Suggestions like a focus on outward oriented trade policies designed to encourage domestic producers to export and therefore drive growth are doomed to fail, all else equal, if it is not supplemented by policies that improve macroeconomic stability. Finally, the popular notion that trade between developed and developing countries can be stimulated if there is a reduction in both tariff and non tariff barriers in the developed countries will also prove ineffective, and would only serve to increase trade between develpoed countries

and as a result, will have little effect on the devloping economies if not accompanied by these policies to ensure stability.

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Appendix 3.1

1. Aggregating the cost function

   $1-\tau d_1 +1-\tau d_2 +1-\tau d_3 +...+1-\tau d_{N^M}$

   $N^M -\tau\left(d_1 + d_2 +...+ d_{N_M}\right) = N^M -\tau\left(D^M\right) \equiv C\left(D^M\right)$

2. Explaining aggregation of expected capital

   Consider the set of real numbers $\Re$ which is a field satisfying the following axioms

   1. Closure: if a and $b \in \Re$ then $a+b$ and $a.b \in \Re$
   2. Existence of inverse under multiplication and addition: If a $\in \Re$, then $\frac{1}{a} and -a \in \Re$

   (There are other axioms such as associativity, commutativity and identity, but I do not need these for the following proof)

   $0 \le \theta_i \le 1 \in \Re$, $d_i > 0 \in \Re$ and $m_i \ge 0 \in \Re$

   Then by axiom 1 above, $\theta_i m_i \left(1-\tau d_i\right) \in \Re$, $\sum_{i=1}^{N_M} d_i = D^M \in \Re$ by the same axiom,

   $\sum_{i=1}^{N_M} \theta_i m_i \left(1-\tau d_i\right) \in \Re$ and $C\left(D^M\right) \in \Re$ since $N_M, \tau, \in \Re$ (by axiom 2, $-\tau \in \Re$)

   Also, by axiom 1, $\sum_{i=1}^{N} m_i \in \Re$

   By axiom 2, $\exists \alpha, \beta \in \Re$ such that $\alpha = \frac{1}{\sum_{i=1}^{N} m_i}, \beta = \frac{1}{C\left(D^M\right)}$

   Therefore by axiom 1, $\alpha\beta \sum_{i=1}^{N} \theta_i m_i \left(1-\tau d_i\right) = \frac{\sum_{i=1}^{N} \theta_i m_i \left(1-\tau d_i\right)}{C\left(D^M\right)\sum_{i=1}^{N} m_i} \in \Re$. As a result, $\exists \Theta \in \Re$

   such that $\sum_{i=1}^{N} \theta_i m_i \left(1-\tau d_i\right) = \Theta C\left(D^M\right) \sum_{i=1}^{N} m_i$

   By definition, $0 \le \Theta \le 1$ because $\sum_{i=1}^{N_M} \theta_i m_i \le \sum_{i=1}^{N_M} m_i$ (due to the fact that $0 \le \theta_i \le 1$)

   $M_t = \sum_{i=1}^{N_M} \theta_i m_i \left(1-\tau d_i\right) = \Theta C\left(D^M\right) m_t$

Where $m_t = \sum_{i=1}^{N_M} m_i$

3. The full specification of the Lagrangian with alternative Bellman specification following

$$L = \max_{c_t, k_{t+1}^D, x_{t+1}} \sum_{t=0}^{\infty} \beta^t \left\{ u(c_t) + \lambda_t \left[f\left(k_t^D, M_t\right) - c_t - k_{t+1}^D + k_t^D - X_{t+1} \right] \right\}$$

$$\frac{\partial L}{\partial c_t} = 0 \Rightarrow \beta^t u'(c_t) - \lambda_t = 0 \quad \text{(A.1)}$$

$$\frac{\partial L}{\partial k_{t+1}^D} = 0 \Rightarrow -\lambda_t \beta^t + \lambda_{t+1} \beta^{t+1} \left[f_1\left(k_{t+1}^D, M_{t+1}\right) + 1 \right] = 0 \quad \text{(A.2)}$$

$$\frac{\partial L}{\partial x_{t+1}} = 0 \Rightarrow \lambda_t \beta^t f_2\left(k_t^D, M_t\right) \frac{\partial M_t}{\partial x_{t+1}} - \lambda_t \beta^t \frac{\partial X_{t+1}}{\partial x_{t+1}} = 0 \quad \text{(A.3)}$$

