Essays on Conflict, International Trade and Trade Cost

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Abstract

This thesis presents three essays in international trade economics. It considers three cases in which international trade and trade costs are linked to conflicts.

First chapter, "International Trade, Conflict and the Distance Puzzle: A Structural Gravity Model", empirically analyzes the relationship between conflict (both intrastate and militarized interstate conflict) and international trade using a structural gravity model. Conflict can be expected to increase international trade cost by a big margin, and hence making it important to fully understand how it affects trade. Using year-by-year cross country regressions, this chapter also focuses on how the distance variable, which proxies the trade cost in gravity model of trade, behaves over time using global dataset from 1962 through 2001. This is analyzed when the effect of conflict is included in the trade cost function of the structural gravity model. This non decreasing distance effect in the gravity model is called the *distance puzzle*.

Costs linked to conflict found to have a substantial negative effect on international trade. Militarized interstate conflict reduces trade by 61% (in tariff equivalent terms) and this is about double the effect of intrastate conflict which has 32%. This chapter also found that due to conflict, high income countries' trade is affected more negatively than low income countries although they can quickly recover. However, on the other hand we found an unexpected distance trend. Although the distance puzzle is not completely solved by using the structural gravity model, the trade cost is stable, that is, over time it is neither increasing nor decreasing by a significant margin. Distance coefficient is constant under the structural gravity model while increasing when the standard gravity model is applied. This chapter concludes that the distance puzzle lies in the structure of the gravity model used and not in the omitted variables.

Second chapter, co-authored with Craig, R. Parsons, "International Trade Cost and Conflict" tries to answer the question of how large is the cost of conflict on trade cost? The effect of conflict on trade may, at first seem apparent. Such violent disruption must surely reduce trade, *ceteris paribus*. Some empirical findings in the literature find a negative effect of conflict on trade. This chapter adds to the nascent literature in two ways. First, much of the literature is focused on the effect of conflict on bilateral trade. In this chapter, we separately examine the effect on trade by both intrastate conflict (civil war) and interstate conflict. Second contribution is the measure of trade costs used. We use the Novy (2013)[1] measure of trade costs. The novelty of the trade model, which is based on micro-models of trade, is that what is important is to compare internal trade to international trade between any two countries. As such, we are measuring the effect of the conflicts on the "trade costs" between countries. We confirmed the negative effects of both types of conflict on trade. We find, in our sample of 110 countries, that interstate conflict raises bilateral trade costs by approximately 21.6% (in tariff equivalent terms), while intrastate conflict raises the trade costs by only 7%. As such, interstate is roughly three times as damaging to trade.

Third chapter, "International Trade and Trade Cost using Non-CES Preferences: Translog Gravity Model" studies the effect of conflicts on trade. In contrary to most previous literature on this issue, this chapter empirically analyzes the relationship between conflict (Militarized Interstate Conflict) and international trade using a non-Constant Elasticity of Substitution (CES) based gravity model following Novy (2013)[2]. Like the first chapter, this section also analyzes the *distance puzzle* (sometimes called the *missing globalization puzzle*) of international economics, in this case, when translog gravity model is applied. Using a micro founded gravity equation which

[1] Published in Journal of International Economics.
[2] Published in Economic Inquiry.

is based on a translog demand system this chapter sheds more light on the non-decreasing distance coefficient of the gravity model using data from 1970 through 2001. The missing globalization in the gravity model may be due to the CES preferences based part of the model. Trade is sensitive to trade costs if the exporting country provides a small share of the destination country's imports. Using the non-CES gravity model, this paper found that the distance puzzle is solved while using the standard gravity model, the absolute distance coefficient is increasing. The results are the same despite the inclusion of conflict effect. In general, given that there is no significant difference in the absolute distance coefficients despite including the effects of conflicts, this shows that the distance puzzle is not present due to the omitted variables, in this case conflict effects. However, since the distance puzzle varnishes after using the translog gravity model it shows that the puzzle lies in the structure of the gravity model.

Declaration

I certify that this dissertation I have presented to the Graduate School of International Social Sciences, Yokohama National University for examination for the Ph.D. in Economics is solely my own work other than the work we jointly carried and it is clearly indicated. Wherever contributions of others are involved every effort is done to clearly indicate the reference from the literature.

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Above all, I thank the Almighty Lord for making everything a success.

Dedication

To my daughter, Allison Nokutenda Mutsvangwa.

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Introduction

International trade costs consist of different types. This thesis focuses mainly on conflicts related costs. The effect of conflict on trade may, at first seem apparent. Such violent disruption must surely reduce trade, *ceteris paribus*. Some empirical findings in the literature find a negative effect of conflict on trade for instance, Glick and Taylor (2010) researched on the effects of conflicts on trade flows and welfare and found that conflicts reduce trade.

However, there have been mixed findings when it comes to the relationship between conflict and trade. Although most of the studies find a negative effect of conflict on trade there are some studies which found that war among major economic powers will not have permanent long term effects on their trade flows (see for example, Barbieri and Levy, 1999). In contrary, other studies like Anderson and Carter (2001) reached opposite conclusion.

van Bergeijk (1994) and Mansfield and Bronson (1997) concluded that conflict lowers trade while on the other side Morrow *et al* (1999) and Penubarti and Ward (2000) who used gravity model, found the effect of conflict on trade to be insignificant. These mixed results about the effect of conflict on trade give this nascent research area a need for further studies. One of the objective of this thesis is therefore to shed more light on the conflict trade relationship.

Most studies on conflict and trade utilize the gravity model of international trade which is now regarded as workhorse tool that has been applied in most empirical literature of international economics. It was first introduced to the field of international trade by Tinbergen (1962), Pöyhönen (1963), and Linnemann (1966). Since then, there have been a wide variety of models which give theoretical microeconomic foundations for the gravity model of international trade[3]. In its basic

[3] See Anderson (1979), Krugman (1980), Anderson and van Wincoop (2003) and Eaton and Kortum (2002) among others.

form the standard gravity model relates bilateral trade flow of two countries to their economic size and geographical distance. In the model, Gross Domestic Product (GDP) represents economic mass, that is, represents market size in two trading countries. GDP of importing country reflects potential demand for imports, while GDP in exporting country represents the potential supply of its goods. Distance reflects the trade costs between the two trading countries. It is with this gravity model that the costs of trade represented in the model by distance should be falling over time due to globalization mainly caused by an increased integration of markets worldwide for example through trade. However, most previous literature do not support this fact, as an example a meta-analysis by Disdier and Head (2008) supported this notion of increasing absolute distance coefficients over time. This non decreasing distance elasticity of the gravity equation is called the *missing globalization* or the *distance puzzle.* Thomas Friedman (2005) argued that the fall in communication costs which are an integral part of overall transactions costs captured by distance, should provide a tremendous opportunity for the poorer countries to integrate the world economy especially because of their backwardness and the rapid spread of reduction in these costs around the world.

Given the above brief background, this thesis has two main objectives. First is related to the understanding of how conflicts affect international trade and trade costs. I apply different econometric methodologies as I try to shed light on this area. Second objective is to empirically analyze the distance puzzle of international economics which is as well related to trade costs part of the gravity model. For these main objectives, this thesis consists of three chapters.

Chapter 1, empirically analyzes the relationship between conflict (both intrastate and militarized interstate conflict) and international trade using a structural gravity model following Yotov (2012) which considers the importance of an increase in international economic integration

relative to the integration in the domestic markets. Using year-by-year cross country regressions, this paper also focuses on how the distance variable, which proxies the trade cost in gravity model of trade, behaves over time using global dataset from 1962 through 2001 when the effect of conflict is included in the trade cost function of the structural gravity model. Militarized interstate conflict with 61% has a greater effect on trade compared to intrastate conflict which has 32%. This paper also found that for high income countries, trade is affected more negatively than low income countries. Although the distance puzzle is not completely solved by using the structural gravity model, the trade cost trend is stable, that is neither increasing nor decreasing by a significant margin. Distance coefficient is, for some reason constant under the structural gravity model whilst increasing when the standard[4] gravity model is applied.

Chapter 2, studies the trade costs and conflict effect. This paper adds to the nascent literature in two ways. First, much of the literature is focused on the effect of conflict on bilateral trade. In this paper, we separately examine the effect on trade by both intrastate conflict (civil war) and interstate conflict. Second contribution is the measure of trade costs used. We use the Novy (2013) measure of trade costs. The novelty of the trade model, which is based on micro-models of trade, is that what is important is to compare internal trade to international trade between any two countries. As such, we are measuring the effect of the conflicts on the "trade costs" between countries. We confirmed the negative effects of both types of conflict on trade. We find, in our sample of 110 countries, that interstate conflict raises bilateral trade costs by approximately 21.6% (in tariff equivalent terms), while intrastate conflict raises the trade costs by only 7%. As such, interstate is roughly three times as damaging to trade on average.

[4] This is the basic gravity model mostly applied in the previous literature.

Chapter 3, has two objectives. First, to empirically analyze the relationship between conflict and international trade applying a non-Constant Elasticity of Substitution (CES) based translog gravity model following Novy (2013). Second, to analyze the distance puzzle of international economics when conflict related cost is included in the translog gravity model. That is, using year-by-year cross country regressions and using a micro founded gravity equation which is based on a translog demand system we shed new light on the non-decreasing distance coefficient of the gravity model using data from 1970 through 2001. The missing globalization in the gravity model may be due to the CES preferences based part of the model. Trade is sensitive to trade costs if the exporting country provides a small share of the destination country's imports.

Using the non-CES gravity model, this paper found that the distance puzzle is solved while using the standard gravity model, this paper found that the absolute distance coefficient is increasing. When conflict effect is included in the benchmark and translog gravity model, the conclusion is still the same as in previous chapters.

Chapter 1: International Trade, Conflict and the Distance Puzzle: A Structural Gravity Model.

1.1 Introduction

Conflict can be expected to increase international trade cost by a large margin. In contrary to most previous literature on this issue, this chapter empirically analyzes the relationship between conflict (both intra and militarized interstate dispute (MID)) and international trade using a structural gravity model following Yotov (2012), which considers the importance of an increase in international economic integration relative to the integration in the domestic markets that is the trade costs should be analyzed in relation to both international and domestic trade. Unlike most of the previous literature which analyzed the effect of conflict on trade focused on either one of the two conflicts, this paper focused on both. This chapter also analyzes the *distance puzzle*[5] of international economics when cost effect of conflict is included in this structural gravity model. This paper extends the work of Yotov by analyzing the trade costs when the conflict effect is added to the structural gravity model.

The gravity model of trade first introduced by Tinbergen (1962) has been one of the successful model of international economics. The World Bank (2002) noted it as a mathematical model derived from an analogy with Newton's gravitational law, used to explain aggregate human behaviors related to special interaction such as migration and traffic flows. It is applied in many fields of economics which include FDI flow, migration, and trade among others. Despite having no theoretical basis at its inception, the model has been widely used to empirically analyze trade between countries because of its good fit to the data. Usually, when the gravity equation has been

[5] Non-decreasing absolute value of distance coefficients in the gravity model.

tested, the estimated effects of distance and output have shown to be economically and statistically significant and reasonably consistent across studies, Rose (2004). However, the model has been improved and modified for it to be consistent with the theory as well as being a better estimation method especially in international trade. For instance, Anderson and van Wincoop (2003) took into account the previously omitted multilateral resistance in the standard[6] gravity model. Yotov (2012) then relies on this theoretically based gravity model to derived a structural gravity model.

There is a growing body of trade literature analyzing how militarized interstate conflict affect international trade, Martin *et al* (2008), Glick and Taylor (2010) with political scientists mostly focusing mainly on how international trade affect war, Polachek (1980), Oneal and Russett (1999), Polachek (2007). On the other hand, there is another growing body of literature on the non-decreasing absolute distance coefficient of the gravity model of international trade. This is despite the second phase of globalization or the increased integration of world economies especially after the World War II, hence the term distance puzzle (see for example, Leamer and Levinsohn,1995; Disdier and Head, 2008; Carrere *et al*, 2009; Lin and Sim, 2012)[7].

It is not complete to analyze the effects of conflict without including economic sanctions between countries. There is high probability that countries in conflict, especially with big economies will too have economic sanctions. In this regard this paper also includes the sanctions effect to the analysis of conflict and trade. Most studies get mixed results probably because of ignoring this effect for instance van Bergeijk (1994) and Mansfield and Bronson (1997) concluded

[6] This is the basic gravity model mostly applied in the previous literature.
[7] See also Frankel (1997), Eichengreen and Irwin (1998) for the missing globalization puzzle also termed the distance puzzle.

that conflict lowers trade while on the other side Morrow *et al* (1999) and Penubarti and Ward (2000) who used gravity model, found the effect of conflict on trade to be insignificant.

Jacks, Meissner and Novy (2009) showed that during the war world trade retreat was entirely driven by the increase in trade costs caused by war, and therefore the importance of conflict on trade costs cannot be ignored. However, besides the interwar period of World War II, their study did not take into consideration the intrastate conflict and the other interstate conflicts in the second wave of globalization[8].

A recent meta-analysis study by Disdier and Head (2008) on the trend of distance coefficients from previous 103 papers that used gravity model showed that around middle of the 20th century, the negative impact of distance on trade started to increase and hence starting from 1962 for data sample in this paper. This is shown in figure 10. Grossman (1998) found that the distance effect has a greater magnitude than one transportation cost could exert alone.

The rest of this chapter is as follows: cost of conflict on trade: this will provide a brief explanation and literature of how the conflict is seen as cost to international trade, specification and methodology: this section shows the methodology and econometric model (structural gravity model) used, data: this provides data sources, results: in this section results are presented and discussed. And lastly the conclusion.

2.1 Cost of Trade and Conflict

In this chapter, Militarized Interstate Dispute (MID) and intrastate conflict will be included in the usual gravity cost component, which include bilateral distance, contiguity, common

[8] The second wave of globalization is considered as the period after the World War II.

language, colonial linkage among others. In general conflicts cause very high costs to an economy and it does not matter whether it is an intrastate or an interstate conflict.

Conflicts have a great cost implication to international trade which cannot be ignored. Through the destruction and disruption effects, the cost of transactions increases, for instance due to asymmetric information caused because of conflict, the cost of communication will increase. Collier (1999) noted that the costs of transportation increase as infrastructure and security deteriorate and the ability to enforce contracts is reduced as the institutions of civil society are weakened, trust declines, time horizons shorten due to uncertainty and opportunism becomes more profitable.

Conflict exerts fear to economic agents and in return impedes economic activities through increasing transport costs and discouraging investment. It causes the displacement of people as well as increasing the costs of labor in a country. Overly, affected firms' production falls greatly or reach a point where some firms have to exit the market because of high costs. This consequently reduces the exports.

