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Journal homepage: [www.publishing.globalcsrc.org/reads](http://www.publishing.globalcsrc.org/reads)**What Determines Bilateral Trade Flows? Evidence from ECO Region**<sup>1</sup>Muhammad Ramzan Sheikh, <sup>2</sup>Ruth Kattumuri, <sup>3</sup>Imran Sharif Chaudhry, <sup>4</sup>Abodh Kumar<sup>1</sup>Associate Professor, School of Economics, Bahauddin Zakariya University, Multan Pakistan, ramzansheikh@bzu.edu.pk<sup>2</sup>Distinguished Policy Fellow, London School of Economics and Political Science, UK, r.kattumuri@lse.ac.uk<sup>3</sup>Professor, School of Economics, Bahauddin Zakariya University, Multan Pakistan, imran@bzu.edu.pk<sup>4</sup>Assistant Professor, Centre for Economic Studies & Policies, Central University of South Bihar, India, Post doctorate Research Fellow, STICERD-IO, London School of Economics and Political Science, UK., abodhkumar@gmail.com**ARTICLE DETAILS****History***Revised format: February 2019**Available Online: March 2019***Keywords***Gravity Model, Trade, ECO Region, Panel Data***JEL Classification:**

F12, C23

**ABSTRACT**

This study provides an analysis of Pakistan's bilateral trade in Economic Corporation Organization (ECO) region. The main purpose of this study is to assess the determinants of bilateral trade flows using the gravity trade model. Panel least square regression has been applied over the period of 1995 to 2015. Two types of gravity models have been estimated: traditional gravity trade model and modified gravity trade model. The study has identified income, population, distance, adjacency, area, landlockedness, continent and terrorism as the main drivers of Pakistan's bilateral trade flows with ECO countries. It is suggested that policies in Pakistan should focus on improving economic growth; offer incentives to Pakistani people to engage more in trade flows; improve transportation to trade with ECO countries; and take measures to eradicate terrorism.

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The notion of international trade has gained copious importance in international economics literature because of the mutual interdependence of economies. Over the years, international trade has provided gains to the nations including sustainable economic development, foreign exchange earnings, employment opportunities via private and public sector development, broadening the production and fiscal base, and uplifting the status of the poor across the globe although many people are still below the poverty line and facing income inequalities (Krueger, 1900; Bhagwati & Srinivasan, 2002; Vijayasri, 2013). Thus international trade is at a crossroads in the changing geopolitical scenario because new challenges and opportunities are emerging which are fortifying thinkers to craft policies in line with the new business models and societal outlooks.

In the modern world, it would be difficult to find any closed economy as mutuality among the countries has compelled them to remain open economies although of different degrees. Self-sufficiency may be a target for the economies but it would be a difficult task to be achieved under the circumstances. The concepts of multilateralism

and regionalism<sup>1</sup> have widespread in the past few decades. Regional trading blocs through regional integration agreements<sup>2</sup> turn out to be alpha and omega of the global trading system. Many countries apart from the any stage of economic development are ensuing regional integration agreements (Kahouli & Maktouf, 2013). The preferential trading blocks in their structure differ to the great extent but they have a common objective of encouraging the trade through minimizing the trade restrictions within the countries. Many regional agreements prioritize to implement the policies regarding tariff and non-tariff restrictions in intra-regional trade (Baldwin, 1979).

One of many regional associations around the globe is Economic Corporation Organization (ECO). ECO comprises of ten member countries including Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkey, Turkmenistan and Uzbekistan. The trade patterns in ECO are fairly different from the other regional associations. It maintains weak intra-regional trade connections being the least integrated organization in the World. Bilateral trade flows have remained at low levels but intra-regional trade potential exists in the ECO countries. A study by PIDE (2011) suggests that with the implementation of potential free trade area (FTA) agreement, the volume of trade would be fast-tracked by a factor of eight in these countries.

Nature has blessed gigantic natural resources to the ECO countries. It is a diverse region related to the Central, the South and the West Asian Muslim predominated nations connected with Mediterranean Sea and Arabia Sea. As a trade bloc, the central Asian states of ECO are connected with Mediterranean Sea via Turkey, Persian Gulf through Iran and Arabian Sea via Pakistan. ECO by its inception is line up on trade and investment linkages among its members by doing bilateral agreements and negotiation. In ECO Economic Review, 2017, it has been admitted that intra-regional trade and investment of ECO countries have been lower than the ASEAN and NAFTA countries due to the non-execution of ECO Trade Agreement (ECOTA) and weak physical infrastructure linkages among the member nations.

This is also a reality that ECO countries individually are the member of many Regional Trade Agreements (RTAs). Afghanistan is the signatory of South Asian Free Trade Agreement (SAFTA) focusing on goods only. Besides, Afghanistan has Partial Scope Agreement (PSA) with India. In case of Azerbaijan, it is member of GUAM having FTA and EIA<sup>3</sup> agreements regarding goods and services. Azerbaijan has contracted bilateral FTA regarding goods with Russian Federation, Ukraine and Georgia. Moreover, it is also the member of Commonwealth of Independent States (CIS) comprising Azerbaijan, Georgia, Turkmenistan and Uzbekistan which have FTA with respect to goods. Iran being the member of Global System of Trade Preferences among Developing Countries (GSTP) has PSA regarding goods. Kazakhstan has bilateral free trade agreements with Armenia, Georgia, Kyrgyzstan and Ukraine. Additionally, it is also the member of preferential trading blocs of Eurasian Economic Union (EAEU), CIS and Common Economic Zone (CEZ). A custom union exists among the Russian Federation, Belarus and Kazakhstan.