(A.2) resolves to $\lambda_t = \lambda_{t+1} \beta \left[f_1\left(k_{t+1}^D, M_{t+1}\right) + 1 \right]$

(A.4) (equation 16 in paper)

(A.3) resolves to $f_2\left(k_t^D, M_t\right) \frac{\partial M_t}{\partial x_{t+1}} = \frac{\partial X_{t+1}}{\partial x_{t+1}}$

$$\Rightarrow f_2\left(k_t^D, M_t\right) \Theta_t(R) \Phi_t(R) C\left(D^M\right) C\left(D^X\right) = \Phi_t(R) C\left(D^X\right)$$

$$\Rightarrow 1 = f_2\left(k_t^D, M_t\right) \Theta_t(R) C\left(D^M\right) \quad \text{(A.5)}$$

(equation 17 in paper)

From 4 Euler equation is given as $\frac{u'(c_t)}{u'(c_{t+1})} = \beta \left[f_1\left(k_{t+1}^D, M_{t+1}\right) + 1 \right]$ (A.6)

Alternatively, the infinite horizon problem can be rewritten as a Bellman equation (principle of optimality) and the solution of the function that satisfies the following equation also solves the infinite sequence problem

$$V\left(k_t^D\right) = \max u(c_t) + \beta V\left(k_{t+1}^D\right) \quad \text{(A.7)}$$

The state variable is k_t^D while the choice or control variables are c_t, k_{t+1}^D and x_{t+1}

Subject to $k_{t+1}^D = f\left(k_t^D, M_t\right) - c_t + k_t^D - X_{t+1}$; $X_t = \Phi_t(R) x_t C\left(D^X\right)$ and

$$M_t = \Theta_t(R) \Phi_t(R) C\left(D^M\right) C\left(D^X\right) x_{t+1}$$

First order conditions

With respect to choice variables

$$c_t : u'(c_t) - \beta V'\left(k_{t+1}^D\right) = 0 \quad \text{(A.8)}$$

$$x_{t+1}: f_2\left(k_t^D, M_t\right)\frac{\partial M_t}{\partial x_{t+1}} - \frac{\partial X_{t+1}}{\partial x_{t+1}} = 0 \quad \text{(A.9)}$$

With respect to the State variable

Envelope Theorem: $V'\left(k_t^D\right) = \beta V'\left(k_{t+1}^D\right)\left[f_1\left(k_t^D, M_t\right)+1\right]$ (A.10)

From (A.8) $u'\left(c_t\right) = \beta V'\left(k_{t+1}^D\right)$ (A.11)

From (A.9) $\beta V'\left(k_{t+1}^D\right) = \dfrac{V'\left(k_t^D\right)}{\left[f_1\left(k_t^D, M_t\right)+1\right]}$ (A.12)

From (A.11) and (A.12) $\dfrac{V'\left(k_t^D\right)}{\left[f_1\left(k_t^D, M_t\right)+1\right]} = u'\left(c_t\right)$ (A.13)

(A.13) therefore implies that $\dfrac{V'\left(k_{t+1}^D\right)}{\left[f_1\left(k_{t+1}^D, M_{t+1}\right)+1\right]} = u'\left(c_{t+1}\right)$ (A.14)

$\Rightarrow V'\left(k_{t+1}^D\right) = u'\left(c_{t+1}\right)\left[f_1\left(k_{t+1}^D, M_{t+1}\right)+1\right]$ (A.15)

(A.11) and (A.15) imply that $u'\left(c_t\right) = \beta u'\left(c_{t+1}\right)\left[f_1\left(k_{t+1}^D, M_{t+1}\right)+1\right]$ (A.16)

Therefore the Euler equation $= \dfrac{u'\left(c_t\right)}{u'\left(c_{t+1}\right)} = \beta\left[f_1\left(k_{t+1}^D, M_{t+1}\right)+1\right]$ (A.17)

(same as A.6 above). Equation (A.9) also resolves to equation (A.5) above.