3.1 Specification and Methodology

In shedding more light on how conflict affect international trade and the trade cost trend, the structural gravity model is applied in this paper following Yotov (2012) who considered the importance of an increase in international economic integration relative to the integration in the domestic markets. Yotov's paper considers the effect of distance between two countries and international trade cost relative to internal distance and internal trade cost. The paper derives the model based on the theory based gravity model concept by Anderson and van Wincoop (2003). This paper extends the model by including the conflict effect and assess how it affects international

trade. The application of this structural gravity model to the analysis of the distance puzzle of international trade is also carried out.

Equation (1) is the standard gravity model specification which is based on international trade only in determining the trade cost. The equation (1) is used as the benchmark estimation specification.

$$T_{\boldsymbol{ij}} = exp\left(\alpha_1 CONTG_{ij} + \alpha_2 LANG_{ij} + \alpha_3 COL_{ij} + \alpha_4 lnDIST_{ij} + \boldsymbol{\alpha_5 CONFL_{ij}} + \boldsymbol{\alpha_6 SANCT_{ij}} + \gamma_i + \mu_j\right) + \epsilon_{ij} \quad (1)$$

The structural gravity model which is based on both international and intra-national trade is shown by equation (2) below: Unlike the standard gravity equation (1) it also has domestic trade and cost.

$$T^*_{\boldsymbol{ij}} = exp\left(\alpha_1 CONTG_{ij} + \alpha_2 LANG_{ij} + \alpha_3 COL_{ij} + \alpha_4 lnDIST_{ij} + \boldsymbol{\alpha_5 CONFL_{ij}} + \boldsymbol{\alpha_6 SANCT_{ij}}\right) * Exp\left(\alpha_7 lnDist_{ii} + \gamma_i + \mu_j\right) + \epsilon_{ij} \quad (2)$$

Where the dependent variable T_{ij} is trade between country i and j. $\boldsymbol{T^*_{ij}}$ is also trade dependent variable, however it includes both inter and intra-national trade flows. $\boldsymbol{CONFL_{ij}}$ is both militarized interstate conflict between two countries and takes 1 if two countries are in conflict and zero otherwise (detailed explanation of this variable is under the data section) and intrastate conflict which takes a value of 1 if at least one of the bilateral trading partners has an internal conflict otherwise it takes value 0, $\boldsymbol{SANCT_{ij}}$ is a dummy variable which takes the value of 1 if at least one of the trading countries has economic sanctions and zero otherwise, $CONTG_{ij}$ is the geographical contiguity and takes value of 1 if there is contiguous border between two countries, $LANG_{ij}$ takes value of 1 if there is common language, COL_{ij} colonial relations between two countries otherwise is zero. $DIST_{ij}$ is the distance between two major two cities of two trading

partners whilst $Dist_{ii}$ is internal distance of country i from Mayer and Zignago (2011)[9]. γ and μ are importer and exporter fixed effects and lastly ϵ_{ij} is the error term.

For the distance puzzle, the above model specifications are estimated year-by-year cross country regressions, whilst a panel estimation is applied for the analysis of trade and conflict. Both are analyzed using the same data sample. Two methods used are: Ordinary Least Squares (OLS) and Poisson Pseudo-Maximum Likelihood (PPML) by Santos Silva and Tenreyro (2006) who showed that their estimator accounts for heteroskedasticity. They pointed out that in the presence of heteroskedastic errors, inconsistent estimation is found if we use the usual logarithmic transformed equation. Using equation (1) and (2), OLS which in this paper is a benchmark estimation method, takes the dependent variable in logs. Exporter and importer fixed effects are applied to both methods to do away with multilateral resistance problem.

4.1 Data

This section describes the data. In this empirical analysis, for the dependent variable, annual goods trade flows data of the years 1962 through 2001, covering 106 countries are used. International trade flow data are from two sources: from Andrew Rose's website[10] and COW (Correlates of War)'s version 3.0 dyadic trade by Barbieri and Omar (2012) and both are originally from IMF Direction of Trade data base.

The ideal measure of internal trade would be calculated by subtracting a given country's total exports to the world from that country's total production as is done in Novy (2013) and Wei (1996). However, this type of data is only available for few countries that have such detailed national accounts and Input-Output data. Many of the countries around the World which are

9 They calculate internal distance of country i as .67 √ (area/π)
10 http://faculty.haas.berkeley.edu/arose/

involved in a conflict, mostly do not have such data. Therefore, the difference between GDP (taken from the World Bank database, in dollars) and total exports of a country is used as a proxy[11].

Data on interstate and intrastate conflicts come from the COW. Specifically, version 3.1 of the Militarized Interstate Dispute data was used for the latter. It provides conflicts information for the period 1816-2010. However, this chapter is mainly focusing on the period 1962-2001 where dyadic MID data are available and also according to Disdier and Head (2008) who carried out a meta-analysis, showed that it is around the middle of the 20th century when the impact of distance was on the rising trend. The MID data is coded into five hostility levels of dispute with 1= No militarized action, 2=Threat to use force, 3=Display of force, 4=Use of force and 5=War. For empirical analysis in the previous literature[12], it is common to use Display of force, Use of force and War, therefore the interstate conflict takes value of 1 if there was conflict of hostility level 3,4 or 5 otherwise it will be zero.

Version 4.1 of intrastate conflict data from COW is used and it encompasses the conflict which happened within the borders of a country.

Table 1: Distribution of Conflicts 1962-2001

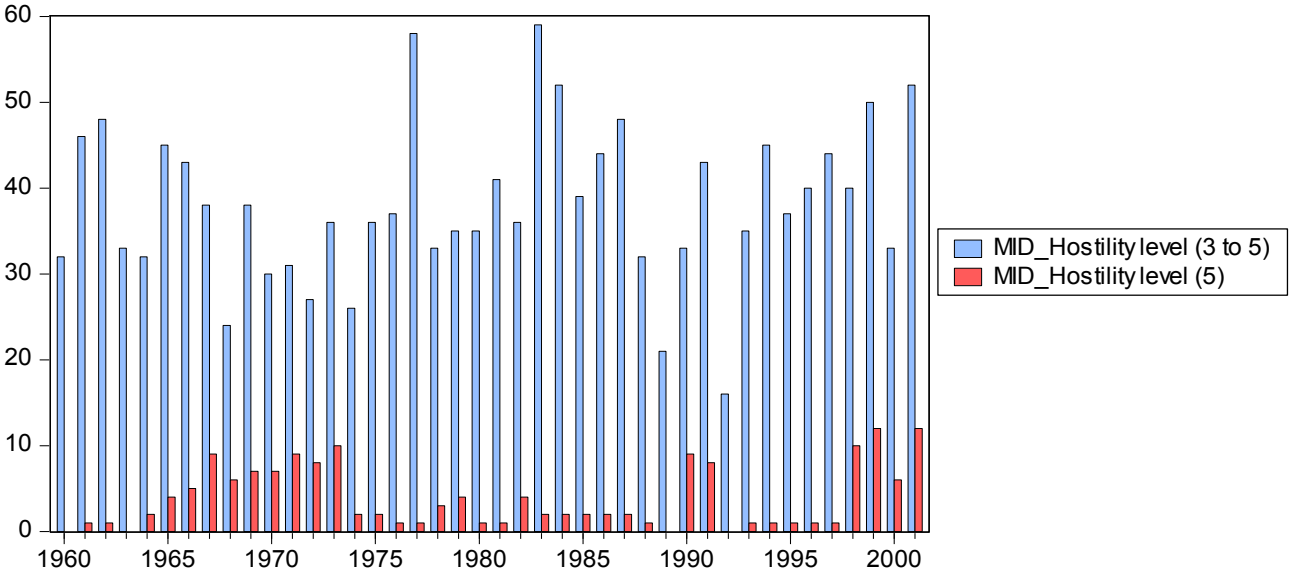
	Militarized Interstate Conflicts Hostility level 3-5 (Display of force, Use of force and War)	**Militarized Interstate Conflicts** Hostility level 5 (War only)
Total	1603	161

Source: author's calculation based on COW data.

11 One of the recent research which used this same proxy is Yotov (2012).
12 See Martin *et al* (2008).

The distribution of conflicts used in this chapter is shown in figure 1 and it displays frequency of militarized interstate disputes by hostility level. Both MID hostility level 3-5 and 5 only, shows that the occurrence of disputes has been common between 1962 and 2001. The frequency of MID hostility level 5 only, shows that number of wars high within the sample period used. Figure 2 and 3 show intrastate conflict frequency trend from 1962-2001 with the former showing only for the sample countries used in this chapter while the latter is for all conflicts available in the COW dataset. Number of intrastate conflicts have been increasing within the sample period used.

Figure 1: Militarized Interstate Conflicts Frequency (1960-2001)

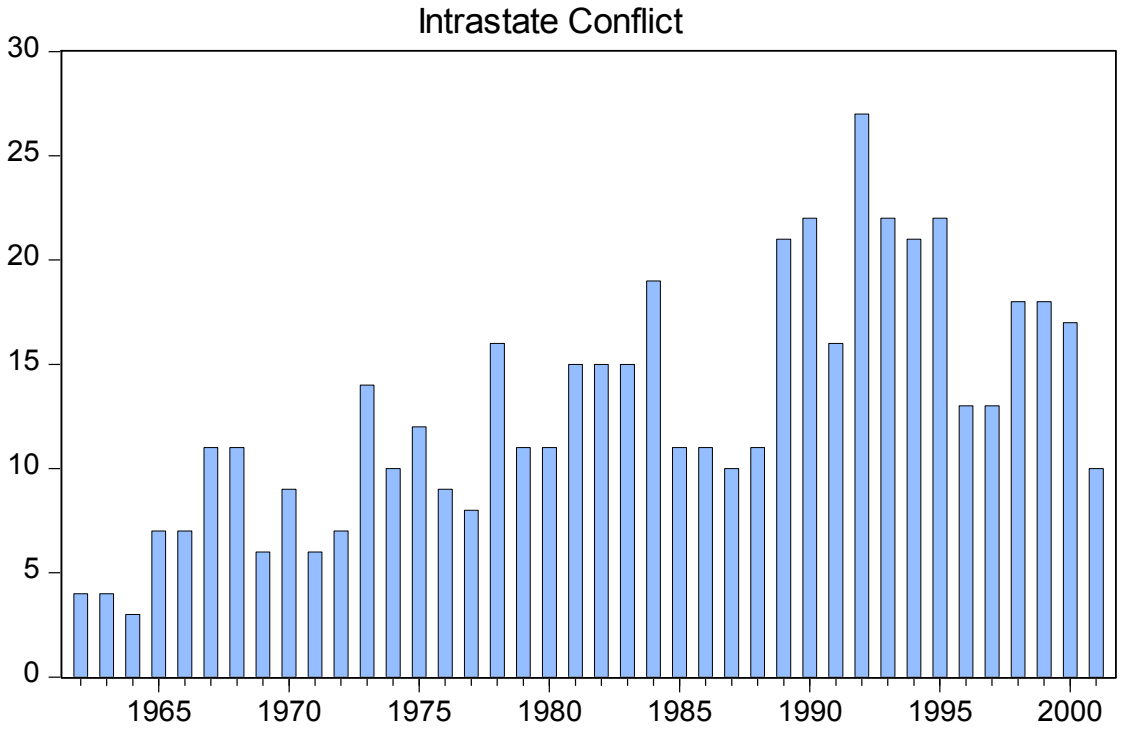


Source: Author's illustration based on COW data.

The trend in figure 2 and 3 show an increase of the frequency of conflicts, peaking between 1990 and 1995. GDP and sanctions data come from the World Bank's World Development

Indicators accessed online and PRIO[13] respectively. Data on distance and other trade costs are from CEPII dataset[14]. Table 1 also shows a summary of conflicts used for this

Figure 2: Intrastate Conflict Frequency, Sample Used (1962-2001)

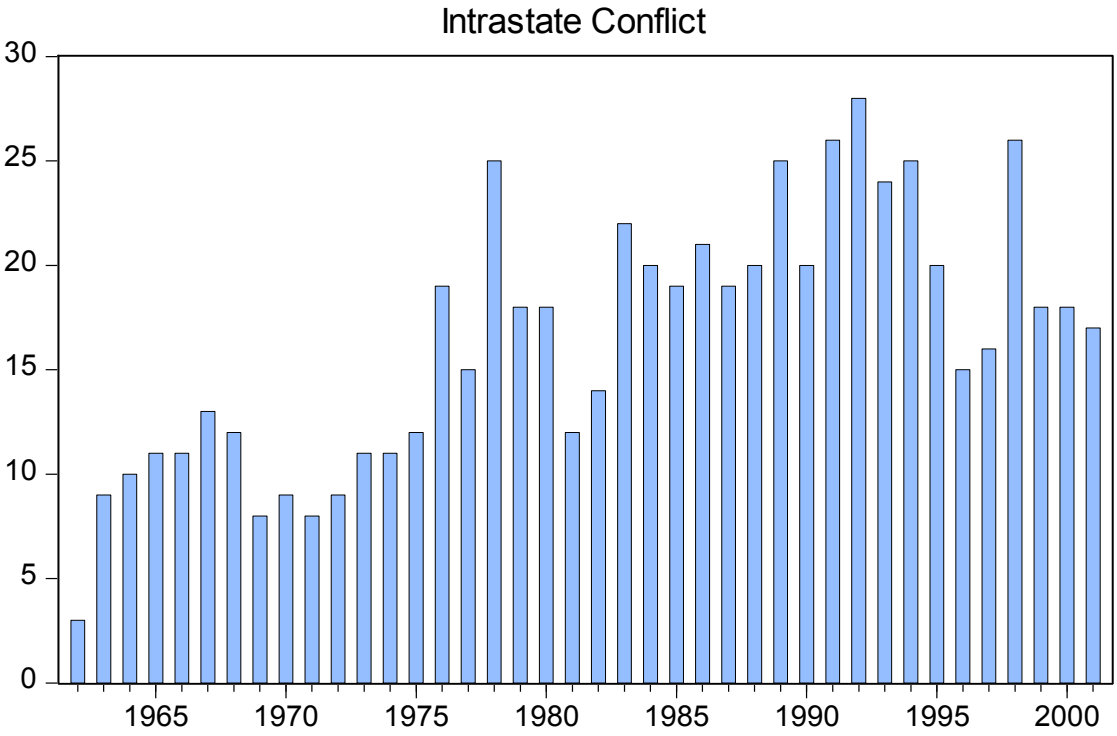


Source: Author's illustration based on COW data.

13 http://www.prio.no/jpr/datasets.

14 The source of distance and other bilateral dummies data is the website of the 'Centre d'Etudes Prospectives et d'Information Internationales' (CEPII) at http://www.cepii.fr/CEPII/en/welcome.asp.

