European Online Journal of Natural and Social Sciences 2019; www.european-science.com
Vol.8, No 4 (s) Special Issue: Perspectives of Economics and Management in Developing Countries
ISSN 1805-3602

The Determinants of Pakistan's Bilateral Trade and Trade Potential with World: A Gravity Model Approach

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Abstract

Nonlinear measurement of gravity model with PPML regression technique has become admired for modeling international trade flows since it approves a better accounting for zero flows and excessive values in distribution tail. In the present study, we have endeavored to investigate the bilateral trade milieu of Pakistan with 198 trading cohorts over the time epoch (1992-2016) 25 years and to stumble on latent markets in case of Pakistan's bilateral trade. The empirical results revealed that market size, bilateral exchange rates, income differential, common religion, border, and trade agreements positively influence bilateral trade volume while bilateral distance and landlocked countries showed a negative relationship towards bilateral trade of Pakistan with rest of the world. The outcome also illustrates that the trade pattern of Pakistan hinges on the Heckscher-Ohlin (H-O) theory, therefore, can be explained by the dissimilarity in factor endowments whereas the WTO membership does not have any influence on bilateral trade of Pakistan. Pakistan owns satisfactory potential to enhance its bilateral trade with nearly 102 countries. The highest potential lies with countries Saudi Arabia, Malaysia, Somalia, Hong Kong, Iran and USA whereas actual trade has exceeded with countries like China, Oman, Spain, UAE, Germany, and the UK. Hence, there is need to address all measures to improve bilateral trade with potential countries moreover per se Pakistan can perhaps decrease or handle the trade discrepancy by targeting these economies, to bring about a reasonable quality in mutual trading relations.

Keywords: Pakistan, bilateral trade, gravity model, trade potential, PPML, zero trade.

Introduction

Economic activities both at national and international level show many fundamental changes due to globalization. Trade liberalization is an important element of economic integration. The economic development has also been characterized by the existence of free trade agreements and economic integration. Many countries are diverting their concentration to promote the economic growth through adopting regional integration Irshad and Xin, (2014a). The history of trade policy of Pakistan shows many ups and downs. Initially, it has restricted trade policy due to the lack of modern and well-developed infrastructure and weak industrial base. Trade liberalization in Pakistan started to flourish in the late 1980s. Many trade reforms and policies of IMF and WTO are adopted to promote free trade. The fairly open economy of Pakistan is characterized by a large volume of exports and imports from different regions of the world. The impact of exports on economic development is more than imports as it is more closely related to domestic activities. The world growth significantly depends upon export share of the world. The export share has a close connection with the growth of a country as well Xin et al., (2014).

The trade structure of Pakistan shows a chequered history. In Pakistan subsequent to the agricultural sector, textile and clothing sector are predominant divisions in the export of Pakistan. Exports are always considered one of the vital determinants of total factor productivity growth of manufacturing sector as stated above. The government followed the policy of overrated exchange rate to make sure the accessibility of cheaply imported contributions to the industrial sector Irshad

and Xin, (2015a). Agricultural input costs were set below the world market prices to ensure the low-priced accessibility of raw materials to the industrial sector. These policies led a vigorous expansion in the exports of manufactured goods. Pakistan exports are very limited in variety and also limited countries who import Pakistani commodities. There should be many countries around the globe those can import from Pakistan and this will lead to reducing Pakistan's trade deficit see (figure 1). Therefore present study explores the impact of various factors on bilateral trade which ultimately leads to growth in international trade of Pakistan.

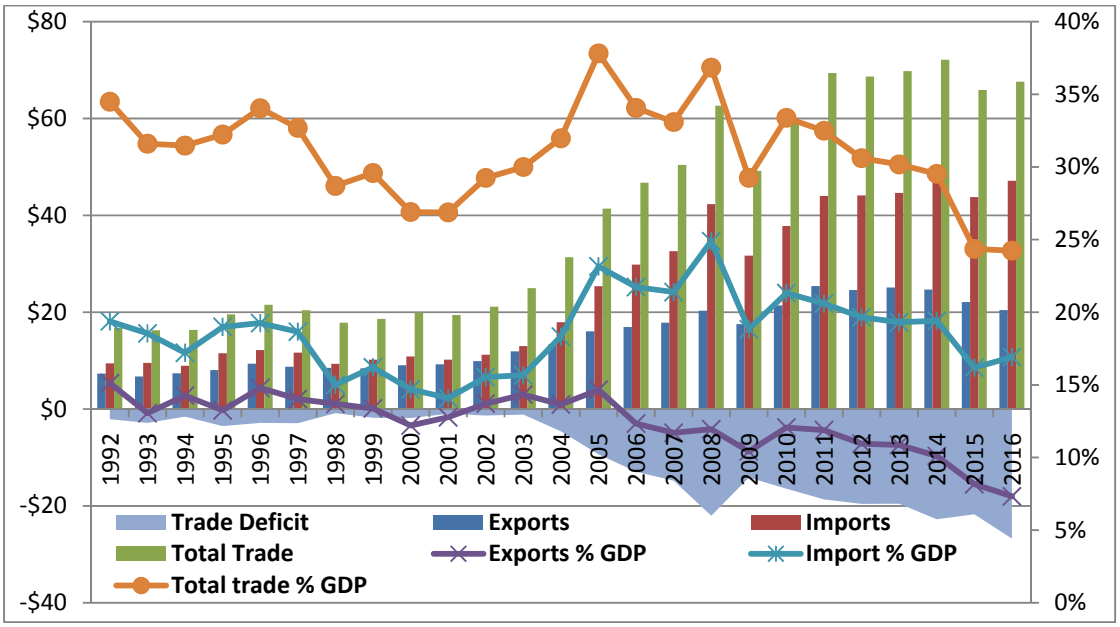

Figure 1: Bilateral trade of Pakistan with percentage share to GDP, (US$ billions) Source: Authors' estimations based on UN-COMTRADE database 2018.