Kyrgyzstan has bilateral FTA with Armenia, Kazakhstan, Moldova, Ukraine and Uzbekistan. It is the member of custom union and has economic integration agreement with Eurasian Economic Union (EAEU) and FTA with CIS. Pakistan has various bilateral FTA, EIA and PSA with China, Malaysia, Mauritius and Sri Lanka. It is also the member of SAFTA. Moreover, Pakistan has PSA of South Asian Preferential Trade Arrangement (SAPTA) Global System of Trade Preferences among Developing Countries (GSTP) and Protocol on Trade Negotiations (PTN). Tajikistan has FTA with CIS along with bilateral FTA with Ukraine. Turkey has a broad strand of bilateral FTA with Malaysia, Moldova, Mauritius, Korea, Jordan, Chile, Serbia, Montenegro, Georgia, Albania, Egypt, Syria, Morocco, Palestinian Authority, Tunisia, Bosnia and Herzegovina, The Former Yugoslav Republic of Macedonia and Israel. Further, Turkey has FTA with European Union and EFTA. A PSA also exists between Turkey and PTN.

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<sup>1</sup> The slogan of trade liberalization is followed by many countries after in the end of World War-II. To achieve this objective, General Agreement on Tariffs and Trade (GATT) and its descendant World Trade Organization (WTO) has been established. The number of countries from the journey of GATT to WTO has varied from less than 50 countries from start to 164 countries in 2016. If GATT and WTO force all the member countries to minimize trade restrictions at the same time, this approach is called multilateralism. Alternatively, Regionalism is an alternative approach of trade liberalization to formulate the Preferential Trade Arrangements (PTAs) sometimes based on geographical contiguity.

<sup>2</sup> It is indispensable for every member country of the GATT or WTO to notify its involvement in Regional Trade Agreements (RTAs). According to WTO statistics, GATT got 124 notifications of RTAs over the period of 1948-1994 whereas WTO had notified about 455 RTAs while the status of 284 RTAs was in force till January 2018 (WTO Secretariat).

<sup>3</sup>Economic Integration Agreement

Turkmenistan has bilateral FTA with Armenia, Georgia, Russian Federation and Ukraine. It is also the signatory of FTA of CIS. Uzbekistan has little bilateral FTA including Kyrgyz, Russian Federation and Ukraine along with the member of FTA of CIS.

The wonders of regionalism have become eminent due to high growth achievements of economic blocs and groups that have spellbound the governments and common people globally. There are many benefits of economic integration that the ECO countries may accrue including efficient resources allocation, access to markets, variety and quality of product, technological development, innovation, returns to scale, trade creation, foreign investment, trade policy reforms, healthy competition, regional security and reduction the risk of conflict etc. Moreover, ECO region is a strong case for endorsing regionalism for economic cooperation and growth due to geographical proximity, same cultural and social values and religion. Nevertheless, some researchers consider these blocks discriminatory and ask the question about its future. Some observers are of the view that regionalism would be the elementary unit of global liberalization in upcoming days (PIDE, 2011).

Based on these reasons, it is imperative to probe the determinants of trade of ECO countries focusing more on the role of terrorism, geographical location and distances. These countries are following the bilateral cooperation and negotiation between each other. This study uses the gravity trade model to investigate the bilateral trends and patterns of trade of ECO countries. In fact, when we are studying the factors determining trade in any region, the main question arises is why the regionalism exists in any region and is there some other factors also present other than geographic location to affect the trade flows between the member countries. These types of studies are important to devise trade policies and reviewing the international linkages. The standard framework to examine the bilateral trade flows is gravity model and various studies have used this approach to study the trade flows. The literature review has suggested that many studies have investigated only the trade pattern of developed countries. To the best of our knowledge, there is no study on ECO bilateral trade flows in the existing literature except one. Therefore, we are intending to explore this area of interest further.

This study is based on the analysis to explore the factors that determine the patterns of bilateral trade flows between the ECO countries. The analysis concentrates the importance of terrorism in determining trading flows. To encapsulate the geographical and cultural proximity effects, a set of dummy variables are also included in the gravity model. The rest of the study is structured as follows: Section 2 provides the theoretical underpinning of gravity model while section 3 surveys the empirical studies on the determinants of trade. Section 4 explains the model specification and section 5 discusses the data and methodology. Section 6 contains an empirical study of the gravity trade model starting by traditional gravity model with modified gravity model. Finally, Section 7 concludes the study along with policy implications.

## 2. Gravity Model: Theoretical Underpinning

Many social sciences including economics often use the laws of natural sciences due to their solid scientific intuition<sup>4</sup> and robust results in the empirical studies. The gravity model has also been borrowed from physics. In 1687, Isaac Newton gave the law of Universal Gravitation that is stated as:

“two bodies or objects are subjected to an attraction force, depending positively on the product of their masses and negatively on the square of their distance”

In equation form, it can be written as:

$$f_{ij} = g \frac{m_i m_j}{d_{ij}^2} \quad (1)$$

Where:

$f_{ij}$  = Gravitational or attractive force

$g$  = Gravitational constant

$m_i m_j$  = Two masses

<sup>4</sup>Examples include epidemic theory in mathematics, prey-predator model in growth cycles, management strategy etc.

$d_{ij}$  = Distance between two masses

The studies by Tinbergen (1962) and Poyhonen (1963) are the seminal and pioneer studies that have used the Newton's law of Universal Gravitation to explain the foreign trade flows between the two nations. After that, the gravity model has been utilized to interpret many economic situations and behaviors such as remittances, migration, bilateral investment and trade flows, buyers' flow to shopping centers, flow of patients to hospitals, commuting and recreational traffic.