Figure 3: Intrastate Conflict Frequency, all COW Conflicts (1962-2001)



Source: Author's illustration based on COW data.

5.1 Estimation Results

This section presents the results of the estimations using above described model specifications, equation (1) and (2). Using the structural gravity equation, the first research question is how does conflict affect international trade? Using the both PPML and OLS with exporter and importer fixed effects this paper found that there is a significant effect of conflict on trade. Table 2 column 1 (under PPML) shows interstate conflict reduces trade by around 61% (that is $1\text{-}e^{-0.948}$) compared to the period of no conflict. Also using OLS, column 7 of the same table, interstate conflict reduces trade by around 56% (that is $1\text{-}e^{-0.828}$). However, comparing the effect of inter and intrastate conflict, the latter has a smaller effect of 32%[15] as reported in column 2 of

15 The percentage is obtained using the same calculation as used above that is $1\text{-}e^{-0.388.}$

table 2 thus holding all other things constant the reason could be the fact that intrastate wars usually rely on lower technology weapons compared to interstate conflicts and therefore maybe less destructive. Using OLS, column 8, the results show a significant but small effect of intrastate conflict on trade.

Table 3 reports the results by different income groups that is high income countries and low income countries. Using PPML, column 1 of table 3 shows that interstate conflict affect trade for high income countries by around 86% whilst for low income countries is around 65%. This result shows that low income countries are negatively affected by interstate conflict less that high income countries. Intrastate conflict reduces trade by around 29% (table 3 column 2) for high income countries whilst its 26% (table 3 column 5) for low income countries. Like interstate conflict, intrastate conflict has a slightly less effect on trade for low income countries than high income countries. Intrastate has an insignificant positive effects when OLS is used for both high and low income countries.

The second research question is does the distance puzzle of trade solved by the structural gravity model? In studying the trend of the distance coefficient applying year-by-year cross country regressions from 1962-2001 and using the structural gravity model this paper also confirmed that the non-decreasing distance elasticity is still existing in most cases[16]. However, the distance coefficient for high income countries is stable compared to low income countries which is on the increase as shown in Figure 11. This is despite of the method used, both OLS and PPML (figure 12) have almost same trends. Using full sample and OLS, the distance coefficient line is steeper (figure 11) than same trend under PPML method (see figure 12) showing an increasing in

16 Note that the distance elasticity is found by taking the difference between α_4 and α_7 of the structural gravity model, equation (2).

the trade cost elasticity by bigger margin. The trend is stable under PPML method. These distance coefficient trends do not significantly change despite including the conflict variable, as shown in figure 13. This shows that the distance puzzle is not present due to the omitted conflict variable in gravity method.

Figure 14 and 15 shows the distance elasticity trends using the standard gravity model (equation 1) and the structural gravity model (equation 2). Both figures show that the trade cost denoted by distance coefficient is stable under the structural gravity model whilst on a clear increase when the standard gravity model is applied. Although the distance puzzle is not completely solved by using the structural gravity model, the trade cost is neither increasing nor decreasing by a big margin.

Table 2: Results: PPML and OLS using Equation (1) and (2)

VARIABLE	(eq2) PPML 1	(eq2) PPML 2	(eq2) PPML 3	(eq1) PPML 4	(eq1) PPML 5	(eq1) PPML 6	(eq2) OLS 7	(eq2) OLS 8	(eq2) OLS 9	(eq1) OLS 10	(eq1) OLS 11	(eq1) OLS 12
Contig	0.305***	0.286***	0.286***	0.389***	0.386***	0.386***	0.759***	0.756***	0.758***	0.771***	0.768***	0.771***
	(0.0457)	(0.0458)	(0.0458)	(0.0351)	(0.0350)	(0.0350)	(0.0178)	(0.0178)	(0.0178)	(0.0178)	(0.0178)	(0.0178)
Comlang	0.192***	0.199***	0.199***	0.111***	0.112***	0.112***	0.0974***	0.0974***	0.0974***	0.101***	0.101***	0.101***
	(0.0409)	(0.0405)	(0.0405)	(0.0251)	(0.0247)	(0.0247)	(0.00521)	(0.00521)	(0.00521)	(0.00523)	(0.00523)	(0.00523)
Colony	0.555***	0.563***	0.563***	0.733***	0.734***	0.734***	1.108***	1.108***	1.108***	1.098***	1.098***	1.098***
	(0.0446)	(0.0443)	(0.0443)	(0.0299)	(0.0293)	(0.0293)	(0.0243)	(0.0243)	(0.0243)	(0.0244)	(0.0244)	(0.0244)
ldistij	-0.775***	-0.780***	-0.780***	-0.765***	-0.767***	-0.767***	-0.419***	-0.419***	-0.419***	-0.413***	-0.413***	-0.413***
	(0.0178)	(0.0175)	(0.0175)	(0.00965)	(0.00957)	(0.00957)	(0.00277)	(0.00277)	(0.00277)	(0.00285)	(0.00285)	(0.00285)
Interstate conflict	-0.948***		-0.809***	-0.174		-0.153	-0.828***		-0.820***	-0.822***		-0.815***
	(0.275)		(0.270)	(0.206)		(0.208)	(0.172)		(0.172)	(0.172)		(0.172)
Intrastate conflict		-0.388***	-0.387***		-0.297***	-0.297***		-0.0426***	-0.0424***		-0.0414***	-0.0412***
		(0.0254)	(0.0254)		(0.0269)	(0.0269)		(0.00474)	(0.00474)		(0.00475)	(0.00475)
ldistii	-0.279***	-0.296***	-0.297***				0.778***	0.777***	0.777***			
	(0.0265)	(0.0261)	(0.0261)				(0.00596)	(0.00596)	(0.00596)			
Constant	17.05***	17.17***	17.17***	18.24***	18.35***	18.35***	11.87***	11.88***	11.89***	11.84***	11.86***	11.86***
	(0.175)	(0.172)	(0.172)	(0.0966)	(0.0955)	(0.0955)	(0.0532)	(0.0532)	(0.0532)	(0.0538)	(0.0538)	(0.0538)
Observations	348,763	348,763	348,763	343,246	343,246	343,246	1,094,600	1,094,600	1,094,600	1,089,083	1,089,083	1,089,083
R-squared	0.570	0.570	0.570	0.647	0.672	0.672	0.463	0.463	0.463	0.423	0.423	0.423
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: Dependent variable is log trade (includes both intra and international trade when estimating equation (2) and only international trade when estimating equation (1)) for OLS and is in levels for PPML method. Robust standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Results: High Income and Low Income Countries-PPML and OLS using Equation (2)

VARIABLES	(eq2H) PPML 1	(eq2H) PPML 2	(eq2H) PPML 3	(eq2L) PPML 4	(eq2L) PPML 5	(eq2L) PPML 6	(eq2H) OLS 7	(eq2H) OLS 8	(eq2H) OLS 9	(eq2L) OLS 10	(eq2L) OLS 11	(eq2L) OLS 12
Contig	0.257***	0.244***	0.244***	0.269***	0.276***	0.281***	-0.139***	-0.143***	-0.139***	0.764***	0.761***	0.762***
	(0.0556)	(0.0555)	(0.0555)	(0.0739)	(0.0743)	(0.0734)	(0.0506)	(0.0506)	(0.0506)	(0.0320)	(0.0319)	(0.0320)
Comlang	0.283***	0.281***	0.281***	0.463***	0.460***	0.479***	0.190***	0.190***	0.190***	0.0423**	0.0412**	0.0414**
	(0.0571)	(0.0565)	(0.0565)	(0.0699)	(0.0723)	(0.0719)	(0.0269)	(0.0269)	(0.0269)	(0.0179)	(0.0179)	(0.0179)
Colony	0.360***	0.368***	0.368***	0.561***	0.582***	0.615***	1.242***	1.243***	1.242***	0.768***	0.771***	0.772***
	(0.0634)	(0.0625)	(0.0625)	(0.133)	(0.135)	(0.132)	(0.0465)	(0.0465)	(0.0465)	(0.166)	(0.166)	(0.166)
ldistij	-0.697***	-0.706***	-0.706***	-0.515***	-0.504***	-0.514***	-0.977***	-0.976***	-0.977***	-0.0660***	-0.0661***	-0.0662***
	(0.0209)	(0.0206)	(0.0206)	(0.0355)	(0.0358)	(0.0357)	(0.0137)	(0.0137)	(0.0137)	(0.00954)	(0.00954)	(0.00954)
Interstate conflict	-1.935***		-1.970***	-1.038***		-1.153***	-2.532***		-2.535***	-0.300		-0.266
	(0.103)		(0.103)	(0.181)		(0.182)	(0.430)		(0.430)	(0.332)		(0.332)
Intrastate conflict		-0.343***	-0.343***		0.228***	0.246***		0.0109	0.0120		-0.0989***	-0.0985***
		(0.0408)	(0.0408)		(0.0752)	(0.0745)		(0.0321)	(0.0320)		(0.0145)	(0.0145)
ldistii	-0.219***	-0.238***	-0.238***	0.450***	0.486***	0.474***	-0.376***	-0.375***	-0.376***	1.304***	1.298***	1.298***
	(0.0308)	(0.0303)	(0.0303)	(0.0506)	(0.0544)	(0.0541)	(0.0242)	(0.0242)	(0.0242)	(0.0162)	(0.0162)	(0.0162)
Constant	16.60***	16.74***	16.74***	5.390***	5.242***	5.292***	19.84***	19.83***	19.83***	0.588***	0.593***	0.594***
	(0.204)	(0.202)	(0.202)	(0.246)	(0.260)	(0.258)	(0.140)	(0.140)	(0.140)	(0.100)	(0.101)	(0.101)
Observations	46,026	46,026	46,026	16,741	16,741	16,741	55,921	55,921	55,921	66,967	66,967	66,967
R-squared	0.570	0.570	0.570	0.639	0.639	0.639	0.714	0.714	0.714	0.420	0.421	0.421
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: Dependent variable is log trade (includes both intra and international trade when estimating equation (2) and only international trade when estimating equation (1)) for OLS and is in levels for PPML method. Robust standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1.

6.1 Conclusion

This chapter empirically analyzes the relationship between conflict (both intrastate and militarized interstate conflict) and international trade using a structural gravity model proposed by Yotov (2012) using large global dataset from 1962 through 2001 covering 106 countries. Using year-by-year cross country regressions, this paper also focused on how the trade cost usually denoted by distance variable trends over time when the effect of conflict is included in the trade cost function of the structural gravity model.

Costs caused by conflict have a substantial negative effect on international trade militarized interstate conflict with 61% having a greater effect compared to intrastate conflict which has 32%. This paper also found that for high income countries trade is affected negatively more than low income countries. However, on the other hand an unexpected distance trend was found. Although the distance puzzle is not completely solved by using the structural gravity model, the trade cost trend is stable, that is neither increasing nor decreasing by a big margin. Distance coefficient is for some reason constant under the structural gravity model whilst increasing when the standard gravity model is applied.

Chapter 2: International Trade Cost and Conflict

2.1 Introduction

The effect of conflict on trade may at first seem apparent. Such violent disruption must surely, *ceteris paribus*, reduce trade. Previous empirical findings in the literature do, indeed, generally find a negative effect of conflict on trade (see for example Glick and Taylor, 2010, and Martin et. al, 2008). One would also reasonably assume that conflict should increase the costs of trade. Mohammed and Williamson (2004) find that transportation costs doubled, tripled or even more during WWI. A study of world trade between 1870 and 2000 by Jacks, Meissner and Novy (2009) showed that increases in trade costs, in turn, have a huge impact on trade volumes. Therefore, the importance of conflict on trade costs, and therefore trade, cannot be ignored.

However, the few extant studies (such as Glick and Taylor) of the effect of conflict on trade or trade costs typically only consider *inter-state* (international) conflict and do not examine *intra-state* (civil war, for example) conflicts. Such internal disruptions certainly have the possibility of affecting and reducing trade. At the same, a line of literature has developed (Novy, 2013 *inter alia*) which emphasizes that to truly understand how "close" or "far" countries are to each other in terms of international trade, one must examine the degree in which a country trades with the world *relative* to how much it trades with itself, i.e. within its own borders. As such, we would like to examine the effect of both types of conflict on such "relative" trade costs.

This paper aims to assess the effect of both types of conflicts, *inter* and *intra*, on the overall trade costs (encompassing distance, language, non-tariff barriers, etc.) between nations. Not surprisingly, we find that both types of conflict raise trade costs between any two countries. This implies that both types of conflicts reduce international trade relative to domestic trade. Moreover,

we find that international conflicts drive trade costs approximately three times as much as intra-state conflicts do.

This paper adds to the nascent literature in two important ways. First, much of the literature is focused on the effect of international conflict on bilateral trade. In this paper, we separately examine the effect on trade from both *intra-state* conflict (civil war) and *interstate* conflict. Second, this paper uses Novy (2013) micro-modelled based measure of (relative) trade costs. The novelty of this trade measure is that what's important when understanding "distance" between any two countries one should compare internal trade (within a country) to the international trade between any two countries. As such, we measure the effect of the conflicts on these "trade costs" between countries. It is important to try and measure the relative magnitude of various elements of trade costs to overall trade costs.

By doing so, we confirmed the negative effects of both types of conflict on trade, or in Novy's terms, the decrease of a warring nation's interconnectedness to its trade partners during times of conflict. We find, in our sample of 110 countries, that interstate conflict raises the bilateral trade costs by approximately 21.6% (in tariff equivalent terms), while intrastate conflict raises the trade costs by only 7%. As such, interstate conflict is roughly three times as damaging to trade on average. To put it another way, if any two countries are involved in war with each other, this is the equivalent of raising their bilateral tariffs by 21.6% while civil wars are equivalent to raising tariffs by (merely) 7%. We also analyzed the effects of conflicts on trade costs by distinguishing between two levels of economic development. Comparing the damage that conflicts have on trade costs using different income groups, we find, in general, that conflict has a larger effect on trade costs low income than for high income countries. It should be noted that these figures represent a measure of bilateral trade costs of each country relative to domestic costs. Naturally, there is a

great deal of variance is the size and scope of conflicts, but when viewed in relation to, say, the Smooth-Hawley tariffs of the 1930s where the US raised tariffs to nearly 50%, the effect of a shooting war seems rather small.

The rest of this paper is as follows. Section 2 will briefly discuss the *a prioris* and the literature on the impact of conflict on trade. Section 3 will describe the methodology and econometric model (gravity model) used. Section 4 will discuss the data and data sources. Section 5 will explain the results and Section 6 will conclude.

