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THE IMPACT OF BORDER WALLS ON INTERNATIONAL TRADE FLOW

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List of acronyms

AD Anno Domini

BC	Before Christ
CEPII	Centre d'Etudes Prospectives et d'Informations Internationales
CMEA	Council for Mutual Economic Assistance
EU	European Union
FEM	Fixed Effect Model
GDP	Gross Domestic Product
GNP	Gross National Product
G20	Group of Twenty
IMF	International Monetary Fund
NAFTA	North America Free Trade Area
NTBs	Non Tarrif Barriers
OECD	Organization For Economic Cooperation and Development
OLS	Ordinary Least Squares
PML	Poisson Maximum Likelihood
US	United States
USD	United States Dolar
WTO	World Trade Organization
WW II	Second World War

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Abstract

Border walls have been proliferated in the world for the last three decades since the end of cold war. An increasing number of countries are constructing walls in their boundaries to control illicit flows. Nearly one third of countries have constructed some kind of walls in their borders. This trend is surprising in this era of globalization and Free Trade Agreements in which many scholars envisioned a global village where goods and people will move freely. It was expected that the era of globalization could eliminate all types of barriers and make borders symbolic. Furthermore, it was believed that border walls were irrelevant and things of the past. Currently we are living in the world which perhaps borders are being fortified than any time in the past.

Although, policies of building walls are under discussion. There is little attention given to their unintended effect. Considering the fact that foreign trade crosses borders, this paper investigates the impacts of these walls on bilateral trade flow between neighboring countries. It focuses on the effect of physical border wall on foreign trade. It seeks to answer the question 'Are international trade flow affected by walls?'

Gravity model is applied to estimate the impact of walls between contiguous countries. The gravity model have estimated the impact using panel data estimation covering 118 trading countries around the world from 1990 to 2010. Fixed effect model have been used in the analysis with different specifications including variables capturing political relationship between trading countries. The empirical results shows that physical border walls have negative significant impact on trade between neighboring countries. Countries separated by wall trade by 51 percent less than those not separated by wall. These findings suggest that erecting walls reduce trade, even though the goal is to reduce illegal flows. The findings have implication for knowing how government policy decisions of fortifying borders lead to unintended negative consequences on bilateral trade in this era of globalization.

Relevance to Development Studies

Open border policies has been a subject of debate for many years in the field of development since the end of cold war. During that time advocates of globalization envisioned a borderless world where goods and people could flow freely. In recent years have emerged a tendency for countries to implement policies of closing their borders and erecting physical border wall has become an attractive policy in which these countries use to control illicit flows. This growing number of border walls and fences in the world has great relevance in development studies in this era of globalization and Free Trade Agreements since they reduce welfare of the people by limiting gains which can arise from specialization, cooperation and trade between neighboring countries. Therefore, the findings of this study stimulates the debate in the academic arena about consequences of these walls and also, it can be considered by policy makers in formulating border management policies that minimize negative effects on trade.

Keywords

International Trade, Border wall, Border barrier, Globalization, bilateral trade.

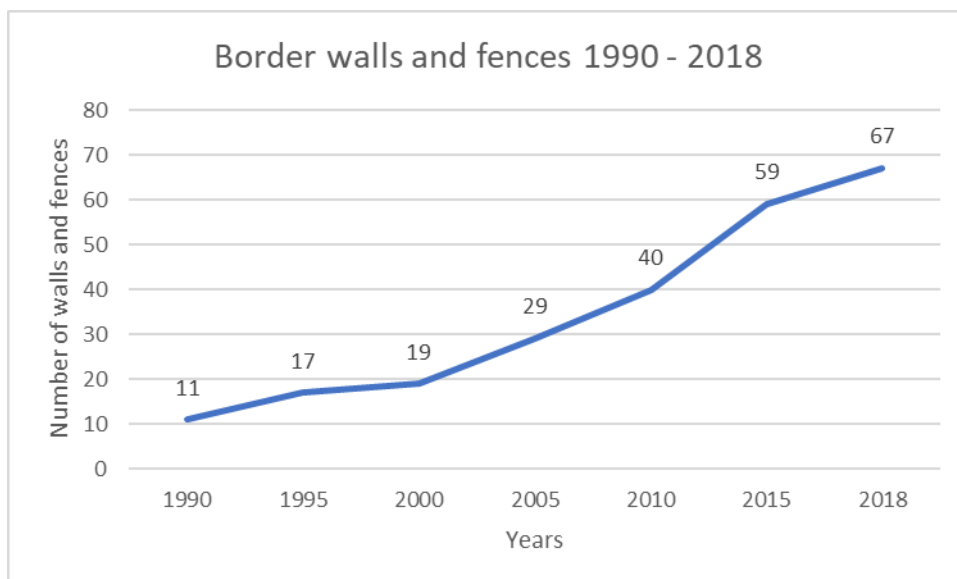
CHAPTER 1: INTRODUCTION

1.1 Statement of the Research Problem

The 20th century was a period in which countries were divided shaped by the “Iron curtain” and Berlin Wall being one of the most known among them. The 21st century seemed to be different as it was signified by the fall of Berlin Wall and the collapse of communist bloc and end of their associated political and diplomatic barriers to trade. This implied development of technology particularly information technology would change the world into a nicer place. It was believed that in a globalized world where there is easy access to technology which helps people to travel from one place to another and transfer information quickly within a short period of time at low cost, border walls would be outdated. Several scholars envisioned a “global village” in which information, people and capital will flow freely. Border walls seemed to be irrelevant in this new world. But it is in this era of globalization in which the world has witnessed high increase in number of border walls being constructed by different countries (Zenderowski, Jankowski 2018:104)

In recent years there is a growing tendency for countries to build walls to separate between them and their neighboring countries. This trend is surprising in the era of globalization and Free Trade Agreements. It is argued that the aim of building these walls is to improve security of the country. It is approximately that there are more than 67 border walls around the world that divide countries from one another. The most well-known are wall between Israel and Palestine and US-Mexico wall. The less known are like Melila wall (wall between Spain and Morocco) and wall between Botswana and Zimbabwe. Other 10 walls are in planning stage of being constructed. A full list of all walls and the planned walls is given in appendix 1. The new trend of border walls has emerged which some scholars call “the fault lines of globalization”. It was believed that the end of cold war was a sign of new era of globalization however, the situation reversed quickly (Carter, Poast 2017:240, Meeuwen 2017:3, Spears 2015:7).

Figure 1.1 Graph of number of walls and fences 1990-2018



Source: Vernon and Zimmermann (2019: 11)

The graph shows number of all fences and walls in the world including partially built fence like the Estonia-Russia fence.

After the end of cold war it was expected that the era of globalization would remove all kinds of barriers and make borders symbolic. However, the rise of national security among states in the world in the post 11/9 together with escalation of migration crisis in the world brought different results. It seems the world has entered the new era of opposing globalization. Three decades after the fall of iron curtain and Berlin Wall, nearly one third of countries in the globe have erected some type of walls or fences in their borders or parts of their borders (Szabó 2018:87). Now we are living in a world where perhaps borders are becoming solidified than at any time in the past as many countries are planning to build walls in their borders instead of dismantling them. Governments of many countries like US, Saudi Arabia, Spain and Hungary claim that walls are efficient mechanism for protecting their countries. This argument is controversial since it does not keep foreign people out of the country's boundary, but it also keeps citizens within their country's border (Ponting 2012:2).

This study examines the impact of these walls on international trade flows between countries. It seeks to answer if these walls have impacted trade between neighboring countries, as it is argued that these walls are built for security reasons. The study assesses bilateral trade at a group of 118 selected countries in which 40 countries among them are separated by walls. The study looks at bilateral trade between these countries from year 1990 to 2010.

These walls are costly to build, for example the walls constructed by US, Israel and India on their boundaries, these are the largest and most costly infrastructural projects implemented in each nation in this millennium. All these fortification projects were planned for several years, but they have not been completed due to larger costs of construction, domestic political resistance and concerns about negative effects "like stigma" which is related to these walls (Jones 2012:3).

More specifically, the existing wall between US and Mexico has costed USD 2.3 billion for construction and USD 0.45 billion for maintenance for the period between 2007 to 2015. It is estimated that the wall lifetime maintenance will need an additional of USD 1 billion (Allen et al. 2018:7). Also, there is high costs of maintaining these walls for example, the Berlin Wall which was 150 km long. It employed 12000 soldiers for patrol and 1000 dogs; Soldiers were equipped with 156 heavy vehicles, 2292 other vehicles, 48 launchers for grenade, 114 flame throwers and 567 "armored personnel carriers" (Vernon and Zimmermann 2019:8).

Despite the large costs involved in their construction and maintaining, less is known about their efficacy and their unintended consequences they bring. Therefore, there is need to investigate other indirect costs of these walls they brings to the economy in order to have a holistic picture on their total costs. This study focuses to investigate the unintended effects of constructing a wall on bilateral trade flow.

1.2 Justification and relevance of this research

While in recent days there is debate about direct costs to the country erecting a wall, the discussion about its implication on trade flow between countries separated by the wall has given little attention. Economics literature suggest that open border policies leads to large benefits to the domestic people compared to walls (Vernon and Zimmermann 2019:17, Peters 2015:115, Rosière and Jones 2012:221). Border openness leads to wide product diversity, low prices and competition among firms (Scheve and Slaughter 2007:39). Moreover, there is large benefits when labour and capital flow to more productive nations (Kennan 2013:3).

Analysis shows that in recent years walls have become a global phenomenon that deserves great attention. Since walls have existed through human history, the end of cold war indicated the discontinuation of building new walls. In contrast, the post 9/11 has witnessed the increase of walls as political instruments which is opposite of what several people expected (Vallet and David 2012:113).

Erecting walls has become an approach used by countries which believe that physical barriers are the only way to deal with border challenges due to lack of trust. After the fall of Berlin wall there were 11 walls around the globe. From that time 40 countries have built fences and majority of them claim that security issues and illegal migration is their main concern. The decision to build more than 30 of those walls were made after 9/11 attacks and 15 of those in the last 3 years (Medzini and Ari 2018:83).

The first wave of globalization which mostly involved developed nations came to an end in 1980s. Following the fall of Berlin wall in 1989 the second wave which involved developing and emerging nations took off in 1990s with China, Asian countries and Eastern Europe entering the global trading system and successfully joined WTO in 2002. For instance, China's world exports and GDP share in the 1980s was very small. After tearing down the Berlin wall all that changed and there was a tremendous increase in its exports and imports (Mukerjee 2017:42)

The post 1989 witnessed a globalization episode which was mainly associated with modernization theory which included a range of economic events like technological transfer, movement of labours across borders, liberalization of trade and escalation of foreign direct investment associated with decrease in costs of transport and communications (Mamba and Jordaan 2015:2).

Globalization was expected to remove physical and political barriers and the formation of Free Trade Agreements like NAFTA and adoption of common borders in the European Union in the 1990s seemed to confirm the idea of moving toward a borderless world. But, security concerns and reluctance to assist migrants and refugees have accelerated building new walls across the world (Medzini and Ari 2018:85, Jones 2012:5). The construction of border walls seems to be contrary to globalization which recommends free movement of labor, capital, goods and services (Roche 2014:106). Contrary to expectations of a borderless world by proponents of globalization, plans to build walls has become attractive to governments of many countries and they are being supported by ordinary citizens. This appears to approve the current tendency of investing in expensive physical barriers (Minca, Rijke 2017:2).

As the drivers for constructing these barriers are different, no countries have been isolated from erecting these walls. Countries in Europe, Asia, America and Africa all have tried to build walls. The drivers in the middle east is terrorism and in Europe and America is migration (Avdan 2018:118).