Following gravity equation has been used by Tinbergen (1962) and Poyhonen (1963) to predict the value of trade:

$$T_{ij} = g \frac{y_i y_j}{d_{ij}} \quad (2)$$

Where:

$T_{ij}$  = Value of trade between country i and country j

$g$  = Gravitational constant

$y_i$  = GDP of country i

$y_j$  = GDP of country j

$d_{ij}$  = Distance between country i and country j

To be precise, other things being equal, the value of trade between any two countries is proportional to the product of the two countries' GDPs and diminishes with the geographic distance between the two countries (reference?). Tinbergen (1962) and Poyhonen (1963) infer that all the above variables between trading partners are found statistically significant with expected signs.

The gravity model or equation observes the factors that may affect the magnitude or level of bilateral trade in any region. It is a simple model with high statistical power. Some researchers are of the view that in this model there is no strenuous derivation involved based on economic theory. Linnemann (1966) applied the gravity equation in Walrasian general equilibrium model. The study assumes that every country has its own demand and supply function for all commodities. The variable of aggregate income exhibits the demand side in an importing country while it shows supply side in an exporting country. The element of transport costs is captured by the variable of distance which determines a wedge between demand and supply. Linnemann (1966) pointed out that bilateral trade flows between the two countries are based on three main factors:

- i. Potential supply conditions at the origin (exporting country)
- ii. Potential demand conditions at the destination (importing country)
- iii. Restraining or stimulating forces between the two countries relating to the specific flows

Regarding potential foreign supply, Linnemann identified two factors i.e. its own national income and the ratio between production for domestic market (PDM) to production for domestic market (PFM). The production ratio (PDM/PFM) is determined by population size of that country. Linnemann elucidated that potential foreign supply and potential foreign demand are counterpart of each other and therefore determined by the same forces of national income, population and per-capita income. Moreover, trade restraining factors are grouped in two categories, namely, Natural Trade Resistance (NTR) and Artificial Trade Resistance (ATR).

To conclude, Linnemann assembled three factors, namely, potential demand and supply factors (national income, population size and per-capita income) and the trade resistance factors (geographical distance and preferential trade) into one equation to explicate the bilateral trade flow.

$$T_{ij} = \lambda \frac{(S_i^p)^\alpha (D_i^p)^\beta}{(R_{ij})^\delta} \quad (3)$$

Where:

$T_{ij}$  = Value of trade between country i and country j

$S_p$  = Potential supply

$D_p$  = Potential demand

$R$  = Trade resistance.

The value of trade between country *i* and country *j* ( $T_{ij}$ ) would depend on potential supply ( $S_p$ ), potential demand ( $D_p$ ) and trade resistance ( $R$ ).

Potential supply is:

$$S_i^p = \phi_0 NI^{\alpha_1} POP^{\alpha_2} PCI^{\alpha_3} \quad (4)$$

Since  $PCI = NI/POP$ , therefore there is no need to introduce per-capita income as an individual variable. So the potential supply equation becomes:

$$S_i^p = \phi_0' NI^{\alpha_1'} POP^{\alpha_2'} \quad (5)$$

In the same way, we can write the potential demand equation as:

$$D_i^p = \phi_1' NI^{\alpha_3'} POP^{\alpha_4'} \quad (6)$$

Linnemann considers the equality between potential supply and potential demand i.e.  $\phi_0' = \phi_1'$ ,  $\alpha_1' = \alpha_3'$ ,  $\alpha_2' = \alpha_4'$ . For equilibrium situation, this condition must hold in the long run but disequilibrium may exist in the short run creating the inequality among the components of demand and supply.

After plugging in the trade resistance factor ( $R$ ) that can be substituted by two variables: i) Geographic Distance ( $DT$ ) and ii) Preferential Trade ( $PT$ ), the trade flow gravity equation can be written as:

$$T_{ij} = \lambda_0 \frac{NI_i^{\lambda_1} NI_j^{\lambda_3} PT_{ij}^{\lambda_6}}{POP_i^{\lambda_2} POP_j^{\lambda_4} DT_{ij}^{\lambda_5}} = \lambda_0 NI_i^{\lambda_1} POP_i^{-\lambda_2} NI_j^{\lambda_3} POP_j^{-\lambda_4} DT_{ij}^{-\lambda_5} PT_{ij}^{\lambda_6} \quad (7)$$

In 1970, Learner and Stern envisaged the international trade flows using the probability based gravity model. Armington (1969), Anderson (1979), Helpman and Krugman (1985) and Bergstrand (1985, 1989) alleged the gravity model due to the absence of theoretical foundations. These studies also criticize the perfect product substitution assumption of gravity model. Eaton and Kortum (2001) applied the gravity model in Ricardian framework with homogeneous goods. Evenett and Keller (1998) and Deardorff (1995) investigated the practicality and worth of the gravity model by testing various assumptions and theoretical trade models.

In a nutshell, the gravity model formulates three sets of factors decisive to the size of trade flow:

- i. Economic forces at the origin of flow
- ii. Economic forces at the destination of flow
- iii. Economic forces either stimulating or resisting the movement of flow from the origin to the destination.

### 3. Empirical Studies on the Determinants of Trade

This section focuses on the review of the empirical studies which have applied gravity-type models to investigate the determinants of trade. The summary of the assorted studies on the determinants of bilateral trade flows is displayed in Table 1.