2.2 The Impact of Conflict on International and Internal Trade

Conflicts have great cost implications for international trade which cannot be ignored. Through the destruction and disruption effects, the cost of transactions increases, for instance, due to asymmetric information caused because of conflict, the cost of communication will increase. The costs of transportation increase as infrastructure and security deteriorate and the ability to enforce contracts is reduced as institutions of civil society are weakened, trust declines, time horizons shorten due to uncertainty and opportunism becomes more profitable (Collier 1999).

From a transactions costs perspective, it seems apparent that a shooting war across borders between two nations would impede commercial trade. The sheer risk of being maimed or killed by stray fire, or being mistaken by either side as a combatant would deter many from conducting their daily business. Moreover, trade may even be targeted or blockaded during times of war, such as the U-boat attacks on commercial shipping. As is well-documented, shipping costs skyrocketed around the world during WWI, often doubling, tripling, or even more during these war years, (see Mohammed and Williamson, 2004).

At the same time, one might imagine some types of trade *increasing* during times of war, at least for some commodities. There are natural resources and other mainly primary commodities that play an important role in sustaining conflicts. During the World War II, the demand for petroleum products increased so as to sustain various conflicts which were underway, with for example Venezuela becoming one of the world's leading exporter of oil in 1939. This means, the trade of oil increased despite the high trading costs which are attached to conflicts. Thus, in theory, it is possible that trade may rise, despite the higher costs, if the reward is great enough. And, of course, the scale and scope of the war matters a great deal. Total war of WWII would differ from the bilateral conflict of the UK and Argentina in the 1980s Falklands Island conflict. One can imagine that UK trade with all other countries (except Argentina, presumably) would have changed very little. As such, it is one goal of this paper to assess a general average effect on conflict on trade over all significant conflicts in the late 20th century.

Conflicts often have significant destruction within one's own borders as well. This is true for international conflicts and also for strictly domestic ones (i.e. civil war). As such, conflict may reduce domestic economic activity as well. One only has to look at present day Iraq or Syria to see that domestic economic activity in those war-torn countries is at an all-time low.

In the recent gravity trade literature, it has been demonstrated that a more instructive measure of how open or closed a country is, is to look at the ratio of how much that country trades with the world, relative to itself (see Novy, 2013 for example). In a truly borderless world, one can imagine an American in Seattle just as easily buying a hat made in nearby Vancouver Canada, than in his own hometown. But as many studies attest, this is not the case (see "border" papers, McCallum, 1995; Engel and Rogers, 1996). What's important is to see, at least in theory, how

much trade is going on within one nation's borders relative to the trade across borders, to see how open or closed a country is. This is what the Novy measure does.

Coming back to the effect of conflict on trade barrier, we know from the above discussion that the effects on trade have more than one *a priori*. Moreover, the scale of effect on internal versus external trade may differ, in general, and will likely differ across conflicts as well.

Nonetheless, as a first step to understand the average magnitude of such effects, this paper sets out to examine how much conflicts, external and internal, affect the "distance" between countries. The answer to this may serve as a very rough estimate to help guide policy in this area. Ideally, conflict would never be a policy option, but the reality is that is does occur. Having some sense of what the effect of such actions plays an important role in both the empirics of gravity models and the economics of war, if such a subfield can be labeled as such.

2.3 Data on Conflicts

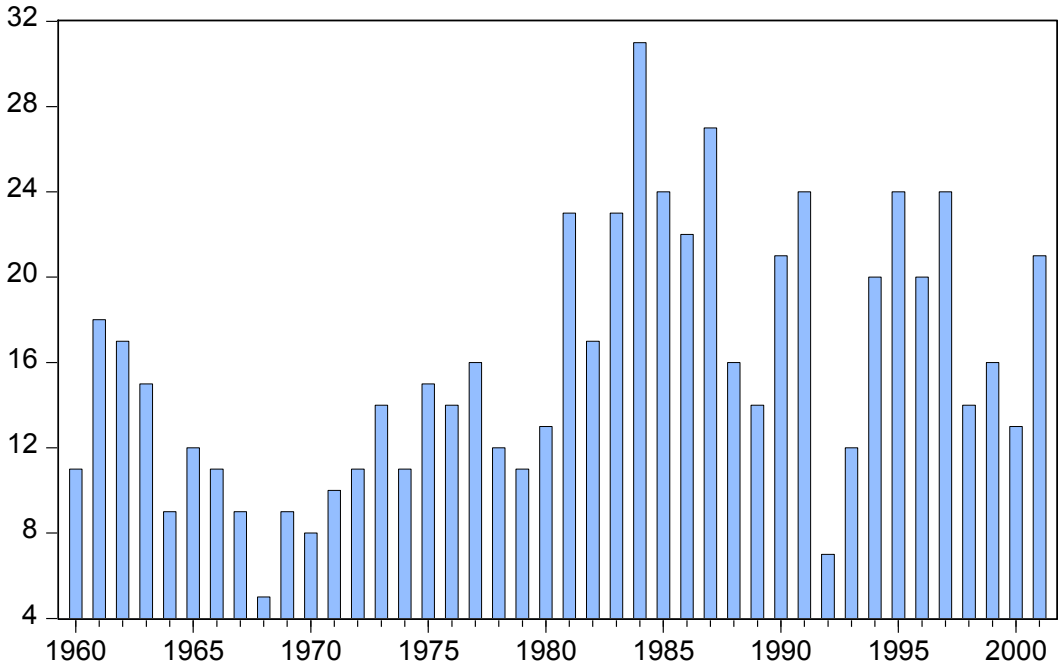
In this empirical analysis, for the dependent variable we used annual goods trade flows of the years 1960 through 2001. International trade flow data are from two sources: from Andrew Rose's website[17] and COW (Correlates of War)'s version 3.0 dyadic trade[18] by Barbieri and Omar (2012) and both are originally from IMF Direction of Trade database. The ideal measure of "internal trade" would be calculated by subtracting a given country's total exports to the world from that country's "Total Gross Product" as is done in Novy (2013) and Wei (1996). However, this type of data is only available for OECD and a dozen or so other countries that have such detailed national accounts and Input-Output data. Many of the countries around the world which are involved in conflict, particularly internal conflict, are not OECD members and do not have

17 http://faculty.haas.berkeley.edu/arose/
[18] http://www.correlatesofwar.org/

such data. We therefore use a proxy calculated as the difference between GDP (taken from the World Bank database, in dollars) and total exports of that country from IMF database.

Data on inter and intrastate conflicts are taken from the COW database. In particular, version 3.1 of the Militarized Interstate Dispute (MID) data was used. This database contains conflicts information for the period 1816-2010. However, our sample period ends in 2001 which is the last year the bilateral conflict data is available.

Figure 4: Frequency of Interstate Conflicts, 1960-2001

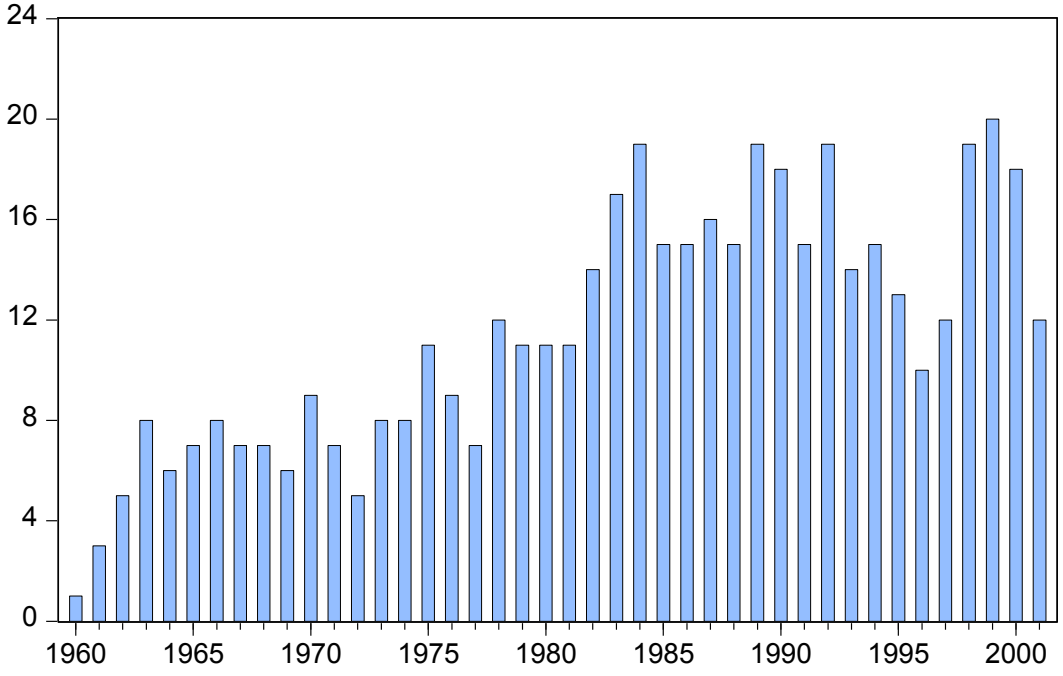


The MID data is coded into five hostility levels with 1= No militarized action, 2=Threat to use force, 3=Display of force, 4=Use of force and 5=War. For empirical analysis in the previous literature[19], it is common to use Display of force (3), Use of force (4) and War (5) and regard (1) and (2) as too small to have a meaningful effect. Therefore, in this paper the interstate conflict

19 See Martin *et al* (2008)

takes value of 1 if there was conflict of hostility level 3, 4 or 5, otherwise, it is zero. Intra-state conflict data from COW encompasses the conflict which happened within the borders of a country. This takes the value of 1 if at least one of the trading partners is involved in an internal conflict, otherwise it is zero. The distribution of conflicts used in this paper is shown in figure 4 and figure 5 for interstate and intrastate conflicts, respectively. The latter shows an increase in number of intra-state conflicts between 1960 and 200. Within the same period, compared to 1960, the number of interstate conflicts generally increased in most years.

Figure 5: Frequency of Intrastate Conflicts, 1960-2001



2.4 Specification and Econometric Methodology

This paper makes use of the micro-founded trade cost measure from Novy (2013) to shed light on the level of trade costs triggered by conflicts (both interstate and intrastate). This inclusive measure of trade costs between countries was developed from a theory-based gravity model by Anderson and van Wincoop (2004). It is a geometric average of trade costs between bilateral

trading countries and is converted to an ad valorem equivalent by subtracting one. This measure of trade costs comprehensively captures all trade costs. As such, it is ideal to apply it in trying to assess the decomposition of various trade costs with respect to total cost. We add to the existing literature by analyzing the how the conflicts affect the trade costs using this method. The measure is as follows:

$$\tau_{ij} = \left[\left(\frac{x_{ii}x_{jj}}{x_{ij}x_{ji}}\right)\right]^{\frac{1}{(2(\sigma-1))}} - 1 \qquad (1)$$

Where: x_{ij} and x_{ji} is bilateral trade between country *i* and *j*, and x_{ii} and x_{jj} is internal trade of country *i* and *j* respectively. We therefore use the tau, which is explained below, as our dependent variable and estimate the following model specification, consisting of the usual gravity trade costs elements besides conflicts:

$$\tau_{ijt} = \beta_0 + \beta_1 \boldsymbol{CONF1}_{ijt} + \boldsymbol{CONF2}_{ijt} + \beta_2 ldist_{ijt} + \boldsymbol{\beta_n Z_{ijt}} + \alpha_i + \alpha_j + \varepsilon_{ijt} \qquad (2)$$

Where: τ_{ij} is the trade cost measure which is the geometric average of bilateral international trade costs between two countries relative to internal (domestic) trade costs of each country. A change in this measure means that international trade is changing relative to change in internal trade. That is, trade costs are closely related to the degree to which one country trades domestically rather than with another country. For instance, if there is an increase in trade between country *i* and *j*, it follows that international trade between the two is increasing relatively to the domestic trade of the two. $\boldsymbol{CONF1}_{ij}$ and $\boldsymbol{CONF2}_{ij}$ represents interstate and intrastate conflicts, respectively. $CONF1_{ij}$ is 1 if two countries are in conflict and zero otherwise (as explained in the data section). $CONF2_{ij}$, intrastate conflict, takes a value of 1 if at least one of the bilateral trading partners has an internal conflict, otherwise it takes the value of 0. The log of distance between the two countries' capitals

Table 4: The Effect of Inter and Intra-state Conflicts on Novy's Trade Cost measure: Full sample

	(OLS)	(PPML)	(OLS)	(OLS)	(PPML)	(PPML)
VARIABLES	Both conflicts	Both conflicts	Interstate	Intrastate	Interstate	Intrastate
Ldist	0.322***	0.329***	0.322***	0.321***	0.330***	0.328***
	(0.00155)	(0.00185)	(0.00156)	(0.00155)	(0.00186)	(0.00185)
colony	-0.307***	-0.270***	-0.306***	-0.305***	-0.269***	-0.268***
	(0.00572)	(0.00603)	(0.00572)	(0.00572)	(0.00603)	(0.00604)
border	-0.134***	-0.195***	-0.135***	-0.128***	-0.197***	-0.187***
	(0.00602)	(0.00762)	(0.00603)	(0.00599)	(0.00764)	(0.00756)
comlang	-0.114***	-0.130***	-0.114***	-0.114***	-0.130***	-0.130***
	(0.00276)	(0.00337)	(0.00276)	(0.00276)	(0.00337)	(0.00337)
Interstate conflict	0.147***	0.196***	0.153***		0.202***	
	(0.0201)	(0.0248)	(0.0202)		(0.0249)	
Intrastate conflict	0.0648***	0.0678***		0.0652***		0.0681***
	(0.00260)	(0.00310)		(0.00260)		(0.00310)
Constant	-3.300***	-3.339***	-3.288***	-3.295***	-3.331***	-3.331***
	(0.0160)	(0.0196)	(0.0159)	(0.0160)	(0.0195)	(0.0196)
Observations	209,564	209,564	209,564	209,564	209,564	209,564
R-squared	0.529	0.457	0.527	0.529	0.455	0.457
Country FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

is "ldist". $\boldsymbol{Z_{ij}}$ is a matrix representing other common trade costs. Here, colonial past ("colony") takes a value of 1 if one of the country pairs was the colony of the other (or vice versa).

So, for example, the country pair France and Algeria would take the value of 1. Shared common border ("border") and shared common language ("comlang") dummies are also included. α_i and α_j are country individual fixed effects. Like Novy (2013), the sigma (σ) in equation 1 is the elasticity of substitution among varieties, and takes the value of 8.