To analyse the determinants of Pakistan's bilateral trade flow this study will approach gravity model of trade. Since it's introduced by Tinbergen, (1962) and Linneman, (1966), the gravity model has been widely used for explaining flows of international trade. As reported by Kepaptsoglou et al., (2010), in the last decade gravity models have been employed in numerous studies for analyzing and assessing trade flows Irshad et al., (2018c); Irshad et al., (2018d). The main purpose of this study in to use a gravity model to provide an overview and to find out the potential markets for Pakistan in the world market during the period of 1992-2016. In our sample, there are 198 partners from the whole world and many countries with zero trade flows. This study allows drawing potential markets for international trade of Pakistan and to test the sensitivity of others explanatory variables such as GDP, distance, bilateral exchange rates, per capita GDP differential, trade agreements, WTO membership, common border and the countries those do not have direct access to sea by using Poisson Pseudo-Maximum- Likelihood (PPML) version of gravity model. The authors have not seen a study such as this in the literature so far in case of Pakistan. We do not find any study that has considered the analysis of Pakistan bilateral trade with 198 countries over 25 years with PPML (with time and countries fixed effects) through a gravity model. Therefore, this study leads to make new research results for business societies and policymakers.

This paper is structured as follows. Section 2 story of Pakistan's trade pattern with geographical composition, whereas section 3 discusses the theoretical background and empirical studies on gravity approach. The methodological aspects, model specification and data sources are introduced in section 4. While section 5 reports and discusses estimation results of gravity approach with highly recommended PPML technique and the bilateral trade potentials in case of Pakistan with rest of the world. Finally, section 6 concludes with policy implications.

The pattern of Pakistan's trade with the geographical composition

Pakistan situated in Southwest of Asia is the sixth most heavily populated nation in the globe and has the second biggest Muslim populace in the world following Indonesia. Similar to other countries, international trade is very important for the economy of Pakistan because the country wants to import and export a range of products to fulfil his domestic demands and earn maximum profits from its exports. The trade patterns of Pakistan have changed a lot since the beginning Irshad and Xin, (2015b). Pakistan is following a strategy of export-led growth, which implies that maximum exports to a maximum number of countries for which the issues of market access are a significant element. The exports of Pakistan are historically concentrated in a small number of products and directed towards limited trading partners and regions conversely, imports getting bigger every year which results in the huge trade deficit. This position could lead to severe volatility in the trade sector and to put Pakistan in backward. The main reasons for the growing trade discrepancy are Pakistan's exports having been curving towards preferred trade partners as well as the concentration of exports in selected commodities. Since last 32 years, 25 countries are the beneficiaries of more than 80 % of the total export of Pakistan. Being a primary commodities exporter, Pakistan now exports primarily manufactured and semi-manufactured goods. Its contribution is over 60 percent of total exports of Pakistan to the world. Pakistan's exports mostly textiles and clothes (which has 60 percent share in total exports) related are directed toward the USA, China, UK, Germany, UAE, Spain, Netherlands and Saudi Arabia Irshad et al., (2015). The USA is the single largest export market for Pakistan, accounting for 16.6 percent of its exports, followed by the China, Afghanistan, and UK. During recent years, Pakistan exports witnessed a lethargic growth. The exports mark for the year 2016 was set at US$ 25.5 billion. The major reasons for the lower performance of exports are generally feeble external demand, a slowdown in economic growth of Pakistan, lost textile and other major products share to new competitors in international markets, and no other potential markets are available Irshad et al., (2016b). For the last few years, Pakistan's exports are screening declining trend.

Similarly, the import side also reveals the same dramatic story. Pakistan's imports do not demonstrate any noteworthy transform over the years as these are greatly determined by few commodities or commodity group specifically, machinery, petroleum products, edible oil, chemicals, transport equipment, iron and steel, fertilizers and tea that comprise more than 70 percent in 1992 and 74 percent in 2016 of total imports. Over 70 percent of imports continue to originate from just twenty countries in 1992 to 2016 same number of countries' share in Pakistan imports reached 87 percent. China is emerging as a major supplier to Pakistan followed by the UAE, Saudi Arabia, USA, Indonesia, Japan and Kuwait. Pakistan has been aggressively pursuing an open gate economic policy over the past decades. It was the first country in South Asia that adopted a liberal economic policy by deregulating and lessening government control, encouraging the private sector, and privatizing state's assets and liabilities Irshad et al, (2016b).

The literature on gravity approach

This study tests to what extent the gravity equation is applicable to explain Pakistan bilateral trade flows as well trade potential countries and to extract implications for Pakistan's trade policy. Determination of bilateral trade determinants and its impact on economic growth is the most debated topic among the economists. Indeed, the empirical literature reveals a considerable number of publications offering either methodological advancements or refinements or attempting to explain policy impacts on trade flows. There is great number of studies exploring the links in bilateral trade flows through the gravity model approach which is a distinguished contrivance to model international trade flows among nations, trading agreements and even between continents (Brun et al., 2002; Redding & Venables, 2004; Liu and Xin, 2011; Novy, 2013; Fung, 2014; Ulengin et al., 2015; Rasoulinezhad & Kang, 2016; Rasoulinezhad, 2017; Irshad et al., 2018a; Irshad et al., 2018b). The first eminent study exploring trade flows goes back to Jan Tinbergen's article "Shaping the world economy: propositions for an international economic policy" long ago in 1962. He believed that based on Newton's gravity law, which is stated as the trade between two countries can be a function of their economic sizes and distance between them Tinbergen (1962). Tinbergen's theoretical foundation of this model was ameliorated by Linnemann (1966), Anderson (1979), Bergstrand (1989), Deardorff (1998), Anderson & Wincoop (2003) and Guttmann & Richards (2004).