**Table 1: Summary of the Studies on the Determinants of Trade**

Reference(s)	Countries	Time Period	Model/ Methodology	Main Findings
Yu and Zietlow (1995)	14 Asia-Pacific countries	1980-1989	Gravity Model	Physical distance (-) Cultural Similarity (+) Political Stability (+) Market Size (+)
Paas (2000)	Estonia and its 46 trading partner countries	1995-1997	Gravity model and WLS	GDP (+) Distance (-)
Limao and Venables	103 countries	1990		Poor infrastructure (-) Transportation cost (-)

(2000)				
Ekanayake (2001)	56 trading partner of Mexico	1996-1998		Average income level (+) Common language and border (+) Trade Orientation (+) Regional integration schemes (+) Trade Imbalance (-) Distance (-) Income inequality (-)
Hutchinson (2002)	33 countries	1994, 1995 and 1996	Gravity Model	English Language (+) Economic development (-) Distance (-)
Raballand (2003)	46 countries out of which 18 were landlocked	1995-1999	Gravity approach	Landlockedness (-) Infrastructure (+)
Nicolini (2003)	European Countries		Gravity model	Home market effect (+) Low transportation cost (-)
Zarzoso (2003)	47 countries	1980-1999	Gravity Model	Language (+) Distance (-) Income (+)
Nitsch and Schumacher (2004)	200 countries	1960-1993	Gravity model	Terrorism (-) GDP per capita (+) Distance (-) Language (+)
Lai and Zhu (2004)	34 countries		Maximum likelihood method	Tariff (-) Distance (-) Production Cost (-)
Egger and Pfaffermay (2004)	Germany and US	1989-1999.	Hausman – Taylor SUR model	Distance (in case of US and Germany) (-)
Groot et al. (2004)	100 countries	1998	Gravity Model	GDP (+) Language (+) Religion (+) Distance (-) Institutional Quality (+)
Baleix (2005)	EU states	1996	Gravity Model	Tariff (-) Quotas on imports of cloths (+) Distance (-)
Sugema (2005)	Indonesia	1984-1997		Devaluation (+) No problem of banking system (+) No socio-political disturbances (+)
Linders et al (2005)	92 countries	1999	Gravity model	GDP (+) Institutional Quality (+) Institutional distance (-) Cultural distance (+)
Jansen and Piermartini (2005)	H-1B beneficiaries of US	2000-2002	Gravity model	Mode 4 (temporary movements of persons) (+)
Hutchinson (2005)	36 non-English countries	1970-1986	Gravity model	Population (-) Distance (-)
Disdier and Head (2005)	Effects of 1467 distance		Meta-regression analysis	Distance (-)
Ceglowski (2006)	28 countries	1999 and 2000	Gravity model	Regional trade arrangements (+) Linguistic ties (+)
Achakzai (2006)	Pakistan and 9 ECO countries	2005	OLS and Gravity model	GDP (+) Per capita income (+)

				Language (+) Distance (-)
Baxter and Kouparitsas (2006)	92 countries	1970-1995.	Extreme Bounds Analysis of Leamer, EBA of Sala-i-Martin and General to Specific approach of Herdry.	Fixed Exchange Rate (+) Custom Union (+) Arable land (-) Education (-) Capital (-) Distance (-)
Baier and Bergstrand (2007)	96 Countries	1960-2000	Gravity model	Free trade agreements (+)
Ramos (2007)	South Africa (developed) and Ghana (developing)	2000	OLS	Tariff (-) Multilateral liberalization (-) Technological Innovation (+)
Duasa (2007)	Malaysia	1974-2003	ARDL Bounds Testing Approach	Supply of money (-)
Tadesse and White (2007)	US and its 75 trading partner countries	2000		Cultural Difference (-)
Chen et al. (2008)	34 countries	2004	Extended trade gravity model.	GDP(+) GDP of partner countries(+) SCO(+) Geographic Distance (-)
Kurmanalieva (2008)	178 countries	1996-2005	Gravity Model	GDP (+) Quality of Infrastructure (+) Open and liberal trade policies (+)
Falk (2008)	32 industrialized countries	1990-2007	Linear Mixed Models and Fixed Effects Models	Real Effective Exchange Rate (-) Real foreign GDP per capita (+) Balanced Government Budget (+)
Karagoz (2009)	11 BSEC economies		Gravity Model	GDP (Income) (+) Distance (-) Population (Importer) (+)
Wang et al. (2010)	19 OECD countries	1980-1998	Gravity model	Foreign direct Investment (+) Research and Development (+) Distance (-)
Dutt and Traca (2010)	122 countries	1989-2001	Gravity model	Corruption (evasion) (+) Corruption (extortion) (-)
Jafari et al (2011)	D8 countries	1990-2007	Gravity Model	Partner country GDP (+) Currency Depreciation (+) Exporter Population (+) Transportation cost (-) Currency appreciation of importers (-) Economic growth (+)
Khan and Hossain (2012)	Bangladesh and its 50 trading partner countries	1980-2005	Unit Root Analysis	Import-weighted distance (-) Relative GDP (-) Real Exchange Rate (-)
Francois and Manchin	Developing countries	1990, 1995, 2000, 2001,	Poisson estimator with	Infrastructure (+) Institutional Quality (+)