On one side open borders are significant for well being of the people but on the other side security issues associated with terrorism, illegal immigration and organized crime motivate countries to close their borders to increase security. For instance, the European Union faces this dilemma. The intention to control people which move illegally is contradictory with the goal of removing control protocols in the border which aim at enhancing trade within and outside EU. After establishment of the Schengen zone, members of EU chose to remove borders between them for easy movement of people and goods and on the other hand they entrusted EU the duty of strengthening the external borders of the union by creating a border management agency called Frontex (Vallet 2016:231).

Another dilemma is contradiction in the case of NAFTA for the border wall between US and Mexico. The aim of NAFTA is to facilitate trade and remove trade barriers while border wall is intended for the opposite role. "Although the US has committed itself to integrating most markets in North America, it has paradoxically sought to prevent the integration of one particular market: labor". It appears that NAFTA does not facilitate easy movement of people nor intend to remove the border fence. (Durand and Massey 2003:235, Meeuwen 2017:21)

Although globalization intensified in the end of 20th century border disputes still persists, the idea of "borderless world" in which there is free movement of goods, money and individuals without considering country borders go together with a practical reality in which countries spend a lot of resources to define their boundaries (Schultz 2015:127). There is a claim that borders increase significantly the general costs of trade and there is no proof that globalization have led to "borderless world" (Nitsch and Wolf 2013:155).

Generally, construction of border walls is very costly since it needs a lot of financial resources, the study explores its implication for flow of trade between countries separated by walls. There is an increasing literature on drivers for wall construction, their efficiency in accomplishing the intended goals and the required costs for construction. Yet little is known about their consequences on trade. This study contributes to the growing literature on the impact of border fortification. It offers a cross country evidence using trade data to investigate the consequences of physical border walls on bilateral trade.

1.4 Research objective

This research aims at assessing the effect of constructing a physical border wall on International trade flow between countries. The analysis will base on how international border walls and fences separating countries influence bilateral trade between them.. Since International trade involves crossing borders, the analysis base on how physical border walls influence bilateral trade flow between neighboring countries. The research studies bilateral trade in 118 selected countries involving 40 countries separated by wall and 78 others which are not separated by physical wall.

1.5 Research Question

This study strives to answer the question ‘Are international trade flow affected by walls?’. The question specifically wants to explore the effect of these walls on exports between countries separated by walls.

1.6 Limitation of the study

Unavailability of data for recent years. Lack of trade data and some of the important variables has lead analysis involving recent years and countries which built wall in the period after year 2010 be excluded in the sample. So, the scope is limited to few countries. Another constraint is availability of more zero trade flows. As argued by Van Bergeijk and Brakman (2010) this occurs particularly in developing countries. If these zero flows are not handled well can lead to biased estimates. Also, in some countries the data for some years are missing.

There is another possibility the trade between countries does not depend on land border, but goods are transported through sea or air. In this case this study can not identify any relationship between trade and wall. Additionally, due to unavailability of information it is possible to include other policies which affected trade and coincided with the policy of wall construction. In this case this study can not differentiate the effect of two policy options. Another constraint is that countries erecting wall can have an intention to prevent all kind of its flows with its neighboring country including legal trade. For instance if there is negative political relation. When this happens a reduction in trade is result of political relation ship and not a wall. Furthermore, currently the literature on border walls and trade is limited. This can also be regarded as constraint.

Despite these constraints, this research takes advantage of the growing number of border walls across many countries in the world since the end of cold war up to date. These walls are being erected for different reason like stoping illegal migration, terrorism and drugs. Some of these wall are being implemented in Free Trade Agreements.

1.7 Organization of the study

This paper is organized into six chapters. The first chapter provides introduction to the topic on border walls and international trade. The second chapter gives the theoretical framework and literature review on gravity model and border walls. The third chapter provides information on overview of physical border walls contexts. The fourth chapter provides data and empirical strategy used. The fifth chapter presents the study discussion and data analysis and the six chapter concludes the main findings of the whole research and gives policy implications.

CHAPTER 2: THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 Trade Theory

The relationship between borders and trade is not a new idea it goes back in the 19th century in which proponents of free trade developed the idea that international trade leads to mutual wealth among economies. According to the Ricardian theory of comparative advantage, countries should specialize in production activities depending on the factor endowment in order to gain from trade. Foreign trade enables a country to specialize and direct its resources in activities which it has a comparative advantage. Despite the fact that some restrictions were required in order for the Ricardo's model to work efficiently, belief in the principles of free trade guided the 19th century thinking and it was used in the organization of financial and economic governance after WWII during the time in which the "condition for sustainable peace" was argued to be free exchanges between countries. Therefore, border and anything which hinders free trade was perceived to be a source of war and poverty (Roche 2014:108, Linders, Gert-Jan M. et al. 2008:440).

2.1.2 Border Walls as Trade Barrier

Despite the benefits of free trade advocated, countries are building walls to close their borders. In the early period it was realized that border walls hinder economic exchanges between countries on two sides of the wall. So, when analysing the wall, there is necessity in considering the geography of economic activities. Gravity model is a tool used to analyse bilateral economic exchanges between countries based on geographical patterns (van Bergeijk 2015:234).

Border walls intensifies border effects. As advocated by McCallum (1995) in his influential paper "border effect" refers to the adverse effect of international borders on trade. Border effects gives reasons for a high trade volume between two firms located in one country than those located in different countries despite the fact that distance among the two firms located within one country may be larger than that of the firms which their transaction involve crossing an international border. Behind the logic of border effect is trade costs. Firms incur extra costs when they decide to trade in international markets. The costs include those derived from geography like transport costs depending on distance, those which depend on trade policies like tariffs, exchange rate and NTBs. Other costs are related to cultural and institutional differences. Since foreign trade crosses international borders, the transported goods passess in the in customs checkpoints. All these regulations reduces trade flow.¹

Further more, there is an argument that borders reduce trade because of existence of non tariff barriers even when tariff barriers have been removed. In addition to that, there are some differences which continue to exist between countries that are related to border management (Nitsch and Wolf 2013:155).

¹ Received an advance copy from the co-author Paul Poast on 17th October 2019. It is a forthcoming paper to be published on Journal of International Organization written by David Carter and Paul Poast.

Helliwell (2000) argues that policies of erecting fences at borders between countries, increase the costs of cross border transactions for private sector agents. There is reduction in trade and in some instances, it eliminates trade. Although the goal of erecting wall is to reduce migration and illicit trade, also fortification of border decreases legal trade. This implies that border security increase may lead to significant trade-offs (Perry World House 2019:3).

Walls have repercussions on trade, and finally on profitability of firms. Like any other movement barrier, wall implies increase in costs of foreign trade. Delays at cross border movement fortified by wall is not only it adds transport costs for companies, but it puts at risk perishable goods like fresh fruits, dairy, fishery products and vegetables which may spoil because of long waiting time. Also, sometimes production inputs for firms come from other side of the border, extra expenses are incurred, decreasing ability of firms to produce (Oberholzer 2015).

Increased security through border walls increases waiting times at border crossing. As a result, this prolonged waiting time has turn into non-trade barrier. This leads to economic consequences on employment along the border and sales of industries that benefit direct from flow of foreign trade and individuals. This involves manufacturing, logistics activities, wholesale and retail trade and professional services. Longer wait times increases transaction costs which are finally passed to consumer due to increase in costs of inventory and other transport and communication delays (Border Network for Human Rights et al. 2008:13).

All kinds of territorial barriers decrease the welfare of the people by impeding the benefits which can arise from partnership, trade and specialization among neighbours (Vernon, Zimmermann 2019:14). Walls may bring numerous effects to the economy, They cause increase in wages which finally lead to high prices of goods since it restricts movement of labour (Allen, Dobbin et al. 2018, Allen, Dobbin et al. 2019). This increases cost of production and reduce volume of trade.

A border wall sometimes can not necessarily harm trade, but it is a symbol of insult to a neighbouring country. Even if there are no border disputes it can provoke neighbouring country since decision to build walls are made by one part and this can lead to distraction of significant commercial relationship (Avdan 2018:125). They may suppress relationship between neighbouring countries, particularly if it is perceived as security tool (Avdan 2018:119).

Walls may harm direct through impeding cross border transaction or indirect by damaging the interaction between two countries. Individuals living near the border they are affected by border walls since they are integrated economically by their closeness. For instance, Mexico criticized the US wall arguing that it will reduce bilateral trade flow. Walls increase costs of economic exchanges. Border between nations hinder trade. This effect increases the negative impact of physical distance on trade. Beyond, infrastructure and personnel

expenses additional in time for waiting and processing documents may lead to reduction in trade (Avdan 2018:124-125).

2.1.3 New Trade Barriers

Nowadays great attention has been to the intangible barriers to trade which substantiates the concept of “unseen walls” as a metaphor in line to this study and may bring significant impact to the economy. These barriers have been available for long time, but less attention was given to them since transport costs were bringing larger effect on trade. Even though proponents of globalization have argued about the “death of distance” empirical findings using gravity model has persistently shown that distance exists, and its significance has grown in recent years. Current studies have shifted their focus to other kinds of distance effects which are associated indirectly to variation in trust, cultural norms and institutional quality (van Bergeijk 2015:236). Although, there is advancement in technology which has led to reduction in transport and communication costs and decrease in formal barriers to trade, trade barriers remain high and persistent. Some studies suggest that this is because of informal barriers to trade, cultural and difference in institutions act as intangible trade barriers and they cause resistance to trade like traditional trade barriers (Moons and van Bergeijk 2011:1).

Another literature which is relevant to intangible barriers is focusing political motivated barriers to trade related to effect of economic diplomacy (van Bergeijk 2015:236). The effect of political relations on trade has been a subject of significant debate in economics and political science particularly international relations. Several studies have found that political relations deterioration have effect on bilateral trade in several ways. It is argued that military conflicts, territorial disputes and conflicting political objectives each affect bilateral trade negatively (Du et al. 2017:211).

Theoretically there are reasons to expect a reduction on trade in the presence of negative political interactions. For instance, deteriorating political relations between countries can increase nationalistic sentiments among people hence consumer preferences can be affected and finally reduce trade. Also, it can stir government decisions that impede trade. Furthermore, it can induce uncertainty which can deter economic activities (Du et al. 2017:223).

Snellman (2005) notes that during 1989 to 1992 flow of trade between West and East Europe increased by 50%. The increase was mainly caused by manufactures and tariffs were never high at the beginning. This implies that trade policy was not the cause and it does not suggest that trade policy has no effect, instead it implies that other factors were more significant in influencing trade. The trade volume during cold war was low and it was caused by the unfavorable political relationship between the two regions.

Another determinant of bilateral trade related to political relationship is regime systems. It is argued that democratic countries trade more with other democratic countries. Bilateral trade between democratic countries is high compared to when one or both countries are not democratic. Democratic state feel more secured when trading with its democratic partner compared to an autocracy because it is less worried if its democratic trading partner will use the gains from foreign trade to risk its security compared to when it trades to a non democratic country. Moreover, democratic countries can enter into economic partnerships

for complete gains without concerned about any risks compared to when trading with autocracy. Democratic countries form policies that enhance their firms to trade with other firms in democratic states which they have good political relationship. Furthermore, private firms prefer to trade with firms from countries which have peaceful relationship with their own country. Also, companies are more confident in conducting business in a rule of law in a democratic state than in autocracy. The predictability of legal and political system of democratic states give confidence to firms that their business interests will be secured. In addition to that, shared norms enhances trade between democratic partners and reduce trade distortions which can result from boycotts and embargoes (Bliss and Russett 1998:1128:1129, Morrow et al. 1998:651).

Democratic paired countries set low level of trade barriers between them than country pairs which are mixed i.e. democracy and autocracy Moreover, barriers to trade between them are likely to be low between countries with similar system than with different system (Mansfield et al. 2000:305).