Abraham and Van Hove (2005) applied a gravity model to investigate the relationship between China and 23 Asia-Pacific countries and time period 1992-2000. Their empirical conclusion showed China's involvement in regional agreements has great export potential and also ASEAN and APEC have diminutive effects on Asia-Pacific exports. Papazoglou (2007) endeavoured to discover potential trade flows for Greece to the EU member states by employing a gravity model. In his conclusion, he stated that actual export of Greece fall short of potential ones, while the opposite is true for Greek imports. Xuegang et al. (2008) used the three explanatory variables GDP, GDP per capita and Shanghai Cooperation Organization (SCO) to construct a gravity model for Xinjiang's bilateral trade. Their outcome illustrated that all the three variables distress the Xinjiang's bilateral trade. Ekanayake et al. (2010) examined the trade diversion effects of the regional trade agreements in Asia on intra-regional trade flows by using a gravity model and annual data for 19 Asian countries during 1980-2009. The findings represented the negative sign of ECO and positive signs of ASEAN, BA and SAARC RTAs. Another industrial sector level study by Chen and Novy (2011) applied a gravity model to find out the trade integration across manufacturing industries in EU countries. They accomplished that substantial technical barriers to trade in specific industries are the most important trade barriers. Tang et al. (2014) investigated the features of traded services in China by using the modified gravity model. They found that the law of comparative advantage does apply to China 'services trade.

A study by Thorbecke (2015) estimated a gravity model to find whether China's exports to the USA are an outlier. The results of the assessment indicate that these exports have been more than predicted in every year since 2005. Rasoulinezhad (2016) investigate how much various sanctions (financial and non-financial) and oil price have affected the foreign trade of Iran with Russia during 1994–2013 by employing gravity model. He concluded that the negative relationship between financial, non-financial sanctions and oil price shocks with the Iran-Russia trade. Irshad and Xin (2017b) employed gravity for examined South Korea's international trade over the period 2001-16 by using dissimilar estimation techniques. Their results showed that the trade pattern of South Korea exports and imports relies on GDP, trade openness and regional trade agreements and bilateral exchange rates while negatively influence by transportation cost and geographically landlocked

countries. Another research by Irshad et al., (2018a) examined China's trade pattern with OPEC member counties over the year 1990-2016 by employing gravity model. The results confirmed that China's bilateral trade with OPEC members positively impacts on GDP, GDP per capita, trade openness in China and WTO member countries in OPEC, while negatively influence on trade cost and supports Linder Hypothesis.

In case of national applications of the gravity model, there are few notable studies which attempted to concentrate on the performance of Pakistan's bilateral trade flows. Khan and Mahmood (2000) investigated gravity model of the disaggregated level of exports and imports of 10 commodities of Pakistan. There results from augmented gravity model revealed that the GDPs of Pakistan and trading partner, real exchange rates, and common language positively impacted whereas distance, tariffs and sharing border dummy negatively impacted on Pakistan's trade flows. Achakzai (2006) attempted to investigate augmented gravity equation of Pakistan trade flow with nine ECO countries. The results exposed the significant constructive impact of ECO on intra-regional trade flows. Butt (2008 investigated the gravity equation in case of export potential of Pakistan by using cross-sectional data from 132 exporting and 154 importing countries. The results revealed that all the explanatory variables are with expected signs and highest export potential with India, Japan, Hong Kong and China in case of Pakistan. Gul & Yasin (2011) also successfully attempted to investigate augment gravity of Pakistan trade flow with 42 trading partners over the years 1981-2011. Their result discovered expected influence of all macroeconomic variables, except negative for common border indicating political tension with sharing border country such as India. Similarly, Abbas & Waheed (2015) applied gravity model to find out potential markets for exports of Pakistan with 40 trading partners over the years 1991-2011. They concluded that Pakistan's export is positively affected by its supply capacity and partner country's demand potential as well as market size, relative price and common language, whereas negatively affected by the geographical distance, border and trade agreement. Pakistan has higher export potential with India, Philippines, Japan, Singapore and Malaysia. In very recent study Lateef et al., (2017) employed gravity model by using PPML estimation technique to calculate the impact of Pakistan-China free trade agreement (PCFTA) on agricultural exports of Pakistan with 110 trade partners over the periods 2001-2014. They have found that PCFTA has incredibly brawny trade creation effect on agricultural export of Pakistan.

Taken as a whole, it can be noticed that there has not been a serious effort to inspect maximum countries and time for Pakistan's bilateral trade and trade potential. Therefore this paper will present innovative and constructive results to find how various factors can shape the bilateral trade of Pakistan with rest of world and to discover new potential markets in case of Pakistan.

Methodology and data

Model specification

At first, this study will establish a gravity model of bilateral trade for Pakistan. Then, the estimated model will be used to forecast the potential trade between Pakistan and rest of world. Our main aim is to analyse the determinants of Pakistan bilateral trade with rest of the world and to discover potential markets in case of Pakistan by estimating gravity equation. We model merchandise total trade (merchandise exports + merchandise imports) of Pakistan with trading partners as a function of GDPs (market size), the difference in per capita income, geographical distance (Population weighted), bilateral exchange rates, trade openness and the dummy variables define below.