(2013)		2002 and 2003	Baier and Berstrand method	
Naanwaab (2013)	33 African countries	2000-2009	Gravity model	Economic Freedom (+) Regional Trade Agreements (+) Distance (-)
Baek (2013)	Japan and Korea	1991-2010	Autoregressive distributed lag approach	Exchange rate (+) But sensitive in the short run and less responsive in long run.
Goswani (2013)	South Asian Countries	1980-2010	Unit Root and OLS tests.	Infrastructure development (+) Financial development (+) Human capital (+) Trade liberalization (+)
Shikher (2013)	19 OECD Countries	1989		Trade cost (-) Taste Difference (-) Factor Endowment (-)
Shawa and Shen (2013)	Tanzania	1980-2012	OLS method	FDI (+) Human capital development (+) Trade liberalization (+) Foreign Income (+) Government expenditures (-) Household Consumption expenditures (-)
Nuroglu (2014)	6 OIC economies	1985-2009	Gravity Model	Population (exporter) (+) Population (importer) (-) Income (+) Distance (-) Exchange rate (-)
Didier and Hoarau (2014)	SSAc and BRICs	2000-2010	Gravity Model	GDP (+) Distance (-) Geographical remoteness (-)
Nuroglu (2014)	6 OIC economies	1985-2009	Gravity Model	Population (exporter) (+) Population (importer) (-) Income (+) Distance (-) Exchange rate (-)
Mahona and Mjema (2014)	Kenya and Tanzania		Gravity Model	Distance (-) Economic size (+) Trade Liberalization (+)
Nho et al. (2014)	20 EU countries with Vietman	2000-2012	Random and fixed estimation and Gravity model	GDP (+) Population (+/-) Real Effective Exchange rate for exports (+) Real Effective Exchange rate for imports (-) Colonial link (+)
Pietrzak and Lapinska (2015)	EU(European Union) States	1999-2010	Gravity Model	GDP per capita (+) Foreign Direct Investment (+) Distance (-)
Syed et al (2016)	SAARC countries	1985-2015	Pooled OLS regression	Remittances (+) Foreign direct investment (+) Foreign exchange reserves (+) Fiscal balance (-) Real effective exchange rate (-)
Azu and Obe	Nigeria and	1992-2014	Cointegration	GDP (+)



(2016)	China		technique	Trade Openness (+) FDI (+) Exchange rate(-) Japan's REER (-)
Mputu (2016)	13 SSA Countries	1980-2011	Fixed Effect and Random effect Model	GDP (+) Exchange Rate (-)
Aylward (2016)	24 European countries	2002-2006	Gravity Model	GDP (+) Distance (-) Common border (+)
Anderson and Yotov (2016)	41 countries	1990-2002	Gravity model	Free trade agreements (+) Global efficiency (+)
Sheikh et al 2018	ECO Countries	2003-2014	Gravity model Panel Least Square	GDP(+) Trade openness (+) Border (+) Distance(-) Per capita GDP(-) Exchange rate(-) Inflation rate(-) Landlocked(-)

Source: Authors' own compilation

This section has presented the significant empirical studies on the factors that determine bilateral trade flows in various countries. We can observe that the basic gravity model postulated by Tinbergen (1962) and Linnemann (1966) are baseline for almost all the studies as they have established their models by encapsulating gravity models. Some studies have used the same gravity models as suggested by Tinbergen (1962) and Linnemann (1966) but some have modified and/or augmented the model by adding many explanatory variables along with dummy variables related to cultural and geographical factors, such as common languages, colonial-ties, landlockedness, common borders and common membership in trading blocs. Some studies have also probed trade creation and trade diversion effects.

A lot of empirical work has been done to explore the determinants of bilateral trade in various regions of the world but we have found a few studies on bilateral trade flows in ECO region for example Achakzai, 2006 Sheikh et al., 2018). Thus literature review suggests that there is still a research gap in exploring bilateral trade patterns in ECO economies.

#### 4. Model Specification

Many studies have used gravity model to explore the determinants of bilateral trade flows globally. This model is very simple in its form but it describes the bilateral trade flows between the trading countries well.

It is based on Newton gravitational equation which states that “the attraction between two heavenly bodies is proportional to the product of their masses and inversely linked to the distance between them”. In its basic form, the gravity model assumes that the trade between the two countries is proportional to the product of countries' income and negatively associated with distance between them. In a modified model, several other variables are added to encapsulate the geographical and cultural factors

To determine the factors affecting the bilateral trade flows between Pakistan and its ECO countries, we have specified two models:

- i. Traditional gravity model (rooted in simple form of gravity equation)
- ii. Modified gravity model (augmented with dummy variables)

**Model 1: Traditional Gravity Model**

$$\ln X_{ij} = \alpha_0 + \alpha_1 \ln GDP_i + \alpha_2 \ln GDP_j + \alpha_3 \ln POP_i + \alpha_4 \ln POP_j + \alpha_5 \ln DIST_{ij} + \alpha_6 ADJD_{ij} + \varepsilon_{ij} \quad (8)$$

**Model 2: Modified Gravity Model**

$$\ln X_{ij} = \alpha_0 + \alpha_1 \ln GDP_i + \alpha_2 \ln GDP_j + \alpha_3 \ln POP_i + \alpha_4 \ln POP_j + \alpha_5 \ln DIST_{ij} + \alpha_6 ADJD_{ij} + \alpha_7 AREAD_i + \alpha_8 LLOCKD_i + \alpha_9 CONTD_{ij} + \alpha_{10} GTI_i + \varepsilon_{ij} \quad (9)$$

**5. Data and Methodology**

We have used panel data to figure out the gravity equations for a period of 21 years (1995-2015) in ECO countries. Pooled OLS regression or constant coefficient model<sup>5</sup> technique has been employed to probe the determinants of bilateral trade in ECO economies. Panel data gives more informative data, more variability, less collinearity among variables, more degree of freedom and more efficiency (Gujarati, 2009).