Even though trade in the world has increased at a fast pace in the past decades, barriers like culture, physical geography and government policies still hinder trade among nations. If you compare actual international trade pattern with theoretical anticipation, it can be concluded that nations trade less compared to what was expected, considering that the key motive for harnessing the gains is due to differences in factor endowments, technology and difference kinds of products produced among nations. It is argued that if there were no barriers, trade volume would be five times larger than currently observed. Therefore, trade barriers are significant determinant of trade volume and the international trade patterns (Linders, Gert-Jan M. et al. 2008:441-442).

2.1.4 Theoretical Development of Gravity Model

The gravity model in international trade analysis was introduced by Tinbergen (1962). The justification was intuitive and it lacked theoretical underpinnings (Snellman 2005:14). The gravity model has become the workhorse in analyzing international trade flow. It derives its analogy from Newton's law of gravity in Physics, which states that the force of gravity exerted between two objects is based on their masses and distance. The concept of gravity has been also applied in social sciences in explaining spatial interaction. The gravity model have been applied in analyzing flow of migration, goods and information (Linders, Gert-Jan M. 2006:4).

The pioneers of gravity model in international trade analysis are Tinbergen (1962), Poyhonen (1963) and Linnemann (1966). Linnemann included more factors and he provided theoretical justification based on "Walrasian general equilibrium system". According to him there are three variables to consider in describing the theoretical aspect of the gravity model: First, the potential supply of the exporting country; second, the potential demand of the importing country; and third, the factors that hinder trade like tariffs and costs of transport. The first and second variables are anticipated to be equal under the assumption that capital and services does dot flow internationally. Trade is considered to happen if products produced domestically is not equal to the domestically demanded products. Particularly, some goods have an advantage to be produced in certain nations which leads to specialization and division of labor. In traditional trade theory this

production specialization describes the occurrence of trade with regard to comparative advantage terms (Paas 2000:12).

The gravity equation has often used in analysing trade policy due to its robustness. The model became popular in 1970s and 1980s, but its lack of theoretical foundation gave bad reputation to the model. Most economist ignored the model due to this fact. Since its discovery, the gravity model for a long time was unconnected to the economic theories. The theoretical underpinning of the gravity equation came after 17 years of its empirical application. The first contribution was by Anderson (1979) basing on the assumption of specialization of product by place of origin and constant elasticity of substitution. The other contribution was by Bergstrand (1985) who completed the theoretical foundation by providing a more detailed information on production side of economies and consideration of prices in the model. After some years later there was some modification, the major one being substitution of the assumption of product differentiation by origin country with the assumption of product differentiation between firms producing goods. Later in 1990 Bergstrand provided a foundation based on the assumption of monopolistic competition. In 1987 Helpman developed a theoretic foundation based on increasing returns to scale in which goods were “differentiated” by firms and not only countries (Gómez-Herrera 2013:3). Later Deardorff (1998) argued that the gravity model is consistent with traditional trade theories.

Since the model could be generated from Ricardian theory, Heckscher-Ohlin and increasing returns to scale it gave confidence to trade policy analysts and became a workhorse for analysing changes in world trade pattern after the collapse of iron curtain. Studies in this period predicted a large increase in trade between Eastern and Western Europe (Anderson, James E. 2011a:1, Van Bergeijk and Brakman 2010:6).

In recent years there has been literature which have provided the extended theoretical foundation of the gravity equation (Linders, Gert-Jan M. 2006:5). This has been given by Anderson, James E. and Van Wincoop (2003) and Anderson (2007). This has led to the modification of the model to include omitted variable bias associated with multilateral resistance to trade.

The seminal contribution by Anderson and van Wincoop (2003) provided a refined theoretical foundations of the gravity models to consider the endogeneity of costs of trade and the institutional trade barriers (Ghosh and Yamarik 2004:9). The gravity model have become popular after improving its theoretical underpinnings and improving its specification by including the multilateral resistance to trade (Linders, Gert-Jan M. 2006:2).

After Anderson and Bergstrand contribution on theoretical foundations it became clear that specialization and “identical preferences” became main elements. Each product is produced in one nation and consumers purchase every product. The model involves “complete and incomplete specialization and firm heterogeneity” (Kabir et al. 2017:62).

2.2 Empirical Study Review

Breuss and Egger (1999) argue that the collapse of communist block and opening of Eastern Europe in 1989 brought a new field of applying a gravity model. Due to its good empirical and statistical performance it became a significant model in analyzing the impact of the collapse of Berlin Wall and Iron curtain.

In 1990s there was substantial literature on the impact of fall of iron curtain on the potential of trade in eastern Europe, which assumed that improvement in diplomatic relationship between Western and Eastern Europe would lead to increase in trade volume between the two regions (Van Bergeijk 2014:36). For instance studies which used gravity model to estimate trade potential and concluded by comparing actual trade flow and the predicted trade flow between Eastern Europe and Western Europe were Havrylyshyn et al. (1991), Wang and Winters (1992), Hamilton and Winters (1992) and Erzan et al. (1992). Using cross section estimation technique these studies indicated significant growth of global trade potential and meaningful movements in patterns of world trade, implying that Berlin wall and Iron Curtain has negative impact on trade. The variables included in their gravity model were GDP, Population, distance, common language and Free Trade Agreements.

They used the estimated parameters of explanatory variables of the gravity model in predicting potential trade level of CMEA countries. Conclusions were made by comparing actual trade volume and predicted trade volume. The potential trade after comparison was huge. Some studies like that by Havrylyshyn et al. (1991) estimated a change in geographical trade pattern. They predicted that Northern Europe trade share to Eastern Europe would rise from 25 – 30 percent to 70 – 75 percent. The shortcoming for these studies was that, they were not estimating directly the impact of Berlin wall and cold war walls. Furthermore, all studies used cross section data. As pointed out by Egger (2000) cross section analysis in gravity models can lead to unreliable estimates since they do not take into account importer and exporter effects.

A study by Van Bergeijk and Oldersma (1990) used different approach with those from other studies, using gravity model and cross section estimation, estimated the impact of walls from the model by means of a dummy variable instead of estimating the impact by comparing between the actual and predicted flows. The included variables were GNP of exporter and importer, population for exporter and importer, distance and dummy variables for East – West trade and East – East trade. The variable for East-West dummy representing iron curtain has negative coefficient and statistically significant. It was concluded that walls exert negative impacts on trade between Western and Eastern Europe. Furthermore, he simulated the post-cold war trade orientation in the absence of political barriers and finally, predicted huge changes in trade patterns in the world. However, the limitation for this study was it used few variables which determine trade.

Another study by Van Bergeijk (2015) using cross section analysis for the year 1988 from 48 countries which cover the major trading countries in the world including G20 countries studied the impact of visible and invisible walls on trade. He revisited the trade literature of the East-West trade in the 1990s and replicated the Van Bergeijk and Oldersma (1990) study and estimated the effect of walls using traditional gravity model and Baier–Bergstrand gravity model which is a modern reformulation gravity model that takes into account multilateral resistance to trade as introduced by Anderson and van Wincoop (2003). The only difference with the previous study was colonial history and common language were included among the control variables. The coefficient estimates for walls was negative and statistically significant in all models. Therefore, the study find strong evidence that both visible and invisible walls exerts negative influence on trade. These walls affect trade in both of its two local sides involved and the consequences goes beyond the local level

implying that it affects the world trade. After simulations breaking down the walls it increased global trade to GDP by 2.7%. The analysis suggest that the invisible walls has important implication for Chinese trade due to changes it undergone.

Carter and Poast (2019) uses gravity equation and panel data from 1900 to 2013 from a sample of 241 countries and territories in the world to study effect of walls on foreign trade relations. In their analysis they included walls which existed under the study period i.e. dismantled walls and existing walls up to 2013. This study unlike other studies, in addition to other variables of the gravity model it included territorial disputes, defence alliance and democratic qualities to capture the political relationship. The estimated coefficient for walls was negative and significant. Therefore, they concluded that border walls significantly associate with decrease in trade between neighboring nations. Countries separated by wall is associated with reduction in trade by 31%.

Nitsch and Wolf (2013) use the the gravity approach as introduced by Anderson and van Wincoop (2003,2004) which includes multilateral resistance in estimating effect of former East and west Germany border which was separated by Berlin wall on German domestic trade for a sample of 16 federal Germany states using panel data for the period 1995 to 2004 find a negative effect of former East and west Germany border. The coefficient estimate showed that cross border trade in 1995 was 71% below the sample average and 42% less of whole trade average which crosses Germany states border. Furthermore, they find that trade between the two former separate parts is less than sample average even after many years of wall and border disappearance.

Allen et al. (2018) on their study on how border wall between United States and Mexico influences cross border flows of people and goods. They use gravity model and panel data analysis from 2006 to 2016 estimated economic impact of wall. They estimated bilateral trade frictions between the two countries and revealed that there is no evidence that a border fence impacted flow of trade between United States and Mexico. Also, the study find that the wall has reduced migration by 1.4%. The drawback of this study is that it used travel time in comparing when goods avoids the wall and when it passes through the wall.

A study by Oberholzer (2015) on the study on impact of the West Bank Wall on the Palestinian labour market, estimated effects of wall on different sectors apart from labour such as agriculture, informal sector and trade using separate linear regression models. He estimated the impact of wall on trade between Israel and Palestine, using linear regression model with wall as the only explanatory variable and panel data analysis for the period 2000 to 2012 and find that there was no significant relationship between trade and wall effect. The estimated coefficient of a wall was negative but not significant. It was argued that the insignificance may be due to smuggling of goods between Israel and Palestine which are not recorded in official data since the wall do not prevent smuggling of goods. However, the shortcoming of this study is it used linear regression model in the analysis rather than gravity model. Another shortcoming is that, the model relates only wall and trade, there are no other variables which determine trade.

Hamzić (2016) on his study on border walls for the case of Saud Arabia from 1995 to 2014 the period in which Saudi Arabia constructed border walls with its neighbours, using descriptive statistics find high volatility in bilateral trade between Saudi Arabia and its neighbouring countries compared to Gross National Income which its variation was very small. This confirmed the idea that the integration of Saudi Arabia with its neighboring

countries is very low. This suggests that walls have effect on trade. The limitation of this study is it did not establish the exact association between trade and wall i.e. the extent in which border walls affects trade.

Table 1.1: Summary of empirical study review

Author(s) (Year)	Main focus	Study Period	Estimation technique	Variables	Major finding
Havrylyshyn, O., L. Pritchett and B. Mundial (1991)	Trade potential	1980 – 1982 and 1986-1987	Gravity model Cross section data 14 countries	GDPs, distance, common language, common border, Island, FTAs	Fall of COMECON increase trade between eastern and western Europe.
Wang, Z.K. and L.A. Winters (1992)	Trade orientation	1984-1986	Gravity model Cross section data 76 countries	GDPs, distance, population and FTAs	Liberalization of Eastern Europe has great trade potential
Hamilton, C.B. and L.A. Winters (1992)	Pontential of trade	1984-1986	Gravity model Cross section data 76 countries	GNP, Population, Distance, Adjacency, colonial links, FTAs	Eastern European transformation will change the trade patterns
Erzan, R., C. Holmes and R. Safadi (1992)	Trade potential	1988 -1990 average	Gravity model Cross section data 76 countries	GDPs, distance, Export or import share in GDP, FTAs	Changes in composition of exports in Eastern Europe.
Van Bergeijk and Oldersma (1990)	Potential for world trade patterns	Year 1985	Gravity model Cross section data 49 countries	GNPs, population, Distace, dummies for west - east and east-east trade	walls exert negative impacts on trade
Van Bergeijk (2015)	Impact of Visible and Invisible Walls	Year 1988	Gravity model and Baier–Bergstrand version of thegravity model Cross section data 48 countries	GNPs, population, Distance, dummy for wall, colonial links and common language.	Both visible and invisible wall decrease trade
Allen et al. (2018)	Border walls	2006 to 2010	Gravity model Panel data 2 countries	GDPs, Overland distance, Travel time	no evidence that border fence impact trade flow.