The following set of variables is taken into consideration and then estimated equation becomes:

$BT_{ijt} =$
$eα_0(MSit.MSjt)α_1DINCMijtα_2DISTWijα_3BEXRijtα_4(TOit.TOjt)α_5Rijtα_6Bijtα_7TAijtα_8WTOijtα_9LLCjα_{10}eμjeηteεijt$
…… (1)

Where:

- BT_{ijt} denotes bilateral trade of Pakistan (*i*) and partner country (*j*) at time *t;*
- α_n is the intercept;
- $MS_{it}.MS_{jt}$ stands for GDP of country *i* and *j*, taken as proxy for market size;
- $DINCM_{ijt}$ is the difference in GDP per capita between Pakistan and partner, employed as a proxy for factor endowment or comparative advantage;
- $BEXR_{ijt}$represents bilateral exchange rates between country *i* and *j;*
- $TO_{it}.TO_{jt}$ percentage of total trade to GDP ratio of country *i* and *j* taken as proxy for trade openness;
- $R_{ij}$is a dummy variable that equals 1 if country *j*'s 50 percent population religion like Pakistan (Islam), and zero otherwise;
- $B_{ij}$is a dummy variable that is equal to 1 if country *j* sharing border with Pakistan, and zero otherwise;
- TA_{ijt} is a binary variable that is equals 1 if both countries have common or regional trade agreement in year *t*, and otherwise zero;
- $WTO_{ijt}$is a binary variable that is equal to 1 if both countries are member of world trade organization in year *t*, and otherwise zero;
- $LLC_{jt}$is a dummy variable that is equal to 1 if county *j* is landlocked, and otherwise zero;
- $\mu_j$is a importing country fixed effects;
- $\eta_t$is a time effects;
- $\varepsilon_{ijt}$is the error term.

After log-linearization, Eq. (1) becomes the following in a static context:

$$BT_{ijt} = \alpha_0 + \alpha_1 ln(MS_{it}.MS_{jt}) + \alpha_2 \ln(DINCM_{ijt}) + \alpha_3 \ln(DISTW_{ijt}) + \alpha_4 \ln(BEXR_{ijt}) + \alpha_5 \ln(TO_{it}.TO_{jt}) + \alpha_6 R_{ij} + \alpha_7 B_{ij} + \alpha_8 TA_{ijt} + \alpha_9 WTO_{ijt} + \alpha_{10} LLC_{jt} + \mu_j + \eta_t + \varepsilon_{ijt} \quad \ldots (2)$$

The dataset is a balanced panel and covers a period of 25 years (1992-2016) with 198[1] partner countries. In accordance with the theoretical structure of the gravity model, it is anticipated that market economy size would have positive impacts on trade flow and promote trade between Pakistan and partner country. The effect of the differential in GDP per capita is ambiguous. This coefficient can have a positive sign if countries have the H-O bilateral trade pattern, while the negative sign of this variable can appear under the Linder hypothesis.

The coefficient for the bilateral exchange rate is expected to be positive (for instance, an increase in the Pakistani rupee leads to an increase in trade flows between this country and a trading partner). The more open the country economy the more it will trade so we are excepting the positive

[1] List of countries provided in Table A Appendix part.

sign for trade openness in both countries. We have employed five dummy variables in our gravity equation to measure the other factors of trade cost such as common border, religion, trade agreement, WTO membership and landlocked countries. The hypothesis is that those countries with same culture or religion and sharing borders and participating in trade agreements tend to trade more and vice versa.

In our study equation (2) is valid only in the case where $BT_{ijt}>0$ and problematic when $BT_{ijt} = 0$ because log of zero is not defined. In our model, there are many countries where Pakistan trade is equal to zero or Pakistan doesn't trade. Normally, there are many cases where two countries have zero trade for a specific period of time. Recently, many studies advocated not to use log-linear model and preferred to choose poison models [Silva & Tenreyro (2006); Burger et al. (2009); Sun & Reed, (2010); Westerlund & Wilhelmsson (2011); Lateef et al. (2017)].

So, we have specified our model as follows:

$$BT_{ijt} = \exp[\alpha_0 + \alpha_1 ln(MS_{it}.MS_{jt}) + \alpha_2 \ln(DINCM_{ijt}) + \alpha_3 \ln(DISTW_{ijt}) + \alpha_4 \ln(BEXR_{ijt}) + \alpha_5 \ln(TO_{it}.TO_{jt}) + \alpha_6 R_{ij} + \alpha_7 B_{ij} + \alpha_8 TA_{ijt} + \alpha_9 WTO_{ijt} + \alpha_{10} LLC_{jt} + \mu_j + \eta_t + \varepsilon_{ijt}] \quad \ldots\ldots\ldots (3)$$

In order to cope up endogeneity problem, we have estimated the equation (3) with time and country-specific effects; it will also help to control different other macroeconomic factors like global economics boom or recessions and country effects Silva & Tenreyro (2011). There are good rationales for arguing that country-specific fixed effects are appropriate when export or import influences or 'environmental' determinants that possibly will drive or hinder trade flows (geographical, political or else chronological determinants) are at hand. These factors are deterministically associated with a country's meticulous distinctiveness and cannot be considered as random. Several potential inadequacies in the specification of gravity model were commented by successive researchers including potential endogeneity dilemma (Trefler, 1993; Lee & Swagel, 1997), zero trade values dilemma (Hallak, 2006; Helpman et al. 2008) and heteroskedasticity problems by Hurd (1979). Clarification to endogeneity dilemma was suggested by (Baier & Bergstrand, 2007; Magee, 2003) by introducing dissimilar types of fixed effects while estimating gravity model. Silva & Tenreyro (2006) anticipated Poisson Pseudo Maximum Likelihood (PPML) estimator for gravity model and argued that it performs splendidly in the presence of heteroskedasticity in trade data. Later on, Silva & Tenreyro (2011) provided evidence that PPML estimator also has consistence results in the presence of zero trade observation. The variables utilized in our gravity equation are explained in (Table 1) with the expected signs and data sources.