The summary of description of each variable, its unit of measurement and sources of data are given in Table 2.

**Table 2: Variables: Description, Unit of Measurement and Sources**

Variables	Description	Unit	Data Source
<b>Dependent Variable</b>			
Xij	Bilateral Exports between ECO countries and Pakistan.	Current US\$ Million	UN Comtrade Database ( <a href="http://comtrade.un.org">http://comtrade.un.org</a> )
<b>Independent Variables</b>			
GDPi	Gross Domestic Product of ECO countries (i = 1,2,3,4,5,6,7,8,9)	Current US\$ Million	World Bank Development Indicators (WDI) Database ( <a href="http://worldbank.org">http://worldbank.org</a> )
GDPj	Gross Domestic Product of Pakistan	Current US\$ Million	World Bank Development Indicators (WDI) Database ( <a href="http://worldbank.org">http://worldbank.org</a> )
POPi	Number of Population in country i (i = 1,2,3,4,5,6,7,8,9)	Million	World Bank Development Indicators (WDI) Database ( <a href="http://worldbank.org">http://worldbank.org</a> )
POPj	Number of Population in Pakistan	Million	World Bank Development Indicators (WDI) Database ( <a href="http://worldbank.org">http://worldbank.org</a> )
DISTij	Geographical Distance of ECO countries and Pakistan	Kilometer	<a href="https://www.distancefromto.net/">https://www.distancefromto.net/</a>
ADJDij	Adjacent /Common Borders Dummy	It takes the value of 1 if Pakistan shares same border otherwise zero	CIA World Fact Book
AREADi	Area Dummy	It takes the value of 1 where the country area greater than 1.5 million km square otherwise zero.	CIA World Fact Book
LLOCKDi	Landlocked country Dummy	It takes the value of 1 where the country is landlocked otherwise zero.	CIA World Fact Book
CONTDij	Continent Dummy	It takes the value of 1 where the country is in the same continent otherwise zero.	CIA World Fact Book

<sup>5</sup> It assumes that the coefficients remain the same across time and cross section (Gujarati, 2016)

GTI <sub>i</sub>	Global Terrorism Index of country i	GTI uses a base 10 logarithmic banding system between 0 and 10 at 0.5 intervals.	Global Terrorism Database (GTD)
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Note: The subscript j denotes Pakistan and i shows other ECO countries

## 6. Results and Discussions

This section delves into the estimated trade gravity models shown in section 2. We investigate the factors of bilateral trade between Pakistan and ECO region by traditional gravity trade equation (equation 8) that particularly concentrates on the transaction cost determinants of bilateral trade. Besides, we have modified the traditional gravity trade equation (equation 9) and include various dummies such as area, landlockedness and continent dummies. Moreover, Global Terrorism Index has also been added in the modified gravity trade equation.

### 6.1 Traditional Gravity Trade Model

Pooled least squares estimates of traditional gravity model of trade are displayed in Table 3. Income variables have two aspects i.e. demand side (import) and supply side (export). Both coefficients of GDPs are expected to have positive sign with bilateral exports between Pakistan and other ECO countries. On demand side, an increase in the income of the trading partners of Pakistan would increase the expenditure capabilities and demand for imports while on the supply side, a rise in Pakistan's income also has the positive effect on the Pakistan exports to the ECO countries as high income indicates more production in volume and varieties is available for exports. A comparison of the coefficients of GDPs exhibits that exporter's positive income effect dominates importer's positive income effect.

The size of a country in terms of population matters a lot in determining bilateral trade. Population of exporter and importer has indeterminate effects i.e. it can reduce or enhance trade flows. The sign of importer population is positive suggesting the division of labor argument by generating the opportunities for demand for imports in a variety of commodities. Conversely, the coefficient of exporter population i.e. Pakistan is negative indicating that a country with large population has large resource endowment, self-sufficiency and less reliance on international trade. Therefore, population size of Pakistan has a negative effect on bilateral exports flows validating the argument that a country can easily achieve minimum efficient scale due to a larger population which could cause her to engage less in exports relative to a less populous country. Furthermore, the coefficients of Populations indicate that exporter's negative population effect dominates the importer's positive population effect. However, in addition to population, this also depends on various other geopolitical and economic opportunities and challenges with regard to the relationship between the countries.

**Table 3: Pooled Least Square Estimates of Traditional Gravity Model**

Dependent Variable: Ln(X <sub>ij</sub> )							
Variable	Coefficient	Least Square Standard Errors			Cluster-Robust Standard Errors		
		Std. Error	t-Statistic	Prob.	Std. Error	t-Statistic	Prob.
C	22.64513	3.931053	5.760577	0.0000	6.269295	8.178341	0.0000
Ln(GDP <sub>i</sub> )	0.337636	0.154412	2.186587	0.0301	0.135738	4.282698	0.0000
Ln(GDP <sub>j</sub> )	0.518479	0.472545	1.097205	0.2740	0.603852	1.807840	0.0706
Ln(POP <sub>i</sub> )	1.365726	0.178154	7.665998	0.0000	0.173522	1.150029	0.2501
Ln(POP <sub>j</sub> )	-4.405244	1.615979	-2.726053	0.0070	2.320036	-5.508595	0.0000
Ln(DIST <sub>ij</sub> )	-1.569736	0.297727	-5.272409	0.0000	0.339941	-1.824198	0.0681
ADJD <sub>ij</sub>	0.498653	0.264527	1.885077	0.0610	0.334784	6.061625	0.0000

Source: Authors' calculations

Turning the coefficient of natural trade-resistance variable<sup>6</sup> of distance, it obviously shows negative sign with bilateral exports between Pakistan and ECO countries. It means with an increase in distance<sup>7</sup>, the trading and transportation cost would increase and resultantly profit margins could be lower for the importer that lead to reduction in trade flows. Long distance creates the non-economic horizon for the traders because ‘psychic distance’ in the form of uncommon and unacquainted laws, habits, language, institutions, taste and preferences, way of life creates more distance between them and therefore distance has an adverse effect on trade flow between countries.