Table 5: The Effect of Inter and Intra-state Conflicts on Novy's Trade Cost measure: High Income Countries

VARIABLES	(OLS) Both conflicts	(PPML) Both conflicts	(OLS) Interstate	(OLS) Intrastate	(PPML) Interstate	(PPML) Intrastate
ldist	0.317***	0.324***	0.317***	0.317***	0.324***	0.324***
	(0.00289)	(0.00334)	(0.00289)	(0.00289)	(0.00334)	(0.00333)
colony	-0.321***	-0.291***	-0.321***	-0.321***	-0.291***	-0.291***
	(0.0101)	(0.0103)	(0.0101)	(0.0100)	(0.0103)	(0.0103)
border	-0.0171*	0.00239	-0.0170*	-0.0162	0.00245	0.00471
	(0.0102)	(0.0110)	(0.0102)	(0.0102)	(0.0110)	(0.0110)
comlang	-0.0932***	-0.133***	-0.0932***	-0.0932***	-0.133***	-0.133***
	(0.00543)	(0.00708)	(0.00544)	(0.00544)	(0.00708)	(0.00708)
Interstate conflict	0.0916**	0.170**	0.0909**		0.169**	
	(0.0408)	(0.0858)	(0.0408)		(0.0857)	
Intrastate conflict	-0.0130*	-0.00836		-0.0128*		-0.00797
	(0.00682)	(0.00848)		(0.00681)		(0.00846)
Constant	-3.266***	-3.317***	-3.271***	-3.262***	-3.319***	-3.311***
	(0.0283)	(0.0331)	(0.0283)	(0.0283)	(0.0331)	(0.0332)
Observations	57,503	57,503	57,503	57,503	57,503	57,503
R-squared	0.569	0.510	0.569	0.569	0.510	0.509
Country FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 6: The Effect of Inter and Intra-state Conflicts on Novy's Trade Cost measure: Low Income Countries

VARIABLES	(OLS) Both conflicts	(PPML) Both conflicts	(OLS) Interstate	(OLS) Intrastate	(PPML) Interstate	(PPML) Intrastate
ldist	0.252***	0.259***	0.255***	0.251***	0.262***	0.258***
	(0.00544)	(0.00615)	(0.00545)	(0.00544)	(0.00616)	(0.00615)
colony	-0.316***	-0.290***	-0.312***	-0.317***	-0.286***	-0.290***
	(0.0160)	(0.0166)	(0.0160)	(0.0160)	(0.0167)	(0.0167)
border	-0.257***	-0.305***	-0.258***	-0.247***	-0.306***	-0.295***
	(0.0136)	(0.0152)	(0.0137)	(0.0135)	(0.0153)	(0.0151)
comlang	-0.141***	-0.152***	-0.143***	-0.141***	-0.154***	-0.152***
	(0.00695)	(0.00793)	(0.00697)	(0.00695)	(0.00796)	(0.00793)
Interstate conflict	0.220***	0.225***	0.222***		0.226***	
	(0.0433)	(0.0430)	(0.0435)		(0.0430)	
Intrastate conflict	0.097***	0.091***		0.098***		0.091***
	(0.0054)	(0.0062)		(0.0054)		(0.0062)
Constant	-1.334***	-1.263***	-1.356***	-1.327***	-1.284***	-1.257***
	(0.0504)	(0.0572)	(0.0504)	(0.0504)	(0.0573)	(0.0572)
Observations	40,219	40,219	40,219	40,219	40,219	40,219
R-squared	0.389	0.351	0.384	0.389	0.347	0.350
Country FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

2.5 Results

As seen in Table 4 above, the standard gravity model variables perform well. Distance is found to be positive, i.e., the farther apart two countries are, the higher the trade costs between them. Conversely, countries that have a shared colonial past, share a border, or share a common language have lower trade costs. All of these parameters are significant at a level of 1% across all specifications. Here, we find that colonial past has a larger effect than common border or common

language. This is generally consistent with the previous literature, (for example Pakko and Wall, 2001).

We will summarize our results from the Poisson quasi-maximum likelihood (PPML) method, thought the straight OLS estimates have very similar results.[20] We find that both interstate and intrastate conflict have significant and negative effects on trade costs.[21] Moreover, the effect of inter-state conflict on trade costs is nearly *three* times as large as that of internal conflict (0.196 vs. 0.68). This translates to a 21.6% increase in trade costs (or tariff equivalent) between a country pair fighting each other. For a country in a state of civil war, the conflict erects the equivalent of a 7% tariff on its trading partners. Of course, this is only an average. Some civil wars are bigger than others. Internal conflict in Rwanda in 1997 (Hutus vs. Tutsis) was no doubt more disruptive to total trade (internal and external) than the struggle of more autonomy in Aceh Indonesia (2003), yet both are coded as a "1" in this analysis.

Table 5 and Table 6 distinguish the effects of conflicts on trade cost between high income and low income countries, respectively. In general, the conflict effect plays a greater role in determining trade costs in low income countries as compared to high income countries. This is an interesting complement to some related research by Arvis *et al* (2013) who analyzed the trade costs in the developing world. They found that lower income countries have, not surprisingly, higher trade costs. Also, they find that the rate of decline of trade costs is considerable slower in developing countries. The Arvis *et al* (2013) paper fails to include conflict as an explanatory

[20] The PPML estimator yields consistent estimators (as compared to OLS, which does not) of the elasticities of log linear regressions when heteroskedasticity is present (see Santos Silva and Tenreyro, 2006).
[21] Contrast this sharp finding with the results of natural disasters on trade (see Gassebner, Keck and Teh, 2010). They find no effect of disasters on trade, but only find a significant effect when adjusted for the size (area) of the country. This suggests that conflicts, large or small, have a more prominent effect on trade, or at least trade costs, than natural disasters.

variable. But the results here, together with the Arvis *et al* results suggest that in addition to the much-needed infrastructure in developing countries, peace and stability are just as important in enabling developing countries to benefit from deeper integration in the global economy, rather than being left out.[22]

All of these results confirm what may be obvious: conflicts do have an important effect on trade. The effect on trade is at least as important as other standard variables in the gravity literature such as distance, language, among others. As such, they should not be excluded from such similar studies.

As such, with a healthy dose of *ceteris paribus*, we assert that international conflict raises the trade costs between any two warring states three times as much as domestic conflict. As one of the primary goals of empirical trade is to better explain the *pattern* of trade, this paper helps fill in one part of that larger puzzle. Clearly more work can and should be done, perhaps on an individual conflict level, to better understand what aspects of conflict (destruction of infrastructure, business uncertainty, higher shipping costs, etc.) drives the greater increase in the wedge between international and internal trade. There is much future work to be done.

2.6 Conclusion

Rapid globalization in the world means that many markets are becoming more integrated, with trade being one of the main channels. As such, it is of great importance to understand trade costs as they play as an important determinant among trading partners. This paper separately examines the effect on trade from both *intrastate* conflict (civil war) and *interstate* conflict, which

[22] The intrastate conflict parameters estimates for high income countries is mixed: either insignificant, or even negative, implying that domestic conflict *lowers* trade costs. However, the number of intrastate conflicts in high income countries is quite small and this may be simply a product of insufficient observations. Moreover, intrastate conflicts in high income countries in recent decades tend to be far less destructive and disruptive than those in low income countries. The war(s) in Chechnya in Russia, would be an important exception, however.

is rarely, if ever, done in the extant literature. The second contribution of this paper is the measure of trade costs used. We use the Novy (2013) measure of trade costs. In this measure of trade costs, the "distance" between any two countries is the internal trade relative to international trade between them. We find that interstate conflict raises the bilateral trade costs by approximately 21.6% (in tariff equivalent terms), while intrastate conflict raises the trade costs by only 7%. As such, interstate conflict is roughly three times as damaging to trade.

We also analyzed the effect of the conflicts on trade costs using two different income groups. Comparing the damage, the conflicts have on trade costs using different income groups, we find, in general, that low income countries are more affected than high income countries. As the nature and magnitude of conflicts vary considerably and the ways in which conflict, intrastate or interstate can affect trade are many, clearly this paper is only a first step in a small, but growing literature in this important area.

Chapter 3: International Trade and Trade Cost using Non-CES Preferences: Translog Gravity Model

3.1 Introduction

The effect of conflict on trade is one of the important aspect of the trade cost in the gravity model of international trade and cannot be ignored. In general, the world poverty problem is better now than many decades before, except in the countries or areas under conflicts. This is one way we can recognize how aggressive is conflict to an economy. This paper extends the conflict related trade literature in two ways. First, is to empirically analyze the relationship between conflict and international trade using a non-Constant Elasticity of Substitution (CES) based gravity model following Novy (2013). Although they used CES based gravity model, most previous literature have found a negative effect of conflict on trade, (see for example, Martin *et al*, 2008: Glick and Taylor, 2010). Second, using this same non-CES gravity model, this paper analyzes the *distance puzzle* of international economics. With globalization showing the increasing integration of world markets through trade, the international trade literature has noted that this should also attribute to the decreasing effects of distance over time. Improved integration of global trade cycles, improved transport and communication systems and reduced barriers to trade between countries, among others, means that the overall trade costs should fall with time as well, however, the literature shows this is not captured by the trade cost component of the gravity model, which is distance. The distance coefficient in the gravity model is important as it proxies these trade cost between two trading countries. This non decreasing distance elasticity of the gravity equation is called the

missing globalization or the *distance puzzle*[23] of international economics. The distance, which is a proxy for trade cost in the gravity model of trade should decline with time.

Most previous studies like Leamer and Levinsohn (1995), Disdier and Head (2008), Carrere *et al* (2009), Lin and Sim (2012), have analyzed the distance puzzle, however they mostly depend on the CES based gravity model.

This paper slightly diverts from their gravity model structures and test the same distance elasticity over time using the translog gravity model which is based on non-constant elasticity preferences. Specifically, to shed new light on the puzzle, this chapter analyzes the distance puzzle of international economics using a micro founded gravity equation which is based on a translog demand system proposed by Novy (2013). Novy showed that the translog utility preferences led distance elasticity to be endogenously determined. As such, the missing globalization in the gravity model is suspected not be captured well due to the CES preferences based part of the model, and hence worth tested. Trade may be sensitive to trade costs if the exporting country provides a small share of the destination country's imports, and hence the distance coefficient should as well be sensitive to the magnitude the two countries are trading. Although this might hold on most merchandise countries trade, there are some exceptional commodities which are almost insensitive to the share of trade between countries for instance most natural resources like oil. One of the nearest research to this chapter is by Yilmazkuday (2013), however, Yilmazkuday's paper considered what their paper called Constant Absolute Risk Version (CARA) preferences. Also, it does not consider the conflict effect as one of the main drivers to trade costs among trading economies.

[23] See Coe et al. (2007)

The gravity model of bilateral trade has become the workhorse model of applied international economics, Eichengreen and Irwin (1998). It was first introduced to the field of international trade by Tinbergen (1962), Pöyhönen (1963), and Linnemann (1966). The gravity model basically relates bilateral trade flows of two countries to their economic size and geographical distance. Distance in the gravity model represent the trading barriers between two countries, hence the need to be closely analyzed as economic agents strongly depend on costs for their profits. The more two countries trade with each other the more trade costs should be at least falling. This fact is found to be opposed by most empirical literature. One of the recent meta-analysis study by Disdier and Head (2008) on the trends of absolute distance coefficients from previous 103 papers that used gravity model showed that around middle of the 20th century that is when the negative impact of distance on trade started to increase.

The rest of this paper is as follows: Effect of conflict on international trade: this section gives a brief link between conflict and international trade, Specification and methodology: this section shows the methodology and econometric model (in this case the translog gravity model) used, Data: this provides data sources, Results: in this section results are presented and discussed. And last of all is the conclusion.

3.2 Effect of Conflict on International Trade

Conflict has a cost to most agents of the economy. It is through the destruction and disruption channel caused by conflict in which the international trade and the whole economy suffers. As noted in the previous chapter, the costs of transportation increase as infrastructure and security deteriorate and the ability to enforce contracts is reduced as institutions of civil society are weakened, trust declines, time horizons shorten due to uncertainty and opportunism becomes

more profitable (Collier 1999). Bilateral trade between countries is affected, usually declines because of high trading costs in this case triggered by conflict.

However, trade in some selected commodities will surely increase. Mainly natural resources and other mainly primary commodities that play an important role in sustaining conflicts are expected to be on high demand especially during time of conflict. For instance, petroleum products were on high demand during the World War II period, and some countries like Venezuela benefited much, in as far as petroleum exports were concerned. Thus, in theory, it is possible that trade may rise, despite the higher costs as long as the profits are positive.

Some studies focus on the effect of trade on the probability of reducing the occurrence of a conflict. They focus on the opportunity costs of not going into a conflict so as to maintain trade relations between two countries (see for example, Polachek, 1980: Morrow, 1999: Oneal and Russett, 1999). This also reveals how the cost of conflict can disadvantage the economies.

3.3 Specification and Methodology

In this section, estimation method is explained. This paper estimated the standard CES based gravity model to confirm the existence of the distance puzzle and then estimate the translog gravity equation, to test if it will be solved. In understanding how conflict affect trade and as well as analyzing trend of distance elasticity, this chapter applies the Novy (2013)'s[24] translog gravity model. This is specified in equations 1 and 2 below while equation 3 is the standard gravity specification with dependent variable as the log of import share. For the translog gravity model,

[24] It should be noted that Novy (2013)'s paper referred to in this chapter is different from the one in the previous chapter.

this paper specifically applied equation (2) instead of equation (1) as it applies fixed effects to do away with multilateral resistance.

$$\frac{x_{ij}}{y_j} = -\gamma\rho\mu_i \ln(dist_{ij}) + \gamma\rho\mu_i \ln\left(T_j^{dist}\right) - \gamma\delta\mu_i adj_{ij} + \gamma\delta\mu_i T_j^{adj} + s_i + \varepsilon_{ij} \quad (1)$$

Equation (1) can be derived into equation (2) below which is easier to estimate as the second and fourth term on the right hand side of the equation (1) will be captured by using exporter and importer fixed effects[25].

$$\frac{x_{ij}/y_j}{\mu_i} = -\gamma\rho \ln(dist_{ij}) - \gamma\delta adj_{ij} - \gamma\varphi confl_{ij} + \hat{s}_i + \hat{s}_j + \epsilon_{ij} \quad (2)$$

Equation (3) according to Novy, represents the standard CES based gravity equation, however, the dependent variable is a representative of the import share of country *i* in country *j*. This was done so as to make it comparable to the translog gravity model. It is with this specification this paper first confirms the existence of the distance puzzle.

$$\ln\left(\frac{x_{ij}}{y_j}\right) = -(\sigma-1)\rho \ln(dist_{ij}) - (\sigma-1)\delta adj_{ij} - (\sigma-1)\varphi confl_{ij}\tilde{s}_i + \tilde{s}_j + \xi_{ij} \quad (3)$$

x_{ij} represents the value of trade from country *i* to country *j* , y_j is income of country *j*, x_{ij}/y_j is the import share of country *i* in market *j*. μ_i denotes the number of goods from country *i* and as mentioned by Novy (2013), data for this is not readily available and extensive margins weight can be used as proxy. In this regard we constructed the extensive margins of trade for our sample also following Hummels and Klenow (2005) and this is explained in the next section, ρ is the distance elasticity of trade cost, δ is the coefficient of the adjacency variable. $dist_{ij}$ is the distance between major two cities of two trading partners, adj_{ij} is the adjacency dummy that takes

25 See Novy (2013) for full derivation stages of the translog equation.

value of 1 if there is contiguous border between two countries otherwise it takes zero, $confl_{ij}$ represents interstate conflict, it takes value 1, if there is an interstate conflict between bilateral trading countries (this variable is explained in detail under data section), $\boldsymbol{s}$ are importer and exporter fixed effects. Last term represents the error term.