Oberholzer (2015)	Impact of the West Bank Wall on the Palestinian Labour Market	2000 to 2012	Linear regression model 2 countries	Wall	no relationship between trade and wall effect
Nitsch and Wolf (2013)	Impact of former berlin wall on trade	1995 to 2004	Gravity model by Anderson and van Wincoop (2003,2004)	Distance and dummie for border and East-West trade	Trade between the two former separate parts of German less
Carter and Poast (2019)	How Border Walls affects Trade Relations	1900 to 2013	Gravity model Panel data 241 countries and territories	GDPs, Distance, Physical barrier, democratic dyad, strategic rivalry, defensive alliance, territorial dispute, Income inequality, FTA, common currency, member of GATT/ WIO	Border walls decreases trade between neighboring nations
Hamzić (2016)	Border Walls consequences	1995 to 2014	Descriptive statistics 8 countries	GDPs	high volatility in bilateral trade than GNP

In sum, there are few main issues that can be drawn from the review of literature. First, these studies differ in their scope, period of study and techniques in determining the impact of walls on trade flow. Second, many empirical studies in their estimation deployed gravity model approach, most of them used cross section data and few used panel. Third, many studies find that border walls has significant negative impact on trade, and few of the studies have find inconclusive results. Finally, many of these studies focused on East – West trade.

To overcome limitations revealed in the reviewed literature, this study relies on post cold war period, since during this period many walls have been built with the claim that they prevent illegal migration and terrorism. It uses a large bilateral trade panel data and large number of walls to conduct cross country analysis unlike previous studies which most of them relied on two regions or countries. Furthermore, the data set covers the period 1990 to 2010 which is the time in which globalization intensified. Generally it differs with previous studies in terms of coverage of countries and time span. Similar to many of the previous studies methodological approach, this study uses gravity model and panel data analysis.

CHAPTER 3: OVERVIEW OF BORDER WALLS

3.1 Historical Background of Border Walls

History shows that the tendency to erect walls and fences has always been demonstrated by human being through his life. These walls can be divided into periods as Ancient and medieval walls and Modern walls.

3.1.1 Ancient and Medieval Walls

The rationale behind building these walls were to protect themselves against enemies, sign of sovereignty, wealth and strength and to show that they belong to that place. These walls, controlled movement of people and goods. There were distinct kind of walls dividing kingdoms (Vernon and Zimmermann 2019:2, Zenderowski and Jankowski 2018:104).

Example of ancient and medieval walls were the Roman empire-built Hadrian's Wall with 118 km and Antonine Wall with 60 km, a wall with 750 km in North Africa and a 568 km wall in Germany in 83-260 AD. Another example is the great wall of China which was constructed from 220 BC to 17th century with 21,196 km with the aim of dividing chinese farming area from the nomadic barbarians and to protect the territory (Vernon and Zimmermann 2019:2-4).

Inspite of the high expenses incurred in building and maintaining them, they partially succeeded in realizing their intended objectives. Still it is unclear if the benefits of those walls exceeded the opportunity cost of their erection (Vernon and Zimmermann 2019:5).

3.1.2 Modern Walls

Modern walls are walls constructed which later became borders of modern nations. These included 155 km long Metaxas built by Greece, the Maginot line constructed by France, a 380 km defensive wall in the border between Italy and Germany, a 1851 km wall built by Mussolini of Italy in 1930-1942 in its northern border facing Switzerland, Austria, France and Yugoslavia. Nations recognized each other borders after WWII when the United Nations was established. It was expected that the existence of diplomacy and peace could lead border walls outdated but persistence of conflict among countries led walls to be considered as a permanent solution. Among the built walls were 150 km built by Israel in 1967 during the six day war with Egypt, Jordan and Syria, 2700 km built by Morocco in 1987 in its border with western Sahara, a 243 km wall built by North and South Korea in 1970s and the Berlin wall built in 1961 with 150 km. in the period 1990 to 2001 six walls were built to prevent terrorism. These included India/Bangladesh, Israel/Gaza, Uzbekistan/Afghanistan, Kuwait/Iraq, Turkmenistan/Uzbekistan and Uzbekistan/Kyrgyzstan (Vernon and Zimmermann 2019:6-8).

After terrorist attacks in 9/11, from 2002-2010 fifteen new walls were constructed. Among others were fences built by Israel which separates it from Egypt and West bank, an 885 km wall constructed by Saudi Arabia separating from Iraq and fences with Jordan, Yemen, Oman and Qatar. Also, there are other fences erected between Myanmar and Bangladesh, Lithuania and Belarus, Brunei and Malaysia, Botswana and Zimbabwe, Pakistan and Afghanistan, Kazakhstan and Uzbekistan and Hungary with Serbia and Croatia. Other fences in Europe have be built in response to massive migration. These include

Macedonia/ Greece, Greece/Turkey, Bulgaria/Turkey, Hungary/Serbia, Hungary/Croatia, Slovakia/Croatia and Austria/Slovenia. (Vernon and Zimmermann 2019:9-10).

3.2 Brief on Border Walls after 1989

The fall of Berlin wall accelerated globalization since it created a definitive change in the dynamics of globalization. Globalization became the governing rule of trade. Eliminating the wall stimulated the integration of the world economy (Wade 2018:4, Mukerjee 2017:30). This led to a belief in 1990s that national borders were irrelevant since the process of globalization indicated that they were losing its meaning. “The idea of Borderless world” came because countries were losing their authority on borders. The adoption of European Market, formation of North America Free Trade Area and other regional integration agreements appeared to confirm that national borders were irrelevant (Simmons and Kenwick 2019:3).

Borders have the role of identifying the internal rules and regulations that distinguish between neighboring countries. Additionally, the formation of World Trade Organization signified this purpose. As indicated in previous section in human history the use of wall to control movement of people is not new. The Roman empire walls and the Great wall of China aimed at security and migration control. During the modern era the communist block prevented their citizens from moving to other countries through building walls. Since this technique failed in 1989 it was expected that it could be the end of most border barriers, the results were contrary to the expectation and in 1990s countries began to erect walls (Rosière and Jones 2012:221). Many walls constructed after 1990 have been built on boundaries which have no disputes. These walls are being described as “Walls of Globalization” (Zenderowski and Jankowski 2018:110, Vallet and David 2012:114). These walls are being built by both governments of authoritarian and democratic states and those of failed states and healthy states.

In a post-cold war period in which Free Trade Agreements plays a significant role in the world economy there has been increase in border fortification particularly in areas that demarcate rich and poor countries. Territorial concerns have shifted from armed fighting to crime combating. This is the case for US-Mexico border in which now there is increase in border controls. These actions of fortifying borders contradicts the idea of a liberalized global economy (Fernández, María José Reyes Retana 2017:3).

Border barriers has monetary and non monetary effects as well as time effects, they add relative distance and impede interactions between two sides (Laine 2012:54). Borders also create and maintain differences in culture, behavior, language and socio economic status by generating discontinuities in cross border interactions (Laine 2012:69).

The modern border barriers are being described depending on their specific roles and contexts. They are identified as security, military, anti-terror and defensive wall. Some are called fence or barrier. Opponents of these walls use their own description depending on how they regard these walls. Terminology like shame, separation, apartheid and political walls is mainly applied in criticizing these walls (Saddiki 2017:3). They use these terms in opposing walls since it is argued that the main driver of illegal migration which finally lead to wall building is inequality, and analysis shows that in recent years countries constructing

walls are much richer than their neighbors counterparts (Vernon and Zimmermann 2019:13)

The tendency shows that countries erecting walls are

The fortification of borders is contrary to liberal globalization in which its common market model proposes four liberties which are free movement of goods, people, services and ideas. Proponents of globalization oppose this trend of partitioning the planet arguing that now is too small to be organized on old territorial demarcation (Roche 2014:106).

3.3 Geography of Walls

Estimates shows that since 1990's countries which are members of the European Union and Schengen area have a built almost 1000 km of walls into their borders to combat migration. Countries erected walls include Hungary, Spain, Greece, Latvia, Bulgaria, Slovenia, the UK, Austria, Norway, Estonia, Lithuania, Ukraine and Macedonia (Benedicto, Brunet 2018:6).

In Middle East Saudi Arabia constructed 885 km security wall with Iraq and fences with UAE, Oman, Qatar, Jordan and Yemen. Israel Erected fences which separates it from the West Bank and Egypt. United Arab Emirates built walls in its borders with Oman and Saudi Arabia. Jordan constructed walls with Iraq and Syria. Iran built wall separating it from Iraq, Pakistan and Afghanistan. Kuwait built wall with Iraq.

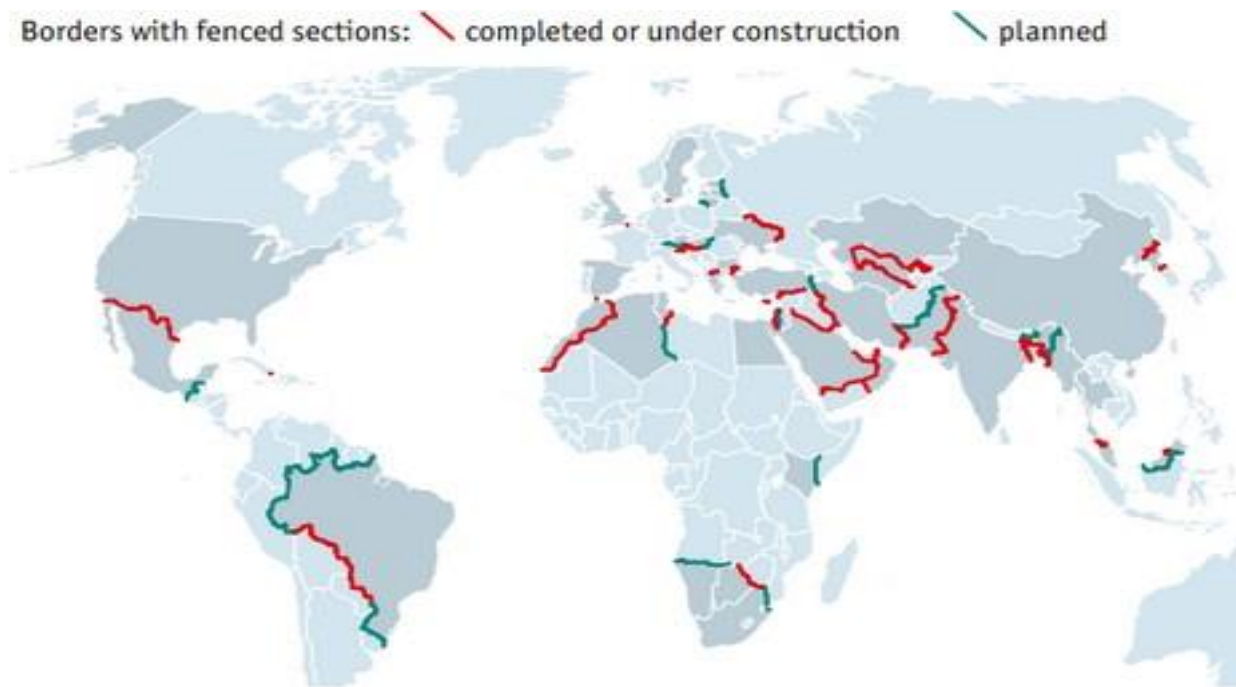
In Asia security walls were built, these includes India/Bangladesh, Uzbekistan/Kyrgyzstan, North Korea/South Korea, Turkmenistan/Uzbekistan, Myanmar/Bangladesh, Uzbekistan/Afghanistan, Lithuania/Belarus, Brunei/Malaysia, Kazakhstan/Uzbekistan, Kazakhstan/Kyrgyzstan, Azerbaijan/Armenia

In Africa there is a fence between Botswana and Zimbabwe, Tunisia and Libya, Algeria and Morocco and South Africa with Zimbabwe and Mozambique built in 1986. In North America there is a wall between Us and Mexico.