Table 1: Description of variables

Variables	Unit	Type	Expected Sign	Data Source
$\boldsymbol{BT_{ijt}}$	US$ 1000	Time-Variant	-	UN Comtrade Database/ Pakistan Bureau of Statistics
$\boldsymbol{MS_{it}.MS_{jt}}$	US$ 1000	Time-Variant	Positive	WDI, World Bank
$\boldsymbol{DINCM_{ijt}}$	US$ 1000	Time-Variant	Ambiguous	WDI, World Bank
$\boldsymbol{DISTW_{ijt}}$	Kilometers	Time-Invariant	Negative	CEPII database
$\boldsymbol{BEXR_{ijt}}$	Rupee	Time-Variant	Positive	WDI, World Bank
$\boldsymbol{TO_{it}.TO_{jt}}$	%	Time-Variant	Positive	WDI, World Bank
$\boldsymbol{R_{ij}}$	(0/1)	Time-Invariant	Positive	CIA (The World Factbook)

Variables	Unit	Type	Expected Sign	Data Source
B_{ij}	(0/1)	Time-Invariant	Positive	World atlas website http://www.worldatlas.com/
TA_{ijt}	(0/1)	Time-Invariant	Positive	Asia Regional Integration Center https://aric.adb.org/fta-country
WTO_{ijt}	(0/1)	Time-Invariant	Positive	World Trade Organization
LLC_{jt}	(0/1)	Time-Invariant	Negative	CEPII database

Source: Authors' Compilation

Potential estimations

After estimated gravity equation (3) using a PPML technique with zero trade in the dependent variable (bilateral trade flow of Pakistan with rest of the world). We used the estimated coefficient to calculate an in-sample trade potential index for Pakistan and then these predicted trade flows are compared to the actual trade flows to distinguish whether or not the trade potential for Pakistan exists. Following are two most using methods to estimate potential trade flows.

$\Delta BTA = Predicted\ trade\ value - actual\ trade\ value$ ……. (4)

Where ΔBTA means bilateral trade flow estimated by our gravity equation (3). A positive value implies the possibility of trade expansion in the future while a negative value shows that Pakistan has exceeded its trade potential with particular country. By using differentiation indicators, we can categorize those countries with which Pakistan have potential for the expansion of bilateral trade flows or otherwise (Gul &Yasin, 2011; Khan et al., 2013; Sultan & Munir, 2015)

In another way to estimate trade potential to double check, the results predict the same in both ways. Equation (5) provides the methodology used to determine these potentials.

$$\Delta BTB = \left[\frac{\left\{\left(\frac{Actual}{Predicted}\right)-1\right\}}{\left\{\left(\frac{Actual}{Predicted}\right)+1\right\}}\right] \quad \ldots\ldots\ldots\ldots\ldots \quad \ldots (5)$$

Where ΔBTB stands for bilateral trade flow estimated by our gravity equation (3). The plus one (+1) and minus one (-1) in equation (5) are used standardize the trade potential. Accordingly the reported potentials will be between minus one (- 1) and plus one (+ 1) where a positive index value (0 , 1) demonstrates a higher trade than what is predicted by the model and that the trade flows have reached or exceeded the potential level whereas a negative index value (-1 , 0) reveals the opposite scenario (Benedictis & Vicarelli, 2005; Mohmand et al., 2015). The zero represents the demarcation value where neither positive nor negative trade potentials are shown.

Results and discussion

Panel cross-section dependence test

Cross-section dependence in macro panel data has acknowledged loads of consideration in the emerging panel time series literature over the past decade. This kind of correlation possibly will occur from worldwide common shocks with heterogeneous impact across countries, such as the oil crises in the 1970s or the global financial crisis from 2008 onwards. Alternatively, it can be the result of local spillover effects between countries or regions (Eberhardt & Francis, 2011; Moscone & Elisa, 2009). Before estimating gravity equation, CD test should be tested to observe whether the sample data are cross-sectionally dependent or independent. Otherwise, based on the assumptions (Breusch and Pagan, 1980; Pesaran, 2004), the results of our gravity equation would be prejudiced

and incompatible. In accordance with the time and cross sections in our gravity equation, Pesaran's (2004) residual CD test is calculated anchored in the pairwise correlation coefficients $\hat{C}_{ij}$ in this fashion:

$$CD = \sqrt{\frac{2}{N(N-1)}} \sum_{i=1}^{N} \sum_{j=i+1}^{N} \sqrt{T_{ij}\hat{C}_{ij}}$$

We calculated CD test only for time-variant variables in our gravity equation because of CD test unable to define in case of time-invariant variables (Rasoulinezhad, 2017; Rasoulinezhad & Kang, 2016). Because of zero values in our dependent variable so that it is not defined in CD test however we calculate it with the whole sample. Based on the result of Pesran's (2004) CD test, shown in Table 2, the null hypothesis (no CD in residuals) can be strongly rejected at the 5 percent level. It implies that all the panel time series have strong evidence for cross-sectional dependence.

Table 2: Results of Pesran's (2004) CD test.

Variables	Pesaran's CD test	Prob.
$(\boldsymbol{BT})_{ijt}$	-	-
$\boldsymbol{ln(MS_{it}.MS_{jt})}$	673.69	0.00
$\boldsymbol{\ln(DINCM_{ijt})}$	53.15	0.00
$\boldsymbol{\ln(BEXR_{ijt})}$	193.94	0.00
$\boldsymbol{\ln(TO_{it}.TO_{jt})}$	311.71	0.00

Source: Authors' compilation from STATA 14.0.