Appendix 3.2

Table C-1: Re-estimation of equation 63 with Ln (1+trade share)

	Growth				
	(1)	(2)	(3)	(4)	(5)
Population Growth	26.86***	26.20***	22.85***	22.19***	25.87***
	(0.001)	(0.001)	(0.005)	(0.006)	(0.002)
Ln area	0.203***	0.208***	0.157**	0.162**	0.160**
	(0.004)	(0.003)	(0.032)	(0.027)	(0.035)
Savings Rate	0.0405***	0.0430***	0.0468***	0.0492***	0.0484***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Trade share Model 1	1.625***		1.462***		
	(0.000)		(0.000)		
Trade share Model 4		2.339***		2.127***	
		(0.000)		(0.000)	
Trade share Model 10					2.217***
					(0.002)
cons	0.142	-0.0394	0.720	0.547	0.796
	(0.875)	(0.966)	(0.447)	(0.567)	(0.427)
N	1515	1515	1408	1408	1408

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively

Estimating variations of equation 64 using random effects estimation procedure with the inclusion of time fixed effects for all columns

Trade share (*Model i*) is the log of one plus estimated instrument of trade as a fraction of GDP from model *Mi* in the first stage.

N is the number of data points used in each column

Table C-2: Generating Instruments for Exports

	Ln Exports				
	(1)	(2)	(3)	(4)	(5)
Ln Distance	-1.5***	-1.5***	-1.464***	-1.464***	-1.469***
Ln Population (partner j)	1.4***	1.356***	1.293***	1.292***	1.091***
Ln Population (Country i)	1.6***	1.648***	1.621***	1.621***	1.432***
Ln Area (Country i)	-0.5***	-0.431***	-0.389***	-0.389***	-0.233***
Ln Area (Partner j)	-0.5***	-0.415***	-0.362***	-0.362***	-0.211***
Country i Risk		0.0178***	0.0218***	0.0220***	0.0197***
Partner j Risk		0.0110***	0.0126***	0.0123***	0.00995***
Lag Growth Partner j			0.00194***	0.00166***	0.00516***
Relrisk				-0.00241***	-0.00126**
DCP country i					0.0121***
DCP Partner j					0.0106***
_cons	-10.0***	-12.97***	-12.80***	-12.76***	-11.17***
N	230087	228515	207073	206914	180640

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively. Table shows estimates of variations of equation 60 using random effects estimation procedure. All variables from equation 60 are included in the regression but only relevant variables are reported."Relrisk" is a ratio of partner country risks and "DCP is domestic credit to the private sector, and N is the number of data points used in each column

Table C-3: Generating Instruments for Imports

	Ln Imports				
	(1)	(2)	(3)	(4)	(5)
Ln Distance	-0.0217	-0.0172	-0.0348	-0.0351	-0.00139
	(0.555)	(0.642)	(0.340)	(0.336)	(0.970)
Ln Population (partner j)	0.856***	0.855***	0.683***	0.681***	0.397***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Population (Country i)	1.057***	1.065***	0.919***	0.917***	0.675***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Area (Country i)	-0.433***	-0.425***	-0.332***	-0.331***	-0.179***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln Area (Partner j)					
Ln Distance	-0.513***	-0.507***	-0.404***	-0.403***	-0.219***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Country i Risk		0.00326***	0.00433***	0.00439***	0.00455***
		(0.000)	(0.000)	(0.000)	(0.000)
Partner j Risk		-0.0000835	0.000576	0.000485	-0.000270
		(0.878)	(0.320)	(0.406)	(0.671)
Lag Growth Partner j			0.000143	-0.000314	0.00201***
			(0.808)	(0.602)	(0.003)
Relrisk				-0.000698	-0.000108
				(0.345)	(0.909)
PPD country i					0.00804***
					(0.000)
PPD Partner j					0.00670***
					(0.000)
_cons	-4.982***	-5.452***	-2.529***	-2.494***	0.990*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.062)
N	236312	234197	210414	210183	166353