Many countries have announced their plan to build walls in future, these includes Poland/Belarus, Estonia/Russia, Latvia/Belarus, Turkey/Iraq, Poland/Ukraine, Hungary/Romania, India/Bhutan, Algeria/Libya, Malaysia/Brunei, Russia (Crimea)/Ukraine and Malaysia/Indonesia. Latin America is free from border walls with exception of one built by US between Guantanamo and Cuba (Vernon and Zimmermann 2019:8-10).

Figure 3.1 below shows the geography of walls in the world up to 2015

Figure 3. 1: Border walls and fences. A World map



Border walls and fences

Source: The Economist 2015² (Available online)

NB: The observed wall in Latin America at Brazilian border is a virtual wall monitored by satellites and drones

3.4 Conclusion

In most cases there is a general accepted argument that the post cold war walls are built to control illegal migration and illicit goods. The observed trend of erecting walls in the world is intense in Europe and Middle East. There is still a debate about rationality of the decisions to build them regarding their efficiency, costs and benefits. Furthermore, overall the newly constructed walls in the globe raise concern about future integration of the world economy. Although, it appears that in terms of efficiency there is no difference between them and other historic walls.

² Map available online at <http://infographics.economist.com/2015/fences/>

CHAPTER 4: DATA AND METHODOLOGY

4.1 Data source

This paper has used data which were collected from secondary sources. Data for exports, GDP, population, distance, colonial ties, common language and contingency was obtained from CEPII database on Trading history by Fouquinand Hugot (2016) accessed on 11th June 2019. CEPII extracted data for exports, GDP and population from the Direction of Trade Statistics of International Monetary Fund (IMF) and World Bank development indicators. The calculation of GDP and Exports is on British Sterling pounds. Distance is measured in kilometers by great circles between the two main cities in each pair of trading countries.

The data for number of walls was extracted from academic articles like Vernon and Zimmermann (2019), Carter and Poast (2017) and Zenderowski and Jankowski (2018). Data on Militarized Interstate Disputes (political hostility) were obtained from the Correlates of War project updated by Palmer et al. (2019) which covers the period 1816 to 2010. The data was accessed on 3rd October 2019. Militarized Interstate Disputes records information on conflicts in which one country threatens, display or use force against another country. Some of the earlier studies used events data to examine effect of political hostility on trade between countries but nowadays most analysis use Militarized Interstate Disputes (Davis and Meunier 2011:628). Morrow et al. (1998) argues that using Militarized disputes is recommended since it is the great sign of conflicts which states engage in the absence of war and can lead to significant trade reduction. If these disputes do not decrease bilateral trade, then the direct effect of other political conflict on trade should be doubted.

Data on democratic dyad were extracted from Polity IV project dataset version p4v2018 for country reports issued by Centre for Systemic Peace developed by Marshall et al. (2017). These data were accessed on 22nd October 2019.

The data are collected for a period from 1990 to 2010. This is the period after the fall of Berlin wall. The panel dataset covers 118 Countries for the period 1990 to 2010. Among these countries 40 are separated by wall. The data is organized as bilateral trade flow. Every unit observation is related to flow of trade in a given time (i.e. year). The observation unit is country pair, direction and in a particular year. The panel obtained is unbalanced since the available number of flows of bilateral trade rises over time

Table 4.1: List of countries contained in the sample

1. Afghanistan	41. German	81. Poland
2. Angola	42. Georgia	82. Qatar
3. Albania	43. Ghana	83. portugal
4. Algeria	44. Guinea	84. Russia
5. Armenia	45. Guinea Bissau	85. Rwanda
6. Azerbaijan	46. Greece	86. Saudi Arabia
7. Burundi	47. Guyana	87. Sudan
8. Belgium	48. Hungary	88. Senegal
9. Benin	49. Indonesia	89. Singapore
10. Bangladesh	50.India	90. Somalia
11. Bulgaria	51. Iran	91. Sierra Leone
12. Bosnia	52. Iraq	92. Sri lanka
13. Belarus	53. Israel	93. Spain
14. Brazil	54. Japan	94. Switzerland
15. Brunei	55. Jordan	95. South Korea
16. Bhutan	56. Kazakhstan	96. Suriname
17. Botswana	57. Kenya	97. Slovak
18. Cambodia	58. Kyrgyzstan	98. Slovenia
19. Canada	59. Kuwait	99. Syria
20. Central African Republic	60. Latvia	100. Thailand
21. Chad	61. Lebanon	101. Tajikistan
22. China	62. Libya	102. Tanzania
23. Cote D'voire	63. Liberia	103. Taiwan
24. Colombi	64. Lithuania	104. Togo
25. Congo Republic	65. Macedonia	105. Turkmenistan
26. Democratic Republic of Congo	66. Mali	106. Turkey
27. Djibouti	67. Malaysia	107. Uganda
28. Croatia	68. Mexico	108. Ukraine
29. Cuba	69. Morocco	109. United Kingdom
30. Cyprus	70. Myanmar	110. United States
31. Dominican Republic	71. Nepal	111. United Arb Emirates
32. Denmark	72. Niger	112. Uzbekian
33. Egypt	73. Nigeria	113. Venezuela
34. Equado	74. Nicaragua	114. Vietnam
35. Eritria	75. North Korea	115. Yemen
36. Estonia	76. Oman	116. South Africa
37. Ethiopia	77. Pakistan	117. Zambia
38. Finland	78. Peru	118. Zimbabwe
39. France	79. Philippines	
40. Gambia	80. Papua New Guinea	

4.2 The gravity model

In examining the impact of walls on trade flows. This study uses gravity model which was pioneered by Tinbergen in 1962. For more than five decades gravity model has been used in analysing international trade. The model rests on the idea that bilateral trade is related positively to their size and negatively related to their distance. It assumes that bilateral trade depends on export supply factors in one nation and demand factors in another nation. Other variables included in the gravity model are costs of transport and other barriers to trade. Since its introduction it has been applied in many empirical studies in describing trade flow and evaluating trade policies (Urata and Okabe 2010:7, Gros and Gonciarz 1996:713).

Van Bergeijk and Brakman (2010) argue that gravity model depict that the bilateral interactions of large economic clusters is stronger than smaller clusters and clusters which are close attract each other more than those which are far apart. Due to its robustness and consistency to trade theories has been a tool in examining trade policies.

Given its early criticism of the model on its theoretical stance, in recent years it has been used widely after being given its economic foundation and theoretical underpinnings in addition to its ability to predict bilateral trade between countries. The gravity model has been applied in estimating different factors affecting international trade flow like regional economic integration, common borders, currency union, language, corruption and other measurement of trade costs on foreign trade flow such as transport costs, NTBs and tariffs (Kabir et al. 2017:60-61). Also, it is used to estimate the impacts of several political, economic, cultural and social variables of trade flow like predicting the effect of migration, military alliances and conflicts (Bergstrand and Egger 2013:543).

The gravity model is a workhorse for analyzing economic exchanges between countries. The popularity of the model depends on three pillars which are: Foreign trade is a key element in all economic partnerships. Therefore, there is need to know how normal trade would be. Second, the data used in estimating the model is now readily available. And third as Baldwin and Taglioni (2006) argues that many high profile papers like McCallum (1995), Frankel et al.(1997) and Rose (2000) have established set of standard practices in estimating the model.

The gravity model has been greatly used in examining the impact of different policy matters like regional trading agreements, Currency union, patent rights and different distortions of trade. The events and policies are included as deviations from the trade volume estimated by the traditional gravity model and they are captured by dummy variables (Cheng and Wall 2005:49).

The gravity model specification includes dummy variables which is a proxy for other variables that influence international transaction costs like economic diplomacy. This has been conducted since the study by Tinbergen in 1962. In his study he included ex-colonial ties as one of the explanatory variables in examining foreign trade flow (Moons and van Bergeijk 2011:6).

Despite a significant reduction in barriers to trade, informal barrier like institutional distance exert influence on trade (van Veenstra et al. 2010:5). The gravity equation quantifies variables that influence foreign trade flow (van Veenstra et al. 2010:9).

Many studies like Tinbergen (1982) Linnemann (1966) and others which followed have indicated that flow of trade exhibit the physical principles of gravity or it can be stated that two opposing forces are the main determinant of bilateral trade volume between economies. The bilateral trade volume depends on level of economic activity, income and trade barriers. Trade barriers involves costs of transport, policies of trade, geographical features and cultural differences (LIU 2018:36).

Tinbergen (1962) developed the model basing on Newton’s gravity equation. The model was presented as:

$$G \frac{m_1 m_2}{r^2} \Rightarrow \text{Trade}_{ij} = \alpha \frac{GDP_i GDP_j}{D_{ij}} \dots\dots\dots(1)$$

Transforming the equation in logarithm form to conform with regression analysis it becomes

$$\ln (\text{Trade})= \alpha + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln D_{ij} + \epsilon_{ij} \dots\dots\dots(2)$$

Where,

Trade_{ij} = is the bilateral trade flows (exports and imports) between the countries i and j,
 GDP_{i(j)} is the GDP of country. A huge economy pulls goods from its trading country, also, it pushes more goods to its trading country.

D_{ij} is distance between the countries i and j. it is a proxy for trade costs among trading economies. The gravity model specification involves distance which is a proxy for costs of trade (Snellman 2005:14)

Distance is proxy for different barriers to trade i.e. costs of transport, language barriers that also is associated with distance, cultural, information and sometime with genetic distance. Some of these are accounted for in estimating gravity equations with control variables and others are difficult to recognize in other words are unexplored (Hinz 2017:3).

4.3 Model specification

This paper deploys gravity model introduced by Tinbergen (1962) which is a framework of analyzing bilateral trade flow. It relates exports to GDPs, populations and distances. The estimating model of this study follows the practice favored by other previous studies of using both GDP and population variables of country A and B representing their size, Distance which is a proxy for trade cost. Since, the model has been used in assessing different political and socio-economic factors affecting foreign trade. Also, it follows the practice of augmenting the model by including other variables like colonial relationship, common language and common border from studies like Van Bergeijk and Oldersma (1990), Hamilton and Winters (1992), Keshk et al.(2004), van Bergeijk (2015). Bilateral trade which crosses walls are modelled by dummy variables as in van Bergeijk (2015). Furthermore, political hostility and joint democracy have been included in the model to capture the quality of countries political relationship as suggested by Morrow et al.(1998). Considering all these together and taking into account the linear logarithmic formulation of the gravity model. The augmented gravity equation will be as follows.

$$\ln E_{ijt} = \alpha + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln POP_{it} + \beta_4 \ln POP_{jt} + \beta_5 \ln Dist_{ij} + \beta_6 \text{Comlang}_{ij} + \beta_7 \text{Comborder}_{ij} + \beta_8 W_{ijt} + \beta_9 \text{Evercol}_{ij} + \beta_{10} \text{Hostility}_{ijt} + \beta_{11} \text{Democratic dyad}_{ijt} + \varepsilon_{ijt} \dots\dots\dots(3)$$

where

E_{ijt} = exports of country i to country j in year t

GDP_{it} = GDP of country i in year t

GDP_{jt} = GDP of country j in year t

$Dist_{ij}$ = distance between capitals of country i and j

POP_{it} = population of country i in year t

POP_{jt} = population of country j in year t

W_{it} = dummy variable for wall, 1 if there is border wall between trading countries and 0 otherwise.

Comlang_{ij} is 1 if country i and country j speak the same language, 0 if otherwise;

Comborder_{ij} is 1 if country i and country j share the same border, 0 if otherwise;

Evercol_{ij} is 1 if country i and country j have colonial links, 0 if otherwise

Hostility_{ijt} is 1 if country i and country j are in a negative political interaction in year t , 0 if otherwise

$\text{Democratic dyad}_{ijt}$ is 1 if country i and country j are both democratic in year t , 0 if otherwise

ε_{ijt} = error term.