Gravity results and discussion

After confirming the cross-sectional dependency in our variables, the regression outcomes for gravity equation (3) are presented in table 3. We have endeavoured to analyze Pakistan bilateral trade flow with rest of world (198 countries) over the years 1992-2016 (25 years). Our analysis starts in 1992 because several trading partners' transition took more time and there was no trade data available for the previous years. 2016 is the upper bound of data availability for most of our variables. We work with an augmented gravity model not only to capture the usually measured effects on the trade on the country but also to analyze the effect of various factors such as bilateral exchange rates, factor endowment, trade openness and religion on Pakistan bilateral trade flow with rest of the world. We have estimated four different models from gravity equation (3) to compare results, where (Model–I) is estimated by Ordinary least square and rest of three are estimated by PPML estimation with time, country and without effects. All four models are with high R-square 0.69, 0.77, 0.82 and 0.95 respectively, meaning that our models fit the data quite well; the explanatory variables explain up to 95 % of the variability in the dependent variable of model four see (table 3).

Table 3: The gravity model results from equation (3).

Variables	Model – I	Model – II	Model –III	Model –IV
Constant	-6.34 (0.84)***	-8.34 (0.90)***	-15.53 (1.22)***	13.96 (5.87)**
$\boldsymbol{MS_{it}.MS_{jt}}$	0.94 (0.02)***	0.71 (0.02)***	0.94 (0.03)***	1.09 (0.07)***
$\boldsymbol{DINCM_{ijt}}$	0.19 (0.02)***	-0.23 (0.04)***	-0.06 (0.03)*	0.39 (0.12)***

Variables	**Model – I**	**Model – II**	**Model –III**	**Model –IV**
$DISTW_{ijt}$	-1.30 (0.05)***	-0.58 (0.06)***	-0.70 (0.05)***	-4.59 (0.63)***
$BEXR_{ijt}$	0.01 (0.01)	0.03 (0.01)***	0.05 (0.01)***	0.02 (0.01)**
$TO_{it}.TO_{jt}$	0.26 (0.04)	0.28 (0.04)***	0.60 (0.05)***	0.18 (0.07)**
R_{ij}	0.41 (0.07)***	1.32 (0.08)***	1.55 (0.07)***	2.61 (0.55)***
B_{ij}	0.63 (0.21)***	1.32 (0.13)***	0.78 (0.13)***	3.06 (0.46)***
TA_{ijt}	-0.58 (0.13)***	-0.43 (0.09)***	-0.27 (0.09)***	0.36 (0.07)***
WTO_{ijt}	0.96 (0.07)***	0.60 (0.14)***	0.48 (0.11)***	0.09 (0.08)
LLC_{jt}	-1.17 (0.08)***	-0.40 (0.16)**	-0.21 (0.16)	-6.01 (0.79)***
Time effect	Yes	No	Yes	Yes
Country effect	No	No	No	Yes
R-Squared	0.69	0.77	0.82	0.95
P.Log Likelihood	1.6375	-3.594e+08	-3.086e+08	-69853221
F-st. (prob.)	242.14 (0.00)	-	-	-
Observations	4288	4950	4950	4950

Note: Robust standard errors are in parenthesis.
***, **,* denotes significance level at 1, 5 and 10 percent respectively.

In above models, only model-IV is the benchmark model in our study. The advantage of this model is that it also highlights the effects of time-invariant variables on trade flows. Fixed effects are included to account for country-specific effects as well as other factors not already considered that might affect trade (Silva & Tenreyro, 2006; Baier & Bergstrand, 2007; Silva and Tenreyro, 2011; Caporale et al, 2015). Coefficients of the GDPs (proxy for market size) variables are statistically significant at the 1% level and show positive sign in all estimated models. A 1% increase in the GDP of Pakistan and trading partner increase the bilateral trade of Pakistan by 0.94% to 2.97%[=exp(1.09)], maximum values predicted by model- IV. While GDP growth has a positive impact on Pakistan's bilateral trade but as expected distance has significantly negative effects in all estimated models; a 1% increase in the distance decreases bilateral trade by 1.3 to 98.49% [=exp(4.59)], higher value calculated by model- IV. Similarly, the coefficient for the difference in GDP per capita appeared with mixed signs, plus in case of model-I and model-IV and vice versa. Turning our focus to model-IV, the factor endowment variable is statistically significant at 1% level, meaning that if the difference in GDP per capita between Pakistan and its trading partner increases, bilateral trade flows between them will increase by 1.48% [=exp(0.39)]. This result supports the Heckscher-Ohlin model, i.e. if the difference in the factor endowments of two countries raises, subsequently trade between them will amplify too, or else the more similar these countries' factor endowments are, the more they will trade with one another.

Regarding the bilateral exchange rate, it appears with highly significant impact on bilateral trade flows between Pakistan and trading partner in all models. We have found positive coefficients for this variable, means that by 1% depreciation of the Pakistani currency (rupee) versus trading

partner countries' currencies will increase bilateral trade flow nearly 1.02%. One might wonder why a depreciation of Pakistani rupee encourages imports from rest of the world because the continuous growth in imports to fulfil the domestic demand. A country's openness has been one of the primary driving forces for stimulating growth A country's openness has been one of the primary driving forces for stimulating growth. A country's openness has been one of the primary driving forces for stimulating growth Sheng et al., (2019). In case of trade openness, variable significant and positive impact on bilateral trade flows between Pakistan and trading partner. A 1% increase in openness variable will increase bilateral trade by 1.2%, means that both countries have enough room to expand its bilateral trade volumes.

All coefficients of dummy variables are significant and with desirable signs expect trade agreement variable. We have noticed that Pakistan with countries those have trade agreements with Pakistan, the majority of countries are with negative trade balance in case of Pakistan. That is the reason we have a negative sign on all models except model-IV. In accordance with model-IV, a 1% increases in common religion, border, a trade agreement and landlocked country increase bilateral trade by 13.6%, 21.33%, 1.43% and 407.5% respectively. The countries belong to WTO members are not affecting the bilateral trade of Pakistan.