3.3.1 Hummel-Klenow Extensive margins of trade

In the translog equations (1) and (2) the variable $\mu_i$is approximated by the weight of the extensive margin. The extensive margin set of goods is weighted by their importance in relation to the total of exports of the exporting country. This variable is directly calculated as proposed by Hummels and Klenow (2005) who used equation 4 below. Unlike Novy (2013) who just applied this weight for only one year and for only OECD countries, this paper calculates for many years from 1970 and covering a wider number of countries.

$$EM_{jm} = \mu_j = \frac{\sum_{i \in I_{jm}} p_{kmi} x_{kmi}}{\sum_{i \in I} p_{kmi} x_{kmi}} \qquad (4)$$

Where I_{jm} is a set of exports from a country and should be greater than zero (i.e. x_{jmi}>0). To calculate extensive margins, this paper utilized disaggregated data from United Nations at 5-digit level of SITC. *k* is representing the world.

The above models specification (equation 2 and 3) are estimated using year-by-year cross section regressions basing on the Ordinary Least Squares to test the distance puzzle. A panel regression is also done to analyze the effects of interstate conflicts on trade between bilateral trading countries. Exporter and importer fixed effects are applied.

3.3 Data

Data are described in this section. In this empirical analysis, for the dependent variable, annual goods trade flows of the years 1970 through 2001 are used. International trade flow data are from two sources: from Andrew Rose's website[26] for the translog equation estimation and United Nations Commodity Trade Database (UNCOMTRADE) via WITS for the construction of the extensive margin of trade. The latter is based on first revision of Standard Industrial Trade Classification (SITC) 5-digit codes which has more than 1000 product categories. This classification is used so as to account for both disaggregation of data as well as able to cover many years. Data on distance is from the Great Circle that has been constructed following the CIA World Fact book for geographical location of the countries.

Data on interstate conflicts come from the Correlates of War (COW). Specifically, versions 3.1 of the Militarized Inter-state Dispute data is used. This paper is mainly focusing on the period 1970-2001 where dyadic MID data are available and also according to Disdier and Head (2008) who carried out a meta-analysis, showed that it is around the middle of the 20th century when the impact of distance started to be on a rising trend. The MID data is coded into five hostility levels of dispute with 1= No militarized action, 2= Threat to use force, 3= Display of force, 4= Use of force and 5=War. Most previous literature[27] use Display of force, Use of force and War, meaning that interstate conflict takes value of 1 if there was conflict of hostility level 3, 4 or 5 otherwise it will be zero. GDP data comes from the World Bank's World Development Indicators accessed online. Alternative distance data are from CEPII dataset[28].

26 http://faculty.haas.berkeley.edu/arose/

27 See for example Martin *et al* (2008).

28 The source of distance and other bilateral dummies data is the website of the 'Centre d'Etudes Prospectives et d'Information Internationales' (CEPII) at http://www.cepii.fr/CEPII/en/welcome.asp.

3.4 Results

In this section the paper presents the results of estimations using the gravity models (equations 2 and 3) described in the previous section. Table 7 shows the impact of militarized interstate conflict effect on international trade. In general, it is confirmed that conflict has a negative impact on trade regardless of the structure of the gravity model used. This is shown by significant negative coefficient of conflict at least at 5% level of significance and below. These results are basically the same despite the degree of hostility used to represent the magnitude of interstate conflict[29]. Using the standard gravity model, all other trade cost variables have significant and expected signs.

Table 7: Impact of Conflict on Trade Using Different MID Hostility Levels

VARIABLES	(Standard Gravity) MID Hostility 3-5	(Translog Gravity) MID Hostility 3-5	(Standard Gravity) MID Hostility 1-5	(Translog Gravity) MID Hostility 1-5
ldist	-1.368***	-0.0115***	-1.368***	-0.0115***
	(0.00955)	(0.000369)	(0.00955)	(0.000369)
border	0.235***	0.00593***	0.237***	0.00591***
	(0.0318)	(0.00112)	(0.0318)	(0.00113)
colony	1.090***	0.0255***	1.091***	0.0255***
	(0.0266)	(0.00136)	(0.0266)	(0.00136)
conflict	-0.237**	-0.00725***	-0.271***	-0.00653***
	(0.0957)	(0.00229)	(0.0924)	(0.00219)
constant	7.859***	0.175***	7.861***	0.175***
	(0.0959)	(0.00422)	(0.0959)	(0.00422)
Observations	129,359	90,644	129,359	90,644
R-squared	0.523	0.222	0.523	0.222
FE	Yes	Yes	Yes	Yes

Robust standard errors are in parentheses, *** p<0.01, ** p<0.05, * p<0.1

[29] Hostility levels of interstate conflict are explained in the data section.

This is also the same for the translog gravity model results. Translog gravity distance coefficients are also significant at 1%, and they are in the same range with previous literature[30]. It should be noted that the higher the extensive margin of trade between two countries, the less sensitive the exports are to trade costs, therefore this should show a much faster declining distance elasticity[31].

Using year-by-year cross country regressions and a micro founded gravity equation which is based on a translog demand system this papers analyzes the distance coefficient trend from 1970 through 2001. The standard CES based gravity model is used as a benchmark model to confirm the existence of the distance puzzle. The results confirm that using this benchmark model, indeed the non-decreasing trade costs captured by distance coefficient, are present. This is shown in table 8 below in which the distance coefficient which is significant at 1% is -0.859 for 1970 rising to -1.211 in 2001. This is generally consistent with literature (see for example Disdier and Head, 2008; Coe *et al*., 2007). The rising distance co-efficient is clearly depicted in figure 6 which is plotted in absolute values. The absolute distance coefficient trend is in general rising between 1970 and 2001 and it is steeper especially after 1980, this is despite the rapid globalization experienced after World War II, especially around 1980s where it accelerated due to technological advancement and lower trading costs.

However, the distance coefficient declines when the translog gravity model is applied. As seen in table 9 below, the distance coefficient significant at 1% has a value of -0.096 in 1970 falling to -0.011 in 2001. This clearly shows the expected distance coefficient trend which is consistent with the theory of the gravity model. Figure 7 shows the falling trend of the absolute distance

[30] See Novy (2013), although in Novy's paper results were only based on one year dataset to construct extensive margins of trade.
[31] The results presented in this section depends on the extensive margin greater than zero.

coefficient from 1970 to 2001. Although there are small fluctuations in the trend, especially around early 1970s, in general it is falling with time. Also testing the distance puzzle when the effect of conflicts is included in the translog regressions specification, the results are basically the same. This is also true with the standard gravity model results which are still showing the existence of the distance puzzle despite including the conflicts effect. Tables 8 and 10 show almost same distance coefficient despite the fact that the former has conflict as one of its cost component. Figures 6 and 8, both are showing an increasing absolute distance coefficient trend. Also, tables 9 and 11 show results of the translog gravity model with the former having conflict effect as well. The distance coefficients are almost the same, showing the non-existent of the puzzle. This is also clearly shown in figures 7 and 9 as absolute distance coefficients plotted from yearly regressions show same trend. In general, given that there are no significant differences in the absolute distance coefficients despite including the conflict effect in one same structure the gravity model, shows that the distance puzzle is not present due to the omitted variables, in this case, conflict effects. Since the distance puzzle varnishes after using the translog gravity model, it shows that the puzzle lies in the structure of the gravity model used. However, it must be noted that, as the number of trading partners has been increasing overtime, for instance due to collapse of Soviet Union, import shares from any one partner are likely declining over time. This would automatically make all elasticities more sensitive overtime. As such, more research is needed to probably understand this surprising result

Table 8: Yearly Regressions Results using Standard Gravity Model with Interstate Conflicts (1970-2001)

VARIABLES	(1970) Standard Gravity	(1975) Standard Gravity	(1980) Standard Gravity	(1985) Standard Gravity	(1990) Standard Gravity	(1995) Standard Gravity	(2000) Standard Gravity	(2001) Standard Gravity
ldist	-0.859***	-0.833***	-0.835***	-0.973***	-1.034***	-1.075***	-1.219***	-1.211***
	(0.0567)	(0.0517)	(0.0657)	(0.0450)	(0.0373)	(0.0341)	(0.0348)	(0.0361)
border	0.0899	-0.0652	0.155	0.352***	0.433***	0.501***	0.380***	0.357***
	(0.173)	(0.163)	(0.173)	(0.134)	(0.123)	(0.116)	(0.116)	(0.112)
conflict	-0.586**	0.600**	-0.380*	-0.399	0.141	-0.207	0.196	0.0383
	(0.267)	(0.281)	(0.221)	(0.334)	(0.321)	(0.184)	(0.389)	(0.213)
Constant	3.807***	3.514***	3.489***	4.297***	4.639***	4.935***	6.319***	6.008***
	(0.550)	(0.495)	(0.631)	(0.434)	(0.370)	(0.354)	(0.350)	(0.359)
Observations	775	930	1,081	1,129	1,462	1,870	2,310	2,345
R-squared	0.863	0.883	0.856	0.871	0.813	0.828	0.784	0.778

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 9: Yearly Regressions Results using Translog Gravity Model with Interstate Conflicts (1970-2001)

VARIABLES	(1970) Translog Gravity	(1975) Translog Gravity	(1980) Translog Gravity	(1985) Translog Gravity	(1990) Translog Gravity	(1995) Translog Gravity	(2000) Translog Gravity	(2001) Translog Gravity
ldist	-0.0960***	-0.0669***	-0.0356***	-0.0319***	-0.0195***	-0.0160***	-0.0127***	-0.0113***
	(0.0149)	(0.0111)	(0.00773)	(0.00776)	(0.00295)	(0.00237)	(0.00156)	(0.00133)
border	-0.0280	-0.0215	-0.00782	-0.00481	0.00422	0.00854	0.00844*	0.00776*
	(0.0407)	(0.0298)	(0.0186)	(0.0155)	(0.00795)	(0.00622)	(0.00448)	(0.00401)
conflict	-0.136***	0.0281	-0.0205	-0.0215	0.00457	-0.0112***	-0.0178***	-0.0130***
	(0.0300)	(0.0409)	(0.0248)	(0.0150)	(0.0108)	(0.00424)	(0.00395)	(0.00316)
Constant	1.120***	0.828***	0.483***	0.393***	0.249***	0.214***	0.176***	0.161***
	(0.140)	(0.106)	(0.0701)	(0.0730)	(0.0311)	(0.0255)	(0.0185)	(0.0161)
Observations	637	805	972	1,061	1,444	1,826	2,282	2,309
R-squared	0.504	0.472	0.496	0.396	0.345	0.264	0.371	0.335

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 10: Yearly Regressions Results using Standard Gravity Model without Conflict effect (1970-2001)

VARIABLES	(1970) Standard Gravity	(1975) Standard Gravity	(1980) Standard Gravity	(1985) Standard Gravity	(1990) Standard Gravity	(1995) Standard Gravity	(2000) Standard Gravity	(2001) Standard Gravity
ldist	-0.863***	-0.840***	-0.828***	-0.971***	-1.034***	-1.075***	-1.219***	-1.211***
	(0.0565)	(0.0518)	(0.0647)	(0.0451)	(0.0373)	(0.0341)	(0.0349)	(0.0361)
border	0.0782	-0.0117	0.138	0.346***	0.433***	0.481***	0.388***	0.359***
	(0.172)	(0.164)	(0.171)	(0.132)	(0.123)	(0.113)	(0.113)	(0.109)
							(0.657)	(0.703)
Constant	3.830***	3.589***	3.419***	4.272***	4.640***	4.928***	6.327***	6.011***
	(0.549)	(0.500)	(0.621)	(0.437)	(0.370)	(0.353)	(0.353)	(0.360)
Observations	775	930	1,081	1,129	1,462	1,870	2,310	2,345
R-squared	0.863	0.882	0.856	0.871	0.813	0.827	0.784	0.778

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 11: Yearly Regressions Results using Translog Gravity Model without Interstate Conflict effect (1970-2001)

VARIABLES	(1970) Translog Gravity	(1975) Translog Gravity	(1980) Translog Gravity	(1985) Translog Gravity	(1990) Translog Gravity	(1995) Translog Gravity	(2000) Translog Gravity	(2001) Translog Gravity
ldist	-0.0970***	-0.0672***	-0.0353***	-0.0318***	-0.0195***	-0.0160***	-0.0127***	-0.0113***
	(0.0148)	(0.0110)	(0.00774)	(0.00775)	(0.00294)	(0.00237)	(0.00156)	(0.00133)
border	-0.0287	-0.0190	-0.00867	-0.00508	0.00424	0.00748	0.00773*	0.00693*
	(0.0407)	(0.0293)	(0.0184)	(0.0155)	(0.00795)	(0.00605)	(0.00442)	(0.00398)
Constant	1.124***	0.832***	0.480***	0.392***	0.249***	0.214***	0.176***	0.160***
	(0.140)	(0.105)	(0.0704)	(0.0729)	(0.0310)	(0.0255)	(0.0185)	(0.0160)
Observations	637	805	972	1,061	1,444	1,826	2,282	2,309
R-squared	0.503	0.472	0.495	0.395	0.345	0.263	0.370	0.334

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Figure 6: Yearly Absolute Distance Coefficients Trend, Using Standard Gravity Model with Intrastate and Interstate Conflicts (1970-2001)