The gravity equation presented above is estimated with panel data. Many studies like Hamilton and Winters (1992) Erzan et al. (1992) and van Bergeijk (2015) used cross section data. However, there is argument that gravity models which uses cross section data yields results which are unstable. Furthermore, it is argued that panel data have many benefits like showing the relation between variables in a specified period and examining impacts among the trading partners (Ghosh and Yamarik 2004:3).

4.4 Definition of variables

Dependent variable

The export values used in this study as proxy for bilateral trade flows is in British Pound sterling. This is the currency used in the original data source. The original data source contains historical trading data from 1827 to 2014. So, the historic trading values were systematically converted into British Pound sterling for international comparison.

Independent variables

GDP

The GDP used in this paper is in current British pound sterling. As argued by Jošić (2008) GDP measures the economic strength of a country. There are two ways in which the size of GDP determines trade flow: first, it indicates the overall demand of the country and second it shows the diversity of production of a country i.e. import is more needed in a country with more diversified economy compared to a less diversified economy. On the other side a diversified economy has high capability of exporting a wide variety of products (Weckström 2013:5).

Distance

Distance indicates transport costs required to export goods between two trading countries. Larger distance implies high costs of transport and finally can decrease trade flows. Distance variable indicates proximity between main cities of the trading countries in kilometers measured using great circle.

Population

Population influences trade in two ways, that is on demand and supply sides. On the supply side population growth indicates more labor for production of exports. On the other hand, population growth on the demand side implies domestic import demand.

Dummy variables

This study uses some dummy variables, namely:

1. Common language: 1 if two countries share the same language; 0 other wise. Common language indicates if a language is spoken by at least 9 percent of the people in both trading partners. Speaking the same language facilitates trade since it decreases communication costs (Lohmann 2011:159).
2. Common border: 1 if two countries share political boundary; 0 other wise. Countries which are contiguous trade more than those which are non contiguous
3. Ever colonial: 1 If two countries was ever in a colonial relationship; 0 otherwise. Trade is greater between a country and its former colonizer (De Sousa and Lochard 2012:411)
4. Wall: 1 if two countries are separated by wall; 0 other wise. Wall distorts trade between countries.
5. Hostility: 1 if two countries are in a political conflict: 0 other wise. Political conflict affects trade directly when government restricts trade from its neighboring country. It affects indirectly when private actors evaluates the possibility of a dispute to disrupt their commercial activities. Therefore, it becomes risk for them to conduct business (Morrow et al. 1998:651)
6. Democratic dyad: 1 if two countries are both democratic; 0 Other wise. Two countries are considered to be both democratic if they have a polity score of atleast 7. Democratic pairs trade more since economic agents have knowlegde about regulatory institutions in the involved countries (Davis and Meunier 2011:630). Additionally, democratic countries trust each other. For a democratic state its security is at low risk when it trades to its democratic partner than to an autocracy (Bliss and Russett 1998:1128).

Table 4.2: Summary of independent variables

Variable	Definition	Expected sign	Source
Dist _{ij}	Geographical distance between the exporter and importer country	Negative	CEPII, Accessed on 11 th June 2019
GDP _{it}	GDP of exporter country in year t	Positive	CEPII, Accessed on 11 th June 2019
GDP _{jt}	GDP of importer country in year t	Positive	CEPII, Accessed on 11 th June 2019
Pop _{it}	Population of exporter country in year t	Positive	CEPII, Accessed on 11 th June 2019
Pop _{jt}	Population of importer country in year t	Positive	CEPII, Accessed on 11 th June 2019
Wall	Dummy variable to describe whether the trading partners are separated by border wall	Negative	Academic articles like (Vernon and Zimmermann 2019), (Carter, D. B. and Poast 2017) and (Zenderowski and Jankowski 2018)
Comlang	Dummy variable to describe if trading partners share the same language.	Positive	CEPII, Accessed on 11 th June 2019
Comborder	Dummy variable to depict if the trading countries share the same border	Positive	CEPII, Accessed on 11 th June 2019
Evercolo	Dummy variable for a country which has ever colonized by a trading partner	Positive	CEPII, Accessed on 11 th June 2019
Hostility	Dummy variable if two countries are in political hostility (dispute)	Negative	Correlates of War project, accessed on 3 rd October 2019
Democratic dyad	Dummy variable if the two countries are both democratic	Positive	Centre for Systemic Peace, accessed on 22 nd October 2019

4.5 The Issue of Zero Trade Flows

There are some challenges which arise in the logarithmic transformation of the gravity model. One of them is that, logarithmic transformation of the gravity model cannot efficiently handle zero trade flows because the logarithm of zero is not defined. There are three main reasons which lead to occurrence of zero trade flows as follows: Rauch (1999) argues that absence of bilateral trade can be caused by lack of historic and cultural links. Frankel et al. (1997) points out that zero trade flows occur due to absence of bilateral trade between small and distant nations. Also, it is argued that sometimes national statistical offices tend to not report foreign trade flow which fall below certain levels.

The effect of zero trade in logarithmic transformation of gravity equation can result into misleading conclusion. However, disregarding zero trade flow can lead to underestimation of the effect of distance and cultural linkages particularly if zero flows occurs between countries that are at higher distance and there is no share of common language and colonial ties. There are many approaches suggested in addressing this draw back. These are omission of zero flows in the sample however there is concern that it can lead to biased results. “Throwing away zero entries implies that one loses any information contained in these flows on why these low levels of trade are observed” (Linders, Gert-Jan and De Groot 2006:3)

Another proposed alternative is to use Poisson Maximum Likelihood. This yields consistency result in the presence of zeroes (Silva and Teneyro 2006). To remove problems associated with zero trade flow it is suggested to use fixed effects panel Poisson Maximum Likelihood (PML) estimator. The problem associated with zero flows is eliminated since PML does not transform into log (Kabir et al. 2017:66).

Another method is replacing a zero-trade flow with a small constant number in order to estimate the log transformation of the model without leaving country pairs with zero flows (Linders, Gert-Jan and De Groot 2006:4). The studies which used this method includes Linnemann (1966), Van Bergeijk and Oldersma (1990) and Wang and Winters (1992). Based on the alternatives above this study will apply the last alternative, that is using log transformation and replacing zero trade flow with a small constant value of 0.05.

CHAPTER 5: RESULTS AND ANALYSIS

5.1 Descriptive Statistics

The dataset is unbalanced panel with 280,845 observations. Zero trade flows in the dataset are 59,483 which is almost 21% of the dataset and there are 26,794 missing values which accounts for 10%. Generally, the zero and missing values accounts for 31%. Exports is dependent variable and involves two directions (Unidirectional export flow meaning that each line in the dataset represents a single flow). For instance, country A exports to country B are recorded in one line of the dataset and country B exports to country A are recorded in a separate line.

Table 5 1 : Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Exports	254,051	2.55e+08	2.71e+09	0	2.48e+11
GDP_o	270,676	1.82e+11	7.06e+11	8.54e+07	9.68e+12
GDP_d	270,718	1.83e+11	7.06e+11	8.54e+07	9.68e+12
POP_o	280,845	48972.1	154267.7	256.939	1337705
POP_d	280,843	49278.94	154543.7	69.66	1337705
Distance	280,843	6.570.507	3.900.072	8.220.391	19812.22
Comlang	280,843	0.1256681	0.3314755	0	1
Com_border	280,843	0.0287776	0.1671813	0	1
Evercol	280,843	0.0163686	0.1268885	0	1
Wall	280,845	0.0024782	0.0497202	0	1
Hostility	280,845	0.0050669	0.0710014	0	1
Democratic dyad	280,845	0.0476847	0.2130986	0	1

5.2 Correlation test

This study provides a correlation test to detect if there is multicollinearity among the explanatory variables. According to Gujarati (2009) multicollinearity exist when there is perfect linear relationship among regressors in the regression model. Existence of multicollinearity can cause many estimation problems including making large variances of estimators, which finally makes difficult to estimate the model precisely. Because of that, the estimated coefficients tends to be insignificant (Gujarati 2009:327). There are many ways of detecting multicollinearity. However, this study used pair wise correlation. The results are as shown below:

Table 5.2: Correlation results

	lnExports	lnGDP_o	lnGDP_d	lnPOP_o	lnPOP_d	lnDist	Comlang	Com_bord	Evercol	Wall	Hostility	Dem_dy
lnExports	1											
lnGDP_o	0.5096	1										
lnGDP_d	0.4042	-0.0435	1									
lnPOP_o	0.3215	0.6711	-0.0449	1								
lnPOP_d	0.2569	-0.0425	0.6712	-0.0367	1							
lnDist	-0.1547	0.0845	0.0848	0.1179	0.1173	1						
Comlang	0.0642	-0.0370	-0.0368	-0.0175	-0.0180	-0.1816	1					
Com_bord	0.1122	-0.0127	-0.0125	0.0284	0.0282	-0.4054	0.1432	1				
Evercol	0.1302	0.0922	0.0923	0.0577	0.0582	-0.0500	0.1632	0.0817	1			
Wall	0.0292	0.0225	0.0215	0.0241	0.0224	-0.1105	0.0714	0.2226	-0.0017	1		
Hostility	0.0372	0.0253	0.0278	0.0462	0.0470	-0.1086	0.0515	0.2205	0.0560	0.2170	1	
Dem_dy	0.1913	0.1889	0.1923	0.0602	0.0611	-0.0275	-0.0120	0.0082	0.0484	-0.0064	0.0017	1

Based on the test, there is evidence that multicollinearity does not exist, since the correlation coefficient between all variables is below 0.8 which is a minimum required level for multicollinearity to exist.

5.3 Regression Results and Discussions

This section presents the empirical results of the gravity model. In obtaining the empirical results panel data on bilateral trade between 118 countries were used to estimate the gravity model in equation (3) presented in the previous chapter. However, the results of cross section results is presented in appendix 3

Martínez-Zarzoso and Nowak-Lehmann (2003) argue that cross section estimation can not handle time effects and country specific effects. Therefore, it can lead to unstable results. But panel estimation can address this limitation since it gives deep analysis of time specific and country specific effects. Furthermore, Egger (2000) notes that in gravity equation panel analysis has more benefits compared to cross section analysis. First, it captures relationship among variables in a long period and it identifies the influence of business cycle while for cross section to minimize the role of outliers some times data are averaged for a certain period. Therefore, in this study panel estimation is used to analyze data in the period under observation.

5.3.1 Hausman test

To overcome weaknesses associated with cross section estimation, this research conducts panel estimation. According to Gujarati (2009) there are three ways of conducting panel data estimation. These are pooled OLS, random effects and fixed effects. But pooled OLS does not take into account time and space dimension. Thus, it is not consistent with the characteristics of panel data used in this study. Therefore, to determine whether random effect or fixed effect is efficient, Hausman test was conducted. If the null hypothesis holds random effects is more efficient, other wise fixed effects is favored. The results of the test is as follows.

Table 5.3: Hausman test summary

Chi2	Prob>chi2
2407.43	0.0000

Source: Authors calculation, using STATA 15

The results shows that Prob>chi2 is less than 0.05, therefore null hypothesis is rejected, indicating that fixed effects is preferred. The full results of Hausman test is shown below

```
. estimate store re
. hausman fe re
```

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fe	(B) re		
lnGDP_o	.7521982	1.402139	-.6499407	.0217332
lnGDP_d	1.101853	1.230706	-.1288529	.0217073
lnPOP_o	1.66871	.5650037	1.103706	.0855812
lnPOP_d	2.136998	.4560881	1.680909	.0854398
Wall	-.70497	-1.360193	.6552229	.0860434
Hostility	.0508191	-.1130859	.163905	.0151263
Democratic~d	.948617	.9488773	-.0002603	.0897314

b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(7) = (b-B)' [(V_b-V_B)^(-1)] (b-B)
 = 2407.43
 Prob>chi2 = 0.0000

Based on Hausman test this study focused on the results of a fixed effects model. Fixed effects also, gives good insights for variables which vary over time. For variable which are time invariant in panel data estimation since they are being omitted then random effects results will be referred for their interpretation.