Evaluation of Trade potentials

The coefficients estimated from the gravity equation (3) model-IV are used to calculate the predicted bilateral trade flows of Pakistan, and then these predicted trade flows are compared to the actual trade flows to see whether or not trade potential exist in case of Pakistan with rest of the world. For the advantage of consuming less space, we split the whole duration (1992-2016) 25 years into 5 sub-sections and then estimated the average results of forecasted/predicted (P) and actual trade (A). Similarly, we demonstrated only 30 countries from our total sample of 198 countries. However, included top 15 countries those have highest bilateral trade potential and 15 with exhausted trade in the case with Pakistan. The bilateral trade potential outcomes for the latest period 2012-2016 average provided in table 4.

The constructive outcome suggests that Pakistan possess the satisfactory potential to enhance its bilateral trade with nearly 102 countries. The highest potential lies with countries Saudi Arabia, Malaysia, Somalia, Hong Kong, Iran and USA whereas actual trade has exceeded with countries like China, Oman, Spain, UAE, Germany and UK. Indeed these results confirm that Pakistan is presently focusing on trade with partners of exhausted potentials. China, UAE, Germany, Japan and USA are a few of the countries with which bilateral trade of Pakistan is the highest, amounting 47.5% Pakistan total trade volume in the year 2016, so far the results disclose that trade potential with the majority of these economies has exhausted. Consequently, even though the bilateral trade of Pakistan is subsequent to developed economies, the genuine trade potential of Pakistan lies with developing economies which are greatly unfulfilled.

Table 4: Bilateral trade potential of Pakistan, average (2012-2016)[2]

Country	**US$ 1000 ΔBTA***	**ΔBTB#**	**Country**	**US$ 1000 ΔBTA***	**ΔBTB#**
Saudi Arabia	930619.2	-0.12	**Argentina**	-95288.5	0.18
Malaysia	487806.0	-0.15	**Thailand**	-98670.6	0.13
Somalia	479964.1	-0.80	**Netherlands**	-106916.2	0.06
Hong Kong	449198.2	-0.37	**Belgium**	-117581.4	0.06

[2] The results for all countries are not presented here to conserve space, but they are available upon request.

Country	US$ 1000 ΔBTA*	ΔBTB#	Country	US$ 1000 ΔBTA*	ΔBTB#
Iran	446301.2	-0.45	**Viet Nam**	-139932.5	0.08
USA	438435.2	-0.04	**Indonesia**	-144571.4	0.19
Qatar	247767.4	-0.26	**Japan**	-145888.6	0.03
Switzerland	207655.9	-0.27	**India**	-160150.8	0.04
Bulgaria	200911.8	-0.77	**South Africa**	-177346.8	0.04
Australia	140908.2	-0.10	**UK**	-200472.3	0.18
Bahrain	109673.8	-0.28	**Germany**	-204183.0	0.05
Korea, Rep.	103898.4	-0.05	**UAE**	-221608.0	0.05
Turkey	100857.8	-0.06	**Spain**	-223432.4	0.01
Sri lanka	80440.4	-0.11	**Oman**	-288914.0	0.18
Myanmar	73098.2	-0.51	**China**	-332763.2	0.17

Note: *Positive value indicates export potential, otherwise exhausted potential;
#Negative value indicates export potential, otherwise exhausted potential.
Source: Authors' calculation based on equation (4) and (5).

Pakistan is chasing a policy of export-led enlargement, for which the concerns of market access are highly essential. Since Pakistan's exports are greatly concentrated in few commodities and only some countries. A supplementary diversified exports development policy in terms of products and markets is obligatory. Grave or bulky concentration of exports in few items and few markets can escort to export volatility which leads to boost the gap balance of payments Irshad and Xin, (2017a). There is a great need to concentrate on the issues that make obstacles in securing market access and economic associations with global markets especially with friend countries if Pakistan really wants to chase the policy of export-led growth profitably.

Conclusion and Policy implications

Trade is an essential part of the entire developmental effort and national growth of an economy. In this paper, we have examined the evolution of bilateral trade flows between Pakistan and rest of the world over the period 1992-2016 by employing gravity approach with PPML estimation technique which takes into account heterogeneity, zero trade and hence avoids potential biases. The high value of R-square in all models and particularly in model-IV proved that the gravity equation fits well in explaining the bilateral trade flows of Pakistan and exploring its unrealized trade potential with rest of the world. We have found the constructive significant relationship between GDPs (a proxy for market size) and bilateral trade volume whereas bilateral distance resulted in a negative relationship towards trade volume. Means greater the distance (trade cost) between countries lessen the bilateral trade between them. Pakistan trade with rest of the world support H-O theory (factor endowment) i.e. the difference in the factor endowments of two countries raises, subsequently trade between them will amplify as well. In case of bilateral exchange rate coefficient also positively influence the bilateral trade of Pakistan with rest of the world. One might wonder why a depreciation of Pakistani rupee encourages imports from rest of the world because Pakistan is a country with heavy dependence on foreign trade owing to the large volume of imports required to fulfil the mounting demands resulting from its economic revival and development. The coefficient for trade openness between Pakistan and trading partner also positively influence on bilateral trade between them.

Sharing a common religion and border increases trade significantly, while Pakistan shares border with Afghanistan, India, Iran and China. Pakistan has a trade agreement with three nations except for India due to some political constraint. While free trade agreements have a positive effect on the model- IV. The impact of free trade agreements on Pakistan trade still remained a controversial issue and under full utilization. Sometimes, free trade agreement and trade liberalization policies may also adversely impact local industry of a country. Successful implementation of free trade agreement would lead to a reduction or elimination of import tariffs that could have a negative impact. Irshad et al., (2016a) it is obvious that WTO membership is a plus point for countries to improve their trade volumes. However in our case, it is found no significant impact on bilateral trade of Pakistan while trade with landlocked countries negatively influences trade flows.