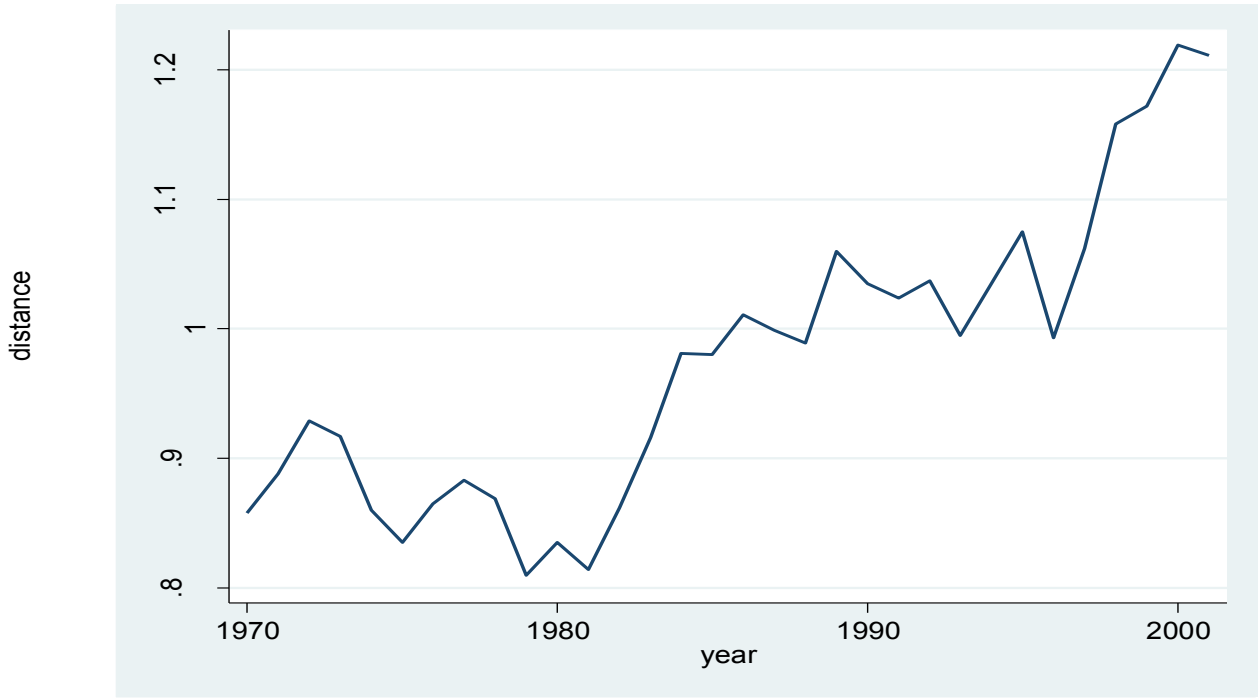


Figure 7: Yearly Absolute Distance Coefficients Trend, Using Translog Gravity Model with Intrastate and Interstate Conflicts (1970-2001)

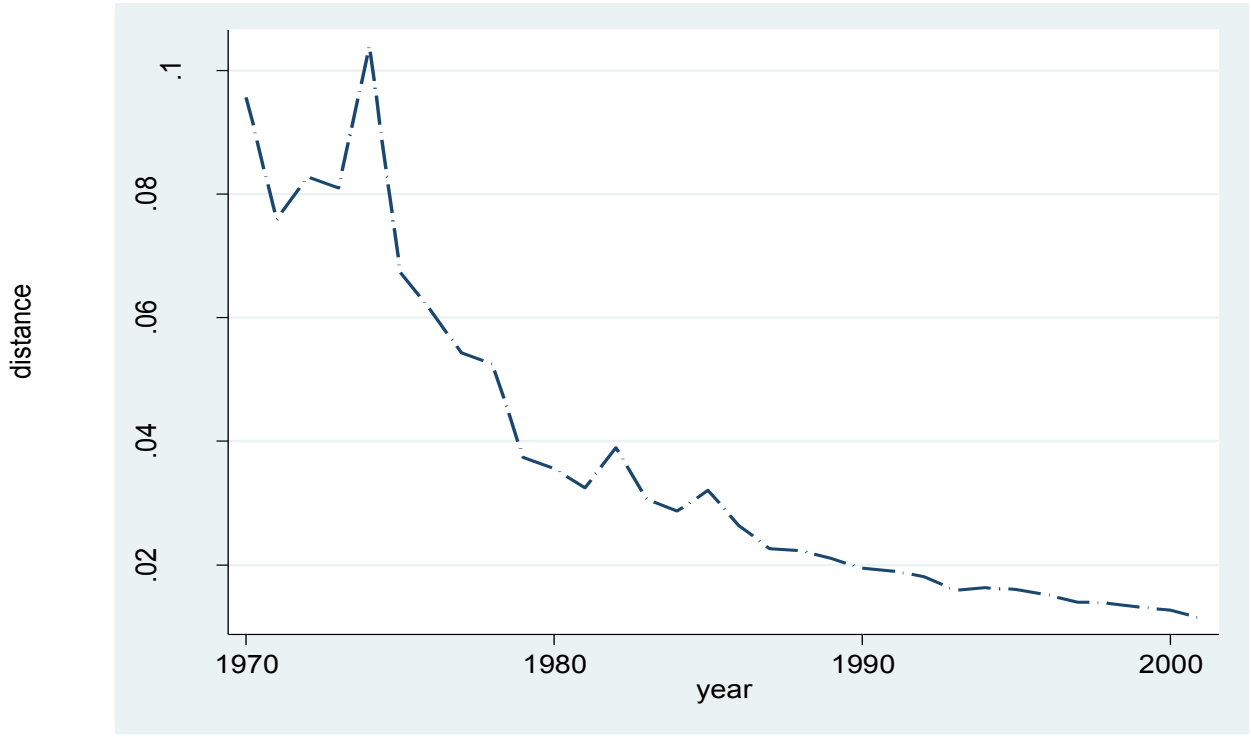


Figure 8: Absolute Distance Coefficients Trend, Using Standard Gravity Model without Conflict effect (1970-2001)

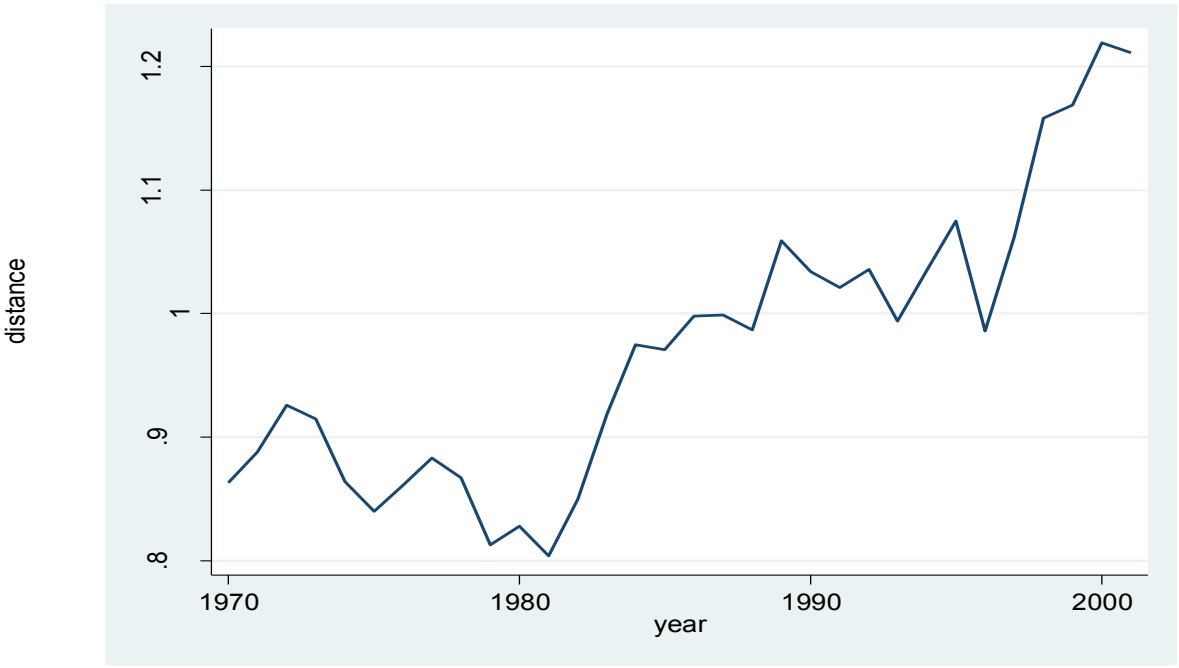
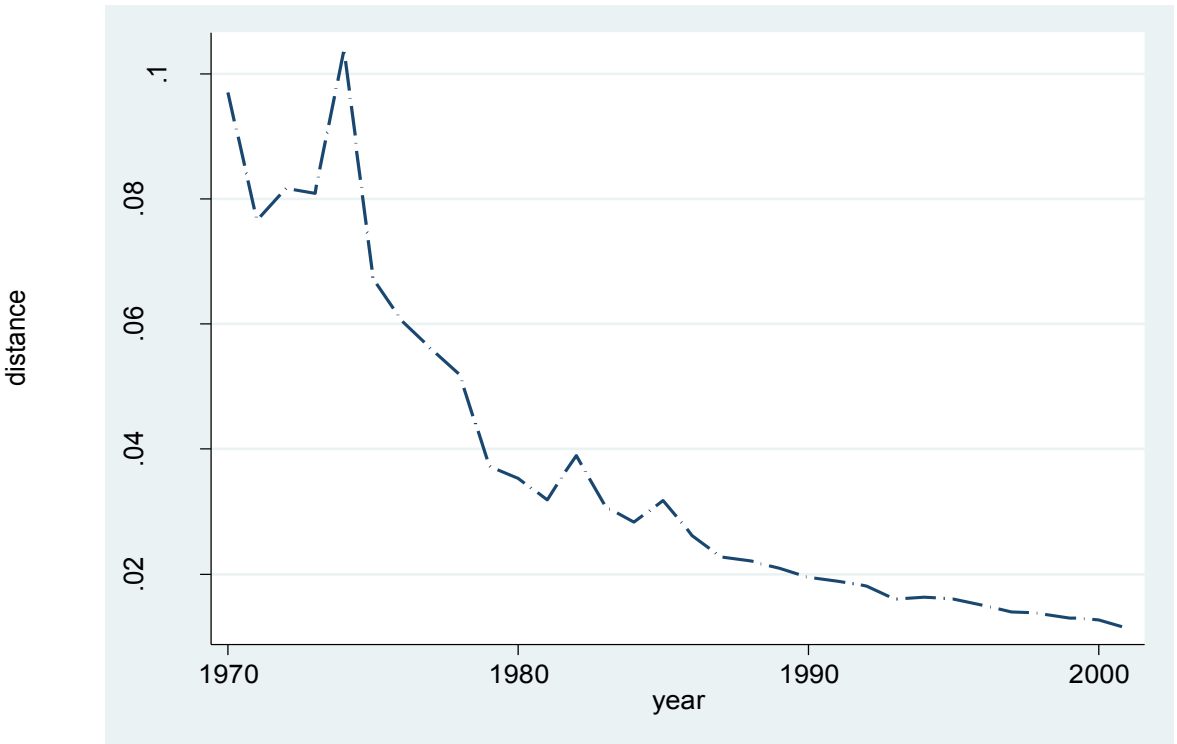


Figure 9: Yearly Absolute Distance Coefficients Trend, Using Translog Gravity Model without Conflict effect (1970-2001)



3.5 Concluding Remarks

This paper empirically analyzes the effect of conflict on trade using a translog gravity model. The distance puzzle of international economics is also tested using this same gravity model over a period 1970 through 2001.

The gravity model is a workhorse tool for empirical research in international trade. The effect of conflict on trade is one of the important aspects of the trade costs in the gravity model. In contrary to most previous literature on this issue, this paper specifically analyzes the relationship between conflict and international trade applying a non-Constant Elasticity of Substitution (CES) based translog gravity model following Novy (2013). This paper also analyzes the *distance puzzle* of international economics when conflict related cost is included in the translog gravity model. That is, using year-by-year cross country regressions and using a micro founded gravity equation which is based on a translog demand system we shed more light on the non-decreasing distance coefficient of the gravity model.

Results confirm the negative effect of conflicts on trade even when using the non-CES gravity model. The non-decreasing absolute distance coefficient puzzled is solved[32] when the translog gravity model with varying elasticity of substitution over time is used. This distance trend is opposite if standard gravity model is applied.

[32] However, this might slightly change if the general size of the trading partners is taken into consideration.

Conclusion

Trade costs are an important aspect of international trade. The majority of theoretical trade papers, if not all at least feature or explain the importance of trade costs. As such, this shows how critical it is to analyze and understand how trade costs affect international trade. This thesis considers three cases in which international trade and trade costs are linked to conflicts. The effect of conflict on trade may, at first seem apparent however such violent disruption must surely reduce trade, all other things held constant.

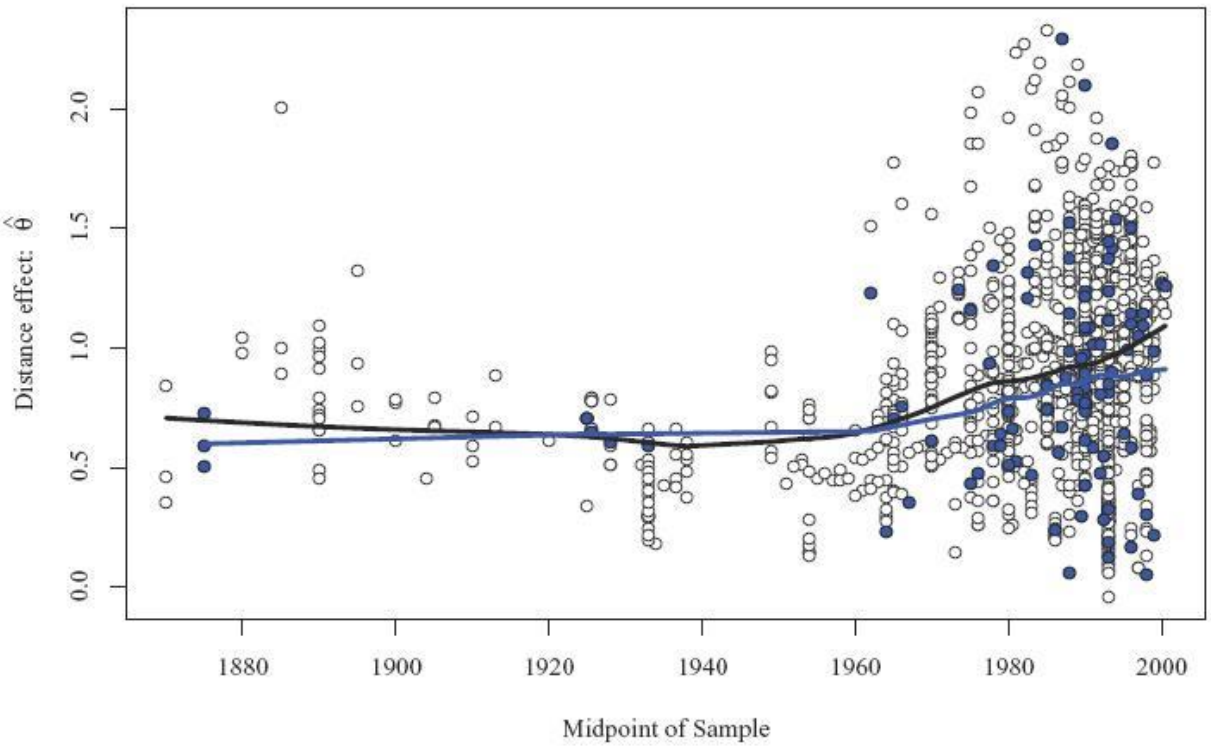
In general, this thesis adds to the existing literature on trade costs, conflicts and trade in different ways. It revisits the analysis of trade costs and conflicts, shedding more light using different structures of the gravity model of trade. Also, given the different forms of the gravity model, I revisit the distance puzzle of international trade which is also related to the trade costs part of the gravity model. The gravity model which in its basic form relates bilateral trade flow of two countries to their economic size and geographical distance. The distance which proxy the trade costs between two trading countries should be falling over time due to increased integration of markets through trade in the World. However, it is noted from previous literature that the absolute distance elasticity is actually increasing. This non decreasing distance elasticity of the gravity equation is called the *missing globalization* or the *distance puzzle* and is also tested using different structures of the gravity model discussed in chapter 1 and 3.