To consider the transportation cost, a dummy variable of adjacency is included in the traditional trade gravity model. The coefficient of adjacency turns out with positive sign with value of 0.50 endorsing the argument that the countries with common border or adjacency have more potential to trade each other. We have to interpret the value of dummy variable of ‘adjacency’ carefully as the dependent variable is logarithmic so we have to take the exponent of dummy variable. It shows that exports of the countries which share the common border is 1.6 times higher than the countries that do not share common border<sup>8</sup>.

Now we discuss the consistency and validity of our pooled least square estimates. In fact, pooled least square regression assumes a very unrealistic assumption that there is no correlation between errors related to the same individual. But in reality, if the unobservable individual characteristics are not included as explanatory variables in the form of dummies in the model, these characteristics would include an error term creating a correlation between errors. In this situation, the standard errors will be invalid and reliability of the least squares estimators is doubtful. Many researchers have proposed various methods for correcting the standard errors e.g. White’s heteroskedasticity-consistent standard errors test and Newey-West standard errors test etc. Similarly, valid standard errors for the pooled least squares estimators can be computed through panel-robust standard errors or cluster-robust standard errors<sup>9</sup> (Hill, Griffiths & Lim, 2014).

If we compare the pooled least-squares standard errors with the counterpart cluster-robust standard errors, it indicates that all cluster-robust standard errors are 50% higher than the corresponding pooled least-squares standard errors. There is none or little effect on the conclusions regarding the significance of estimated coefficients because both set of standard errors have almost the same p-values. Two variables namely Ln(GDP<sub>j</sub>) and Ln(POP<sub>i</sub>) have changed their probability values from 0.27 to 0.07 and 0.00 to 0.25 respectively, casting doubt about these variables.

## 6.2 Modified Gravity Trade Model

Now we explain the results of modified gravity trade model. In modified model, we have augmented the various dummies such as area, landlockedness and continent dummies. Additionally, global terrorism index has also been added to analyze the impact of terrorism on bilateral export flows. The summary of results of the pooled least squares regression method is displayed in Table 4. The coefficients of GDPs, Populations, distance and adjacency have similar results to those of traditional gravity trade model.

It can again be observed that the exporter’s economic ability dominates importer’s economic effect and exporter’s negative population effect dominates the importer’s positive population effect. The magnitude of distance and adjacency variables changes more in the modified model.

Coming to the dummy variable of ‘Area’, its coefficient has appeared with positive sign having the value of 0.95 endorsing the argument that the importer countries with large physical area can create the opportunities for demand for imports in a variety of commodities due to the division of labor argument. In other words, a large country might have more resources endowment than the small area based countries, so they can have greater economic activity across borders. As bilateral exports are in logarithmic form, we have to take the exponential value<sup>10</sup> to interpret the

<sup>6</sup> Linnemann (1966) pointed out three factors to explain the natural trade resistance i) Transport cost ii) transport time and iii) economic horizon or Psychic distance. Transport cost is determined by geographical distance, kinds of commodity, kind of surface and number involved in reloading operations. Transport time is established by perishable good, interest cost, risk of losing opportunities and adjustment according to changing conditions. Economic horizon or psychic distance can be explained by laws, habits, language, institutions, preferences, way of life etc.

<sup>7</sup> It is the geographical distance between two capital cities or big cities.

<sup>8</sup>  $[\exp^{(0.50)} = 1.65]$

<sup>9</sup> Clusters are the time series observations on individuals.

<sup>10</sup>  $[\exp^{(0.95)} = 2.6]$

dummy variable of Area. It shows that imports of countries with large physical area have 2.6 times higher exports than countries with small physical area.

Landlockedness is another geographical measure. The coefficient of dummy variable of ‘landlockedness’ is negative having the value of -2.90 validating the argument that landlocked importer countries have less demand for imports due the fact that landlockedness increases transportation cost<sup>11</sup> relative to non-landlocked or coastal countries. Bilateral exports are expressed in logarithmic form, so we have to take the exponential value to interpret the dummy variable of ‘Landlockedness’. It illustrates that imports of landlocked countries as 18.2 times lower than the coastal countries.