Fixed effects in gravity model generate estimates that are consistent with coefficients of standard regression. “However, the FEM cannot estimate the effects of time-invariant drivers of trade flow, such as distance, a common language, common borders, etc” Random effects are not directly estimated but they are estimated depending to their variance and covariances by considering the form of “random intercepts or coefficients”. Random effects accommodates time invariant variables that cannot be handled by fixed effects (Kabir et al. 2017:67).

Another argument in favor of FEM in gravity equation is sample selection. For example, trade between OECD and central and eastern European countries. In this scenario one has no intention in predicting trade between randomly sample of selected countries but between “an ex ante predetermined selection of nations”. He/she would be interested to know how the trade relations between a CEEC and an OECD member country would be if they adapted the “typical relationship” between OECD members (Egger 2000:26)

Results

Although basing on Hausman test fixed effects have been chosen, this study provides estimation results from random effect model for comparison.

The empirical results of the gravity model using panel data estimation measuring the impact of border walls on foreign trade flow is presented in table below:

Table 5.4: Panel regression results

VARIABLES	FE Model 0 lnExports	FE Model 1 lnExports	FE Model 2 lnExports	FE Model 3 lnExports	FE Model 4 lnExports	RE lnExports
lnGDP_o	0.760*** (0.0275)	0.761*** (0.0275)	0.761*** (0.0275)	0.752*** (0.0275)	0.752*** (0.0275)	1.402*** (0.0168)
lnGDP_d	1.111*** (0.0274)	1.111*** (0.0274)	1.111*** (0.0274)	1.102*** (0.0275)	1.102*** (0.0275)	1.231*** (0.0168)
lnPOP_o	1.641*** (0.0906)	1.644*** (0.0906)	1.644*** (0.0906)	1.669*** (0.0907)	1.669*** (0.0907)	0.565*** (0.0301)
lnPOP_d	2.107*** (0.0905)	2.109*** (0.0905)	2.109*** (0.0905)	2.137*** (0.0906)	2.137*** (0.0906)	0.456*** (0.0301)
lnDistance	-	-	-	-	-	-2.336*** (0.0570)
Comlang	-	-	-	-	-	1.186*** (0.122)
Com_border	-	-	-	-	-	0.725*** (0.256)
Evercol	-	-	-	-	-	2.034*** (0.308)
Wall		-0.707** (0.311)	-0.708** (0.311)	-0.705** (0.311)	-0.705** (0.311)	-1.360*** (0.298)
Hostility			0.0498 (0.146)		0.0508 (0.146)	-0.113 (0.145)
Democratic_dyad				0.949*** (0.146)	0.949*** (0.146)	0.949*** (0.116)
Constant	-69.19*** (0.706)	-69.25*** (0.707)	-69.26*** (0.707)	-69.39*** (0.707)	-69.39*** (0.707)	-41.78*** (0.582)
Observations	237,146	237,146	237,146	237,146	237,146	237,146
No. of country pairs	12,948	12,948	12,948	12,948	12,948	12,948
R-squared	0.095	0.095	0.095	0.095	0.095	0.092
Adjusted R-squared	0.095	0.095	0.095	0.095	0.095	0.092

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.5 above shows results of different specification of fixed effects models i.e. column I to V, and column VI is a random effect estimation. Based on this study the interpretation was based on model 4 since it contained all variables. Other models were used for comparison.

5.3.2 The Impact of GDP, Population, Distance, Common Language, Common Border and Colonial Link

The results for distance variable can be obtained in the random effects model results in column VI because it has been omitted in the fixed effects model since it is time invariant. The distance coefficient is significant for all years, its magnitude of coefficient was -2.2336

implies a 1 percentage increase in distance leads to a decrease in exports by 2.2336 percent variables being constant. This confirms the argument that despite the fast growth in world trade and much debate about “death of distance” many studies have found that the impact of distance on trade flow is still persistent. Distance matters despite fall in costs of transportation and communication. Due to fall in transport and communication costs it has been proven that intangible barriers to trade persist and are significant in determining resistance to trade (Möhlmann et al. 2009:2).

The effect of distance is constant even after advancement in transport and communication technologies. There are contrasting results about the impact of distance on trade over time. There are several reasons given, some argue that improvement in infrastructure leads to decline in distance effect. Proponents of non-decreasing effect of distance argue that this occurs since trade have increased at shorter distances in comparison with that at longer distance. The other explanation given is that of changes in distance among industries. There are two reasons for this, first, products have become more substitutable in some industries and second, there is changes in costs of trade (Magerman et al. 2016:3).

The GDP for origin and exporting country exerts positive influence on exports, implying that the larger the GDP the higher the ability to export for the exporter country, and for the importer country the higher the ability to import. The coefficient of 0.752 of the origin countries means a 1 percent increase in GDP of exporting country will lead to 0.752 percent increase in exports other variables being constant. The coefficient of 1.102 for the destination country implies a 1 percent increase in GDP of a receiving nation results in 1.102 percent increase in exports other variables held constant. The results are in line with economic theories and study expectation. Meaning that rich countries trade more.

The coefficient estimates for population have positive signs for both origin and destination and are consistency with the expected signs. This is in line with the argument that population in the gravity model is a proxy for market size for the importing country and labour supply for the exporting country and exerts positive influence on exports.

Language as per this study can be obtained from random effects results, the estimated coefficient is positive and statistically significant, implying that common language enhances trade. Language facilitates easy and transparent transaction. Individuals speaking the same language can communicate and trade easily (Fidrmuc and Fidrmuc (2014:2). Common language facilitates foreign trade through direct communication together with translation (Melitz 2008:668). Without efficient communication, trade will be ineffective particularly in violation of contract enforcement because of misinterpretation (Melitz and Toubal 2014).

The estimated coefficient for common border has positive sign confirming the idea that neighboring countries trade more compared to distant countries. This conforms to the distance variable which has a negative sign indicating that if countries are a further apart trade less. Distance have influence on international trade. Therefore, it is suggested to trade with nearby countries since it is much cheaper. The large the distance between trading partners the higher the transport costs (Paas 2000:25). Sanidas (2018) argue that nations which share border have high chance of exporting to each other. Neighbors offers immediate market for goods and services mainly depending on their population and level of development. For every nation, neighbors are key drivers in determining their exports.

Role of economic geography matters for trade in countries sharing borders and there is empirical evidence in support of this argument.

For colonial history, the coefficient has expected positive sign and statistically significant. This finding confirms the argument by Mayer (2008) who points out that past colonial relationship leads to current higher bilateral trade levels.

5.3.3 The impact of Political Hostility and Joint Democracy

Joint democracy have expected positive significant impact on trade. Democratic countries trade more by 158% than if one or both trading partners are not democratic³. The results are consistent with literature which advocate that democratic partners trade more. The results corresponds to the findings by Bliss and Russett (1998) they find a significant effect of democracy in promoting bilateral trade. It also confirms the idea that democratic states are associated with good institutions which tend to protect consumer quality and regulates products quality which finally increase trust among them and hence trade more (Yu 2010:291)

Unexpectedly political hostility have a positive sign but is insignificant. Implying that unfavorable political relationship does not play any role in the bilateral trade between countries in the studied sample. Therefore, this finding may partly confirm a claim that political conflict is not a main reason for building border walls in the post cold war era. Furthermore, it is argued that militarized dispute can have little effect on trade due to adjustment made in commercial activities by private actor agents before real conflict occurs as a response to deteriorating political relationship (Davis and Meunier 2011:630). Furthermore, Davis and Meunier (2011) argue that there are reasons which can lead a political conflict to not cause significant negative impact on trade in this era of globalization. First, the advancement of global economy with less barriers to trade has limited the ability of countries to determine trade to meet their national objectives; second, Because liberalization has widespread in the world, few countries are ready to implement trade policies which are politically motivated as a response to dispute; third, firms which engage in foreign trade after they establish a base in a particular foreign market they do not change abruptly their pattern of trade even if there is conflict.

5.3.4 The Impact of Physical Wall on Trade

The main variable of interest was to investigate the impact of physical walls and on bilateral trade between neighboring countries. Considering the series of models in table 5.3. Starting with model 0 which is a base model with no border barrier. Model 1 contains physical border wall and other control variables like GDP and population. It shows a negative significant relationship between wall and bilateral trade flow. In model 2 up to model 4 control variables that indicate country's political relationship which sometimes are associated with erecting a wall were added to model 1. After adding political hostility i.e model 2 the coefficient for wall variable slightly increased from -0.707 to -0.708. Adding democracy it slightly decreased to -0.705, and finally adding both democracy and political hostility i.e. model 4 which is our model of interest for interpretation it remained -0.705.

³ Elasticity for trade= $e^{0.949}-1$

Therefore, we can conclude from regression results that physical border walls exerts significant negative influence on trade. The relationship is significant at 5%. The results show that countries separated by walls trade less by 51 percent compared to those not separated by wall. This result corresponds to previous findings by van Bergeijk (2015), Van Bergeijk and Oldersma (1990) and Carter and Poast (2019) on impact of walls.

5.4 Other Consequences of Walls

The costs of erecting walls are very high in terms of economic and social costs, at the same time its benefits to the economy and protection are not clear (Deeds and Whiteford 2017:28). They have no benefit since historically it have shown that these wall are inefficient. For example, Chinese wall and Berlin wall. Chinese wall failed to inhibit nomadic barbarians from encroaching Chinese agricultural land and the Berlin Wall did not prevent East Germans from leaving their country (Langerbein 2009:23)

Economic costs

Walls increase costs of transport through increase in waiting time at the border, perishable products like fruits and vegetables are at risk, consumer welfare is reduced since they are paying higher prices for reduced selection of products. Moreover, apart from impacting trade, border walls affect tourism and value of properties. Tourism is decreased because of rise in crime rates like murder, human trafficking and kidnapping. This also causes property values to decrease (Carter, C. L. 2013:11).

Walls are expensive to construct for example it is estimated that the US-Mexico border wall cost per mile ranges from USD 3.9 million to USD 16 million depending on the design of wall, land cost and terrain (Deeds and Whiteford 2017:26)

Environment

International boundaries crosses in areas with different species. Construction of border wall disrupts the ecosystem in borderlands by destructing plants and disturbing flow of animals (Carter, C. L. 2013:12)

Cultural

The construction of border wall separates people who lives near the border who share their racial and cultural relationship. This action decreases the welfare of citizens living along the border (Carter, C. L. 2013:13). The local people living near the border are being impacted too since their survival depends on the environment (Eriksson and Taylor 2008:9).

Generally, the benefits of wall are unclear, many studies suggest that they bring more costs than benefits. This suggest that their anticipated goals are not achieved.

5.5 Effectiveness of Walls

The evidence that walls controls smuggling and terrorist is very little. Even when they are effective, the construction costs should be compared to the outcomes they attain, considering other policy options in controlling them (Vernon and Zimmermann 2019:13). Fore the case of smuggling a study by Getmansky et al. (2019) on border walls and smuggling for the case of Israel fence in the West Bank find that border wall displaced

smuggling activities to other sections of the border not fortified by a wall despite the rise in smuggling costs.

For illegal immigration, inequality is mentioned to be the driving factor. Wealthier nations are building walls against their poorer neighbor counterparts. It is estimated by Jones (2012) that the average Gross Domestic Product (GDP) of a country constructed a border barrier for the period 2000 to 2011 was around 5 times more than the GDP of a neighboring country. Further more, Carter and Poast (2017), find evidence that inequality have impact in the presence of border wall. Thus, it has been suggested to solve poverty and inequality problems in developing countries to control migration. Although this can be achieved in the long term. Massey et al.(2016) find that despite the increase in securitization of the US and Mexico the number of illegal migrants increased.