With regard Pakistan's bilateral trade potential with rest of the world the productive outcome suggests that Pakistan possess the satisfactory potential to enhance its bilateral trade with nearly 102 countries. The highest potential lies with countries Saudi Arabia, Malaysia, Somalia, Hong Kong, Iran and USA whereas actual trade has exceeded with countries like China, Oman, Spain, UAE, Germany and UK. Indeed these results confirm that Pakistan is presently focusing on trade with partners of exhausted potentials. China, UAE, Germany, Japan and USA are a few of the countries with which bilateral trade of Pakistan is the highest, amounting 47.5% Pakistan total trade volume in the year 2016, so far the results disclose that trade potential with the majority of these economies has exhausted. Consequently, even though the bilateral trade of Pakistan is subsequent to developed economies, the genuine trade potential of Pakistan lies with developing economies which are greatly unfulfilled.

Pakistan is chasing a policy of export-led enlargement, for which the concerns of market access are highly essential. Since Pakistan's foreign trade are greatly concentrated in few commodities as well as merely several countries. A supplementary diversified exports development policy in terms of products and markets is obligatory. Grave or bulky concentration of exports in few items and few markets can escort to export volatility which leads to boost the gap balance of payments. Reducing industrial and non-industrial expenditures of manufacturing, improving labour productivity and growing industrial production are significant factors for persistent foreign trade growth in Pakistan. Pakistan should endeavour to move from low value-added unqualified labour-intensive to technology-intensive high-value-added manufacturing. Presently climate of rapid trade liberalization, Pakistan's textiles and clothing sector and the rest prominent sectors will come under increasing competitive pressure from lower cost producers. Hence, there is need to address all of these issues for sustainable growth in bilateral trade of Pakistan as well as regional trade with rest of the world.

Taken as a whole, it can be distinguished that consequent supplementary factors might manipulate Pakistan's bilateral trade with rest of the world, for instance, geopolitical apprehensions, tariffs and pricing, as well as import replacement strategy in importing countries, the authors' recommend future research studies with disaggregated dataset regarding these factors philanthropic improved results are fewer miscalculations. Though, from our standpoint, this research, demonstrates constructive and has some appealing outcomes and conclusion, which can facilitate industrialists and policymakers to achieve a better view of Pakistan's bilateral trade with rest of the world particularly to potential countries.

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Appendix A. List of the Countries Used in the Empirical Application

Afghanistan	**Dominica**	**Lebanon**	**Sao Tome and Principe**
Albania	Dominican Republic	Lesotho	Saudi Arabia
Algeria	Ecuador	Liberia	Senegal
Andorra	Egypt	Libya, State of	Serbia
Angola	El Salvador	Liechtenstein	Seychelles
Antigua and Bermuda	Equatorial Guinea	Lithuania	Sierra Leone
Argentina	Eritrea	Luxembourg	Singapore
Armenia	Estonia	Macau	Slovakia
Aruba	Ethiopia	Macedonia, Rep.	Slovenia
Australia	Fiji	Madagascar	Solomon Islands
Austria	Finland	Malawi	Somalia
Azerbaijan	France	Malaysia	South Africa
Bahamas	French Polynesia	Maldives	Spain
Bahrain	Gabon	Mali	Sri lanka
Bangladesh	Gambia	Malta	St. Kitts and Nevis
Barbados	Georgia	Mauritania	St. Lucia
Belarus	Germany	Mauritius	St. Vincent and the Grenadines
Belgium	Ghana	Mexico	Sudan (N + S)
Belize	Gibraltar	Moldova	Suriname
Benin	Greece	Monaco	Swaziland
Bermuda	Greenland	Mongolia	Sweden
Bhutan	Grenada	Morocco	Switzerland
Bolivia	Guatemala	Mozambique	Syrian Arab Republic
Bosnia and Herzegovina	Guinea	Myanmar	Taiwan
Botswana	Guinea-Bissau	Namibia	Tajikistan
Brazil	Guyana	Nauru	Tanzania
Brunei Darussalam	Haiti	Nepal	Thailand
Bulgaria	Honduras	Netherlands	Togo
Burkina Faso	Hong Kong	New Caledonia	Tonga
Burundi	Hungary	New Zealand	Trinidad and Tobago
Cabo Verde	Iceland	Nicaragua	Tunisia
Cambodia	India	Niger	Turkey
Cameroon	Indonesia	Nigeria	Turkmenistan
Canada	Iran	Norway	Tuvalu
Central African Republic	Iraq	Oman	Uganda
Chad	Ireland	Palau	Ukraine
Chile	Israel	Panama	United Arab Emirates
China	Italy	Papua New Guinea	United Kingdom
Colombia	Jamaica	Paraguay	United States
Comoros	Japan	Peru	Uruguay
Congo, D.Rep.	Jordan	Philippines	Uzbekistan
Congo, Rep.	Kazakhstan	Poland	Vanuatu
Costa Rica	Kenya	Portugal	Venezuela

Côte d'Ivoire	Kiribati	Puerto Rico	Viet Nam
Croatia	Korea North	Qatar	West Bank and Gaza
Cuba	Korea, Rep.	Romania	Yemen
Cyprus	Kuwait	Russian Federation	Zambia
Czech Republic	Kyrgyzstan	Rwanda	Zimbabwe
Denmark	Lao PDR	Samoa	
Djibouti	Latvia	San Marino	