**Table 4: Pooled Least Square Estimates of Modified Gravity Model**

Dependent Variable: Ln(Xij)							
Variable	Coefficient	Least Square Standard Errors			Cluster-Robust Standard Errors		
		Std. Error	t-Statistic	Prob.	Std. Error	t-Statistic	Prob.
C	16.24847	2.614149	6.215589	0.0000	8.086868	2.832720	0.0046
Ln(GDPi)	0.186730	0.072211	2.585902	0.0105	0.182814	-0.150147	0.8806
Ln(GDPj)	0.498633	0.249373	1.999549	0.0471	0.714585	2.360492	0.0183
Ln(POPi)	0.535288	0.131180	4.080567	0.0001	0.219656	3.311385	0.0009
Ln(POPj)	-2.715493	0.937679	-2.895974	0.0043	2.640717	-2.802172	0.0051
Ln(DISTij)	-0.959487	0.162501	-5.904508	0.0000	0.641847	-0.518536	0.6041
ADJDij	3.686076	0.588413	6.264440	0.0000	0.712302	6.639411	0.0000
AREADi	0.945420	0.133676	7.072454	0.0000	0.335836	3.197273	0.0014
LLOCKDi	-2.901388	0.348769	-8.318942	0.0000	0.606745	-6.050200	0.0000
CONTDij	6.449350	0.611116	10.55339	0.0000	0.603053	11.89369	0.0000
GTIi	-0.227354	0.066447	-3.421564	0.0008	0.200803	-0.717538	0.4730

Source: Authors' calculations

The dummy variable of ‘continent’ has appeared with positive sign. The value of the coefficient is 6.45 suggesting that the countries belonging to the same continent have more trade flows with each other than those countries which are not situated in the same continent due to the cost factor. Since the dependent variable is in logarithmic form, so it is necessary to show the coefficient of continent in exponential form to understand the results. It demonstrates that the countries that are linked within the same continent have 665.14 times higher exports flows than countries in another continent.

Finally, we have added an important variable of terrorism<sup>12</sup> to examine the impact of terrorism on bilateral export flows. The coefficient of terrorism has appeared with negative sign showing that terrorism hurts bilateral trade flows. Terrorism generally exerts negative impact on international trade through trade cost factor. Specifically, trade cost escalates and results in reduction in trade flows due to distrust in international trade relations, change in production and consumption patterns<sup>13</sup>, insecure trade transactions, increase in cost of doing business due to larger risk, destruction of tradable commodities and physical transport structure and low cross-border transactions due to security standards (Nitsch and Schumacher, 2004; Egger and Gassebner, 2014).

<sup>11</sup>Limao and Venables (2001) argued that landlockedness increases the trade cost due to border delays, high insurance cost due to uncertainty and delays, transportation coordinated problem and transitory charges etc.

<sup>12</sup> Buckelew (1984) defines terrorism as “violent, criminal behavior designed primarily to generate fear in the community, or in a substantial segment of the community, for political purposes”.

<sup>13</sup> Due to terrorism, people become nervous and hesitate to travel and shopping as they considered themselves unsafe so resultantly production, consumption and trade patterns disturb in the country.

Turning to the comparison between pooled least-squares standard errors and cluster-robust standard errors, it points out that six out of ten cluster-robust standard errors are 50% lower than the corresponding pooled least-squares standard errors. There is none or little effect on the conclusions regarding the significance of estimated coefficients because both set of standard errors have almost the same p-values. Three variables namely  $\ln(\text{GDP}_i)$ ,  $\ln(\text{DIST}_{ij})$  and  $\text{GTI}_i$  have changed their probability values from 0.01 to 0.88, 0.00 to 0.60 and 0.00 to 0.47 respectively, casting doubt about these variables.

## 7. Conclusions and Policy Recommendations

This study provides an analysis of Pakistan's bilateral trade in ECO region. The main purpose of this study is to assess the determinants of bilateral trade flows using the gravity trade model. Panel least square regression has been applied over the period of 1995 to 2015. Two types of gravity models have been estimated: one is traditional gravity trade model and the other is modified gravity trade model.

The results based on traditional gravity trade model suggests that income elasticities of both the exporting and importing countries are positive and exporter income effect dominates importer income effect. Population elasticities have mixed results i.e. it is negative in the case of exporting country and positive for importing countries and exporter's negative population effect dominates the importer's positive population effect. Additionally, distance turns out with negative sign while adjacency is positively related with bilateral exports flows.

So far as modified gravity trade model is concerned, we have added three dummy variables such as area, landlockedness and continent along with global terrorism index traditional gravity trade model to analyze the patterns of bilateral export flows. The results of the modified gravity trade model exhibits that there is no change in the signs of the traditional gravity trade model variables. However, the magnitude of distance and adjacency variables alter more in the modified model.

The result from dummy variable of area shows that imports of countries with large physical area are higher than the countries with small physical area due to the division of labor argument. The coefficient of dummy variable of landlockedness demonstrates that imports of landlocked countries are lower than that of coastal countries as a result of high transportation costs. Furthermore, the variable of continent validates that the countries that are linked with the same continent have higher exports flows than countries not in the same continent. Another important variable that can affect trade flows is terrorism. The findings of the coefficient of terrorism confirm the proposition that terrorism is a bane for trade flows due to miscellaneous factors.

The key policy recommendations to enhance bilateral trade flows from Pakistan to ECO countries include the following:

- The results show that economic growth plays a significant role in boosting the trade flows of Pakistan. It can be suggested that policies should focus on improving economic growth in order to enhance trade flows.
- As an exporter to ECO countries, with its large population, Pakistanis might apply themselves less to increase trade. However enhancing trade with its ECO partners would be beneficial for improving the welfare of people in Pakistan. Therefore, it is essential to have policies in Pakistan to involve people in greater trade flows with ECO countries.
- As proximity variables distance, landlockedness generally reduces bilateral exports flows, therefore, the need is to improve infrastructure for modern and faster transportation between trading partners to enhance trade flows. Terrorism also hurts trade flows due to miscellaneous factors so it is essential to take measures to eradicate terrorism.

In a nutshell, there is no doubt that more research can be conducted depending upon data availability. Nevertheless, we believe that this study has made a valuable contribution to empirical literature of determinants of trade in ECO region.

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