It is argued that modern walls like ancient walls they can partially achieve their goals. Walls have never been efficient. There is no wall or fence can prevent terrorism committed by legal residents, no barrier can stop migrants who travel through sea and also, a border wall can not reduce drug while large amount of it is crossing through legal check points (Vernon and Zimmermann 2019:17, Szabó 2018:86).

Therefore, policies which facilitate more open borders is suggested since they would raise the welfare of the people in the world compared with erecting walls. In addressing illegal trade, economic policies are more efficient than building walls and for the case of territorial disputes diplomacy is an effective tool in dealing with it rather than a wall (Vernon and Zimmermann 2019:17). Generally, illicit flows are complicated, they can not be prevented with physical walls that do not focus on source of their problems.

In sum, there is general consensus in the literature that walls are inefficient in performing their intended roles. As argued by Zenderowski and Jankowski (2018) walls appears to perform more psychological function than physical role. They do not physically protect borders, instead they provide feeling of safety and comfort to the society.

CHAPTER 6: CONCLUSION AND POLICY IMPLICATION

The main focus of this study has been to investigate the impact of border walls on bilateral trade flow. After the fall of Berlin Wall in 1989 it was believed to be the end for countries to implement policies of building walls. Many people envisioned a global village where goods and people will move freely. But contrary to the expectation of many, we are witnessing a high increase in number of border walls being built by different nations. Relying on bilateral trade panel data and using gravity equation, the study examined the determinants of trade which are important in estimating the effect of walls on trade.

Based on the analysis, the results suggest that border walls have significant and negative impacts on international trade flow. Countries with physical border walls trade 51 percent lower than those not separated by wall. These findings identifies that border walls does not necessarily prevent illicit goods and illegal migration but it has implication on bilateral trade between neighboring countries. The results help to understand the unintended consequences of the policy of erecting walls that can bring to other sectors of the economy. These results are contrary to the popular idea that border walls are being built to prevent illicit trade, illegal migration and terrorism. So, they have implication on the current public policy debate of border securitization which focus on direct costs of constructing wall and ignore the indirect costs they bring.

This negative impact is consistent with the literature which suggest that physical border walls trumps border effects which finally reduces trade. Furthermore, given that this study took a different route by considering many walls and cross country evidence by utilizing large data set in a post cold era, its findings are consistent with other studies like Bergeijk (2015), Van Bergeijk and Oldersma (1990) and Carter and Poast (2019).

The empirical findings of this study show that the policy of erecting walls leads to unintended consequence of inhibiting trade. The justification for this argument according to literature, it suggests for the need to have good management border policies other than walls. Additionally it suggests countries to seek other alternative policies to deal with border challenges. Example of these policies is the hypothetical policy proposed by Allen et al. (2018) which state that if US and Mexico both engaged in a policy of reducing trade costs by 25% so that the effect of distance on foreign trade can be equal to that of domestic trade, it could have lead to decrease in illegal migration and increase in welfare for all workers in both countries.

The policy of erecting walls seems not to meet the targeted goals. Given the limitations of this research like limited in recent data and the possibility for trade between countries to not depend on land border, in which goods are may be transported through sea or air, these results do not make the generalization of the results but it provides new insights on border walls in a cross country context in the post cold war era. For clear understanding of the implications of these findings future research is needed which can utilize more recent data and cover many countries which have recently erected walls. Additionally, future research is needed for a case study of two countries by considering data for along period of time.

Despite of what has been reported to be the benefits of walls in the current policy debate, these walls in practice have large unintended consequences including reducing trade as this study shows. In practice they have not been efficient in accomplishing their objectives and their benefits are doubtful.

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Appendices

Appendix 1: List of walls up to 2019

No.	Country constructed	Country/area separated	Year constructed
1.	Cuba	US (Guantanamo)	1961
2.	Hong Kong	China	1962
3.	Israel	Syria	1973
4.	Cyprus	Cyprus Northern	1974
5.	South Africa	Mozambique	1975
6.	Israel	Lebanon	1976
7.	North Korea	South Korea	1977
8.	Thailand	Malaysia	1978
9.	Morocco	Western Sahara	1980
10.	South Africa	Zimbabwe	1984
11.	India	Pakistan	1988
12.	Thailand	Cambodia	1987
13.	Israel	Jordan	1981
14.	United States	Mexico	1993
15.	India	Bangladesh	1994
16.	Kuwait	Iraq	1994
17.	Uzbekistan	Afghanistan	1994
18.	Spain	Morocco-Ceuta	1995
19.	Spain	Morocco-Melilla	1998
20.	Egypt	Gaza Strip	1994
21.	Uzbekistan	Kyrgyzstan	1999
22.	Turkmenistan	Uzbekistan	2001
23.	Israel	West Bank	2002
24.	Botswana	Zimbabwe	2003
25.	Iran	Afghanistan	2003
26.	Saudi Arabia	Yemen	2003
27.	India	Myanmar	2004
28.	Lithuania	Belarus	2004
29.	Brunei	Malaysia	2005
30.	Arab Emirates	Oman	2005
31.	Arab Emirates	Saudi Arabia	2005

32.	Kazakhstan	Uzbekistan	2006
33.	Saudi Arabia	Iraq	2006
34.	China	North Korea	2006
35.	Iran	Iraq	2007
36.	Iran	Pakistan	2007
37.	Jordan	Iraq	2008
38.	Jordan	Syria	2008
39.	Russia	Georgia	2008
40.	Myanmar	Bangladesh	2009
41.	Saudi Arabia	Qatar	2009
42.	Saudi Arabia	Oman	2009
43.	Israel	Egypt	2010
44.	Kazakhstan	Kyrgyzstan	2010
45.	Greece	Turkey	2012
46.	Bulgaria	Turkey	2013
47.	Algeria	Morocco	2014
48.	Oman	Yemen	2014
49.	Turkey	Syria	2014
50.	Turkmenistan	Afghanistan	2014
51.	Austria	Slovenia	2015
52.	Azerbaijan	Armenia	2015
53.	Hungary	Serbia	2015
54.	Kyrgyzstan	Kazakhstan	2015
55.	Kyrgyzstan	Uzbekistan	2015
56.	Latvia	Russia	2015
57.	Macedonia	Greece	2015
58.	Morocco	Algeria	2015
59.	Slovenia	Croatia	2015
60.	Ukraine	Russia	2015
61.	United Kingdom	France	2015
62.	Norway	Russia	2016
63.	Tunisia	Libya	2016
64.	Estonia	Russia	2017
65.	Lithuania	Russia	2017
66.	Turkey	Iran	2017
67.	Iraq	Syria	2018

	Planned		
68.	Algeria	Libya	
69.	Hungary	Romania	
70.	India	Bhutan	
71.	Latvia	Belarus	
72.	Malaysia	Brunei	
73.	Malaysia	Indonesia	
74.	Poland	Belarus	
75.	Poland	Ukraine	
76.	Russia	Ukraine	
77.	Turkey	Iraq	

Source: Authors description based on Vernon and Zimmermann 2019:24-25, Carter and Poast 2017:249-250 and Zenderowski and Jankowski 2018:107

Appendix 2: Walls included in the dataset for analysis

1.	Cuba	US (Guantanamo)	1961
2.	Israel	Syria	1973
3.	Israel	Lebanon	1976
4.	North Korea	South Korea	1977
5.	Thailand	Malaysia	1978
6.	South Africa	Zimbabwe	1984
7.	India	Pakistan	1988
8.	Thailand	Cambodia	1987
9.	Israel	Jordan	1981
10.	United States	Mexico	1993
11.	India	Bangladesh	1994
12.	Kuwait	Iraq	1994
13.	Uzbekistan	Afghanistan	1994
14.	Spain	Morocco-Ceuta	1995
15.	Spain	Morocco-Melilla	1998
16.	Uzbekistan	Kyrgyzstan	1999
17.	Turkmenistan	Uzbekistan	2001
18.	Botswana	Zimbabwe	2003
19.	Iran	Afghanistan	2003
20.	Saudi Arabia	Yemen	2003
21.	India	Myanmar	2004
22.	Lithuania	Belarus	2004
23.	Brunei	Malaysia	2005
24.	Arab Emirates	Oman	2005
25.	Arab Emirates	Saudi Arabia	2005
26.	Kazakhstan	Uzbekistan	2006
27.	Saudi Arabia	Iraq	2006
28.	China	North Korea	2006
29.	Iran	Iraq	2007
30.	Iran	Pakistan	2007
31.	Jordan	Iraq	2008
32.	Jordan	Syria	2008
33.	Russia	Georgia	2008
34.	Myanmar	Bangladesh	2009
35.	Saudi Arabia	Qatar	2009

36.	Saudi Arabia	Oman	2009
37.	Israel	Egypt	2010
38.	Kazakhstan	Kyrgyzstan	2010

Source: Authors description based on Vernon and Zimmermann 2019:24-25, Carter and Poast 2017:249-250 and Zenderowski and Jankowski 2018:107

Appendix 3: Cross section regression results

VARIABLES	(1991) lnExports	(1994) lnExports	(1997) lnExports	(2000) lnExports	(2003) lnExports	(2006) lnExports	(2010) lnExports
lnGDP_o	2.360*** (0.0440)	2.122*** (0.0385)	2.039*** (0.0345)	2.030*** (0.0322)	2.074*** (0.0301)	2.089*** (0.0310)	2.290*** (0.0344)
lnGDP_d	2.006*** (0.0440)	1.819*** (0.0385)	1.750*** (0.0345)	1.692*** (0.0322)	1.718*** (0.0301)	1.629*** (0.0310)	1.633*** (0.0344)
lnPOP_o	-0.148** (0.0595)	-0.0166 (0.0540)	-0.0158 (0.0469)	0.0345 (0.0440)	-0.00720 (0.0409)	-0.0675 (0.0419)	-0.360*** (0.0457)
lnPOP_d	-0.326*** (0.0593)	-0.0731 (0.0540)	-0.0781* (0.0469)	0.104** (0.0440)	-0.0259 (0.0410)	0.119*** (0.0419)	0.0850* (0.0457)
lnDistance	-2.216*** (0.100)	-2.581*** (0.0887)	-2.549*** (0.0757)	-2.380*** (0.0726)	-2.219*** (0.0687)	-2.085*** (0.0699)	-2.235*** (0.0735)
Comlang	1.567*** (0.185)	1.690*** (0.176)	1.077*** (0.159)	0.889*** (0.152)	1.122*** (0.145)	1.475*** (0.147)	1.383*** (0.154)
Com_border	2.509*** (0.431)	1.988*** (0.392)	1.617*** (0.348)	1.449*** (0.336)	1.835*** (0.317)	1.722*** (0.329)	1.660*** (0.345)
Evercol	1.603*** (0.476)	1.483*** (0.443)	1.129*** (0.404)	0.937** (0.392)	0.432 (0.372)	0.216 (0.378)	0.496 (0.394)
Wall	-10.08*** (1.915)	-6.875*** (1.745)	-5.889*** (1.576)	-2.858** (1.414)	-2.028* (1.085)	-3.418*** (0.893)	-3.020*** (0.833)
Hostility	-5.170*** (0.828)	-2.613*** (0.868)	-2.027** (0.876)	-1.152 (0.965)	-3.444*** (0.689)	-2.149** (0.879)	-4.099*** (1.109)
Democratic_dyad	-0.848*** (0.318)	-0.720** (0.310)	-0.450* (0.250)	-0.462* (0.239)	-0.836*** (0.214)	-0.346 (0.216)	-0.00758 (0.223)
Constant	-68.99*** (1.353)	-59.77*** (1.182)	-55.69*** (1.045)	-57.85*** (0.987)	-59.26*** (0.951)	-60.29*** (0.988)	-62.54*** (1.077)
Observations	8,568	9,968	11,444	12,002	12,201	12,397	11,982
R-squared	0.504	0.487	0.499	0.527	0.543	0.522	0.509
Adj R-squared	0.503	0.487	0.498	0.527	0.543	0.521	0.508

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1