In general, the empirical results show the importance of trade costs, in particular those caused by the involvement of trading partners in a conflict. Also on the distance puzzle of international economics, the standard gravity model confirms the existence of non-decreasing of

the absolute distance coefficient while using other different structures of the gravity model explained in different chapters above, it is either partially solved or completely solved. This shows that, the puzzle is mainly housed in the structure of the standard gravity model.

Appendix

Figure 10: The Rising Distance Effect in Gravity Models



Source: Disdier and Head (2008, figure 3, p.19).

Table 12: Data Sources[33]

Variable	Description	Source
Trade	Bilateral trade: annual goods trade flows of the years 1962 through 2001, Intranational trade: because this data cannot be accessed directly we calculated as the difference between GDP and total exports of a country	-Andrew Rose: http://faculty.haas.berkeley.edu/arose/ -Correlates of War
Conflict	Militarized Interstate Conflict: if two trading countries had an MID conflict in any period between 1962 through 2001.	Correlates Of War
Sanctions	Economic sanctions	http://www.prio.no/jpr/datasets

[33] Data sources for first chapter.

GDP	Gross Domestic Product of each country in current US Dollar.	World Bank Development Indicators accessed online
Distance	Distance between two countries in kilometer as well as internal distance within a country	Centre d'Etudes Prospectives et d'Information Internationales' (CEPII)
Contiguous	This shows if two trading countries share same border or not.	Centre d'Etudes Prospectives et d'Information Internationales' (CEPII)
Colony	If two trading countries have colonial linkages.	Centre d'Etudes Prospectives et d'Information Internationales' (CEPII)
Language	If two trading countries have same language.	Centre d'Etudes Prospectives et d'Information Internationales' (CEPII)

Figure 11: OLS: Full Sample, High and Low Income Countries

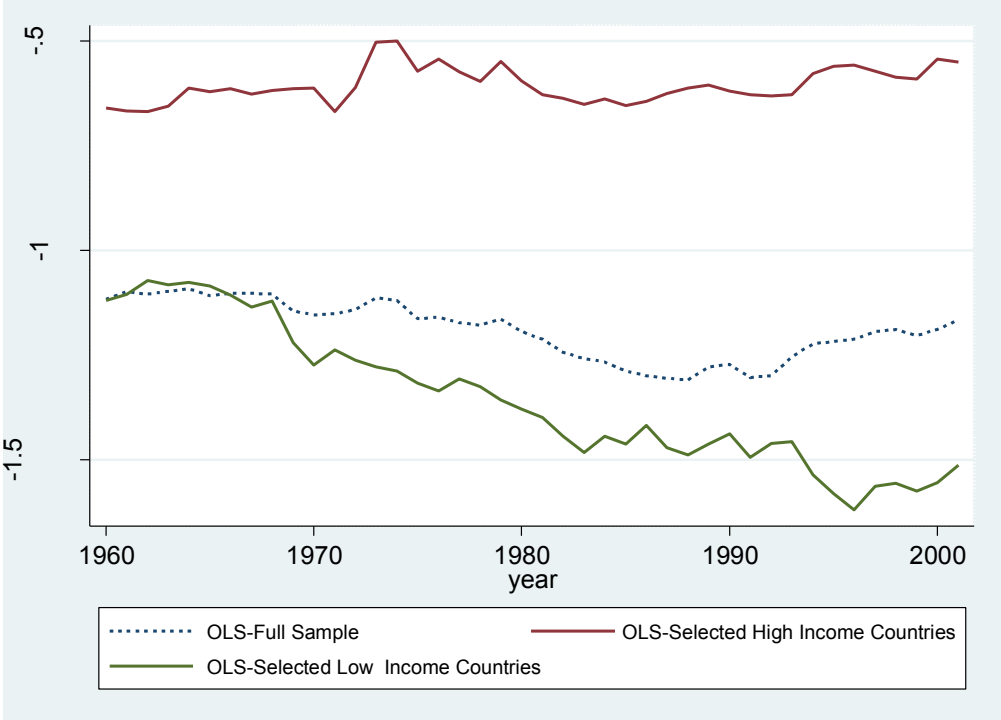


Figure 12: PPML: Full Sample, High and Low Income Countries

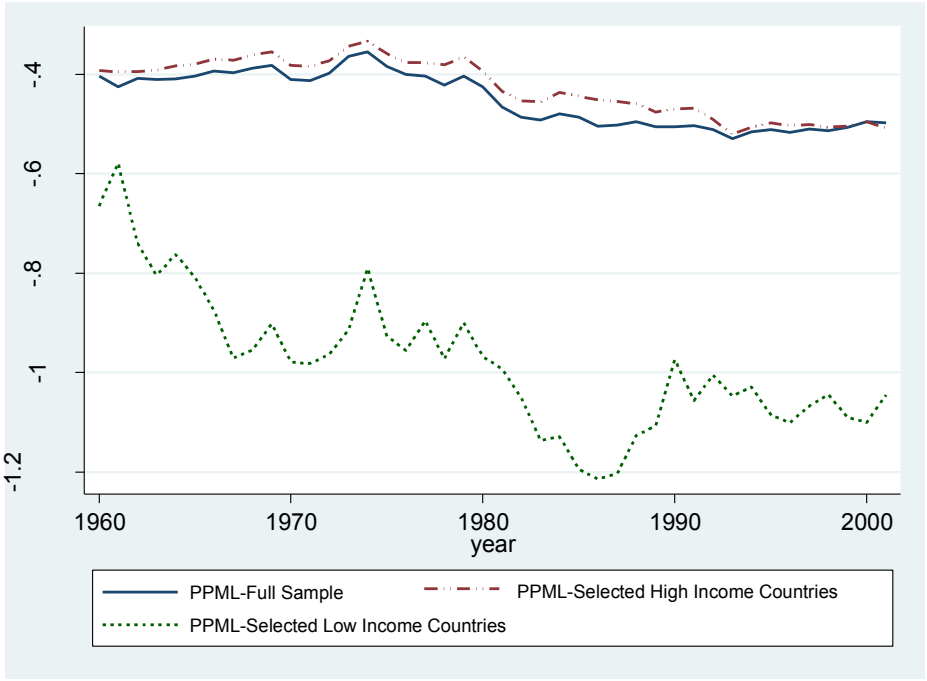


Figure 13: PPML Full Sample with and without Interstate and Civil Conflict Effect

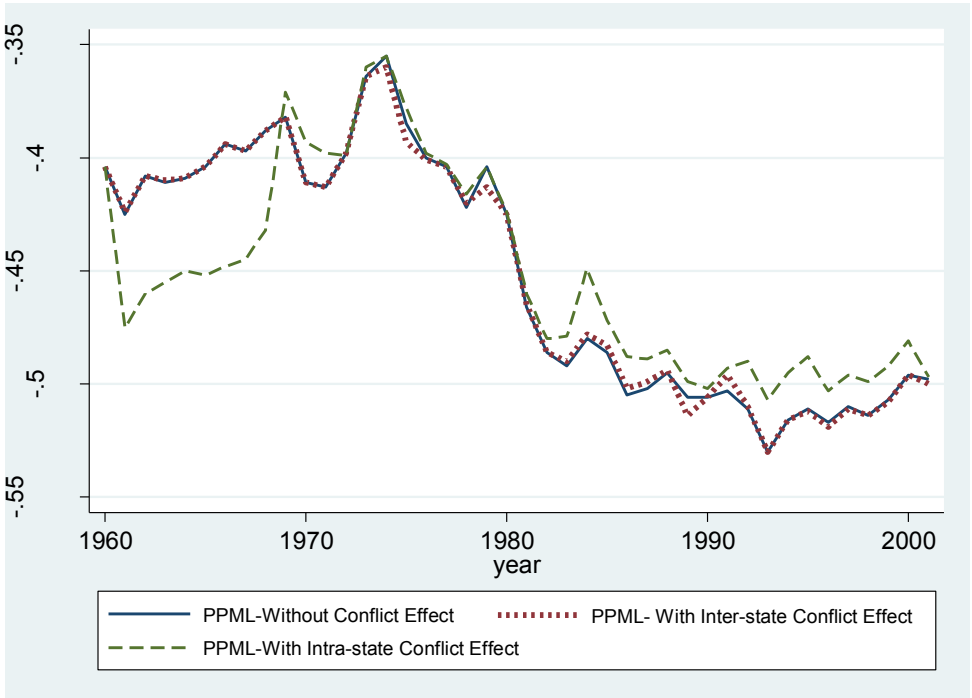


Figure 14: OLS: Structural Gravity Equation (2) and Standard Gravity Equation (1)

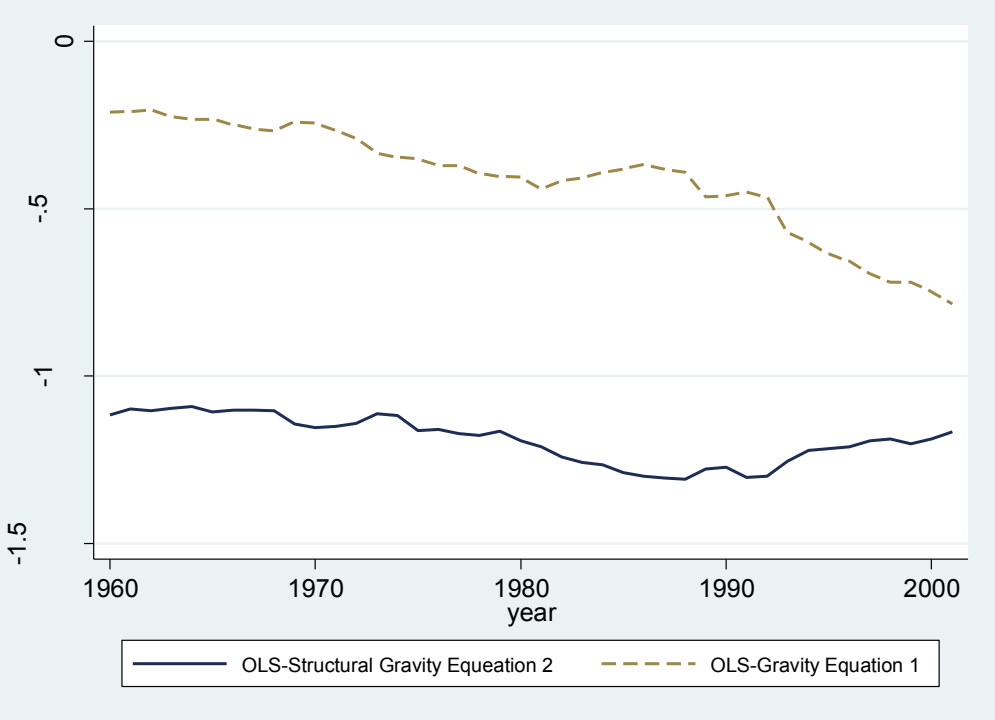
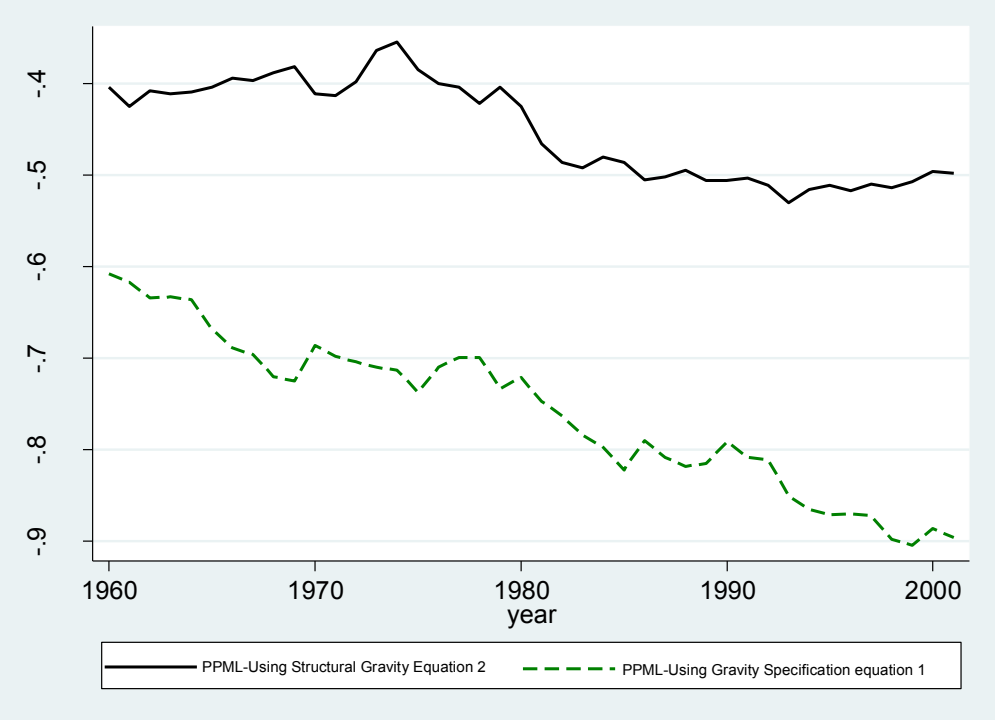


Figure 15: PPML: Structural Gravity Equation (2) and Standard Gravity Equation (1)



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1. Mutsvangwa. S. (2016), International Trade and Trade Cost using Non-CES Preferences: Translog Gravity Model, *91st Annual Conference, Western Economic Association International 2016 (29 June-3July, USA)*
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