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively. Table shows estimates of variations of equations 60 using random effects estimation procedure. All variables from equation 60 are included in the regression but only relevant variables are reported."Relrisk" is a ratio of partner country risks and "PPD" is private credit by domestic money banks and, and N is the number of data points used in each column

Table C-4: Establishing the role of Exports and Imports individually on growth

	Growth			
	(1)	(2)	(3)	(4)
Population Growth	20.54**	20.90***	24.59***	24.15***
	(0.011)	(0.010)	(0.003)	(0.003)
Ln of area	0.259***	0.275***	0.171**	0.190**
	(0.001)	(0.000)	(0.025)	(0.014)
Savings Rate	0.0573***	0.0584***	0.0453***	0.0479***
	(0.000)	(0.000)	(0.000)	(0.000)
Ln of Import share (Without risk)	0.421***			
	(0.008)			
Ln of Export share (Without Risk)	0.267**			
	(0.021)			
Ln of Import share (With risk)		0.494***		
		(0.000)		
Ln of Export share (With Risk)		0.312***		
		(0.006)		
Ln of 1+Import share (Without risk)			11.15*	
			(0.067)	
(Ln of 1+Import share)^2 (Without risk)			-33.78**	
			(0.015)	
Ln of Export share (Without Risk)			1.355***	
			(0.000)	
Ln of 1+Import share (With risk)				19.97**
				(0.017)
(Ln of 1+Import share)^2 (With risk)				-70.90***
				(0.009)
Ln of Export share (With Risk)				1.877***
				(0.000)
_cons	2.396***	2.668***	0.563	0.136
	(0.007)	(0.003)	(0.585)	(0.897)
N	1408	1408	1408	1408

*,**, and *** indicate significance at the 10%, 5% and 1% level respectively

Estimating variations of equations 64 using random effects estimation procedure with the inclusion of time fixed effects for all columns

Ln Export(Import) share is the natural log of the estimated instrument of trade as a fraction of GDP from the models with and without risk in the first stage. N is the number of data points used in each column

Table C-5: Table of Variable sources and descriptions

Variable	Description	Source
Bilateral Exports & Imports	Value of total exports from a country to each trading partner	International Monetary Fund Database. data.imf.org
Distance	Arial distance between trading pairs	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8
GDP/Growth rates	Gross Domestic Product of each Country/change in GDP for each country	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators
Population	Number of people in each country	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators
Area	Surface area is a country's total area, including areas under inland bodies of water and some coastal waterways	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators
Risk Measure	Political stability of the Governments and the presence of terrorism in each country	World Bank World Governance Indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=worldwide-governance-indicators
Common language	0 if no common language and 1 if both countries in a pair speak the same language	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8
Contiguous	1 if both countries share a border and 0 if they do not	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8
Col45	1 if both countries have had a colonial relationship after 1945 and 0 if they do night	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8
Comcol	1 if both countries have been colonized by the same country and 0 if they do not.	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8
Curcol	1 if trading partners are currently in a colonial relationship 0 otherwise	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8
colony	1 if one country in a pair was colonized by the other, and 0 otherwise	French Research Center in International Economics http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8

Table C.4 (cont.)

Variable	Description	Source
Rule of Law	Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence	World Bank World Governance Indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=worldwide-governance-indicators
Corruption	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests	World Bank World Governance Indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=worldwide-governance-indicators
Government effectiveness	Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies	World Bank World Governance Indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=worldwide-governance-indicators
Savings rate	Gross savings (% of GNI)	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators
DCP	Domestic credit to private sector (% of GDP)	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators
LL	Liquid liabilities to GDP (%)	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators
PPD	Private credit by deposit money banks to GDP (%)	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators

Table C-4 (cont.)

Variable	Description	Source
PPDF	Private credit by deposit money banks and other financial institutions to GDP (%)	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators
NE	Net enrollment rate is the ratio of children of official school age who are enrolled in school to the population of the corresponding official school age	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators
GEE	Expenditure on education as % of total government expenditure	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators
GET	Expenditure on tertiary as % of government expenditure on education (%)	World Bank World development indicators http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators

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