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Export, Import and Total Trade Potential of Pakistan: A Gravity Model Approach

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Abstract

This paper aims to find export, import and total trade determinants and potential of Pakistan by using augmented gravity model. Panel data for the period ranging from 2000 to 2013 across 38 countries has been used for analysis. The results obtained from gravity model confirms that export and import determinants are different from total trade determinants. Similarly, export and import potentials of Pakistan are different from total trade determinants. Pakistan has highest trade potential with Norway and Hungry while for exports the highest potential exist with Switzerland and Hungry and in case of imports Pakistan has highest potential with Norway followed by Philippines, Portugal and Greece. Border sharing countries offer lower transportation cost due to minimum distance as compared to non-border sharing countries. China and India are two major border sharing countries but only with China, Pakistan has exhausted its trade potential (both export and import potential).

1. 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. International Monetary Fund (IMF), World Bank and World Trade organization (WTO) are the main pillars in this regard. The economic development has also been characterized by the existence of free trade agreements and economic integration. South Asian Association for Regional Cooperation (SAARC), Economic Cooperation Organization (ECO), North American Free Trade Agreement (NAFTA) and Association of Southeast Asian Nations (ASEAN) are the dominant examples of such economic integration. Many countries are diverting their concentration to promote the economic growth through adopting this regional integration.

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 late 1980s. Many trade reforms and policies of IMF and WTO are adopted to promote free trade. Fairly open economy of Pakistan is characterized by large volume of exports and imports from different regions of world. Pakistan's major export markets are U.S.A, China, Afghanistan, U.K, Germany, France, Bangladesh, Italy and Spain. About 60% of total exports are concentrated in these markets. Major import markets of Pakistan are UAE, China, Kuwait, Saudi-Arabia, Malaysia, Japan, India, U.S.A, Germany and Indonesia. China is the major trading partner of Pakistan both in terms of exports and imports. However, in case of India the situation is quite opposite. Pakistan's exports to India are negligible while imports are higher (seventh major supplier).

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. The trade structure of Pakistan shows a chequered history. In 2006 the exports of Pakistan were 16% of the GDP while the imports were 29%. Pakistan's exports are decreasing with its neighboring and EU countries. However, the grant of Generalized Scheme of Preference (GSP) was considered to boost the trade volume of Pakistan with European countries. Exports of Pakistan with UAE, India and other Asian countries are also not showing higher level despite of the presence of

PTAs and FTAs with some countries like SAFTA with India and Bangladesh. Thus, it is important to find trade potential of Pakistan both in export and import perspective independently.

Determination of bilateral trade determinants and its impact on economic growth is the most debated topic among the economists. Gravity model has been widely used in computing trade potential. In literature the direction of future trade is determined through the difference of estimated gravity model trade flow and actual trade flows (trade potential). But mostly the studies are conducted to find the total trade potential of a country with its trading partners. Trade is not segregated into its two components i.e. export and import. Particularly for Pakistan few studies are conducted to find the total trade and export potential with partner countries. Total trade flow of a country for a particular market is quite different from export and import markets separately. Picture of total trade potential may be different from export and import potential. So that it is import to explore this side of trade.

The objective of this study is to quantify Pakistan's trade potential with its border sharing and other trading partners. The specific objectives of this study are: to analyze the determinants of total trade as well as export and import determinants of Pakistan, to find the role of spatial friction in Pakistan's trade prospects, and to find Pakistan's total trade, import and export potential with its border sharing and other trading partners. The study will provide a useful insight into the trade direction of Pakistan with its neighboring countries and other trading partners. Various policy implications will be provided by this study in order to exploit untapped trade potential of Pakistan. Augmented gravity model is used to find the trade potential of Pakistan with its border sharing and other trading partners with 38 countries from 2000 to 2013 at annual frequency.

The remainder of the paper is organized in the following manner. Previous literature is discussed in Section 2. Model, methodology and data are described in section 3. The empirical results on the determinants and potential are analyzed in section 4. Section 5 contains concluding remarks and policy recommendation.

2. Literature Review

A lot of theoretical and empirical literature exists on the role of trade and development. There are several dimensions of trade that has been investigated by researchers. But the most attracted question is to find the trade determinants and future possibilities of trade expansion of a country. The gravity model has been widely used in measuring trade flows.

Tinbergen (1962) was the first who used the concept of Newton gravitational law in measuring trade flows among countries. In his work "Shaping the World Economy" he proposed that bilateral trade flows between countries have direct relation with economic size and indirect relation with distance between them. This initial gravity model lacked the theoretical background. Tinbergen (1962), gravity equation was derived from different international trade models in order to justify its theoretical foundation. Linneman (1996) derived it from partial equilibrium model of import demand and export supply by incorporating three types of shipping cost (physical cost, time related cost and cost incur due to cultural differences). Gravity model from constant elasticity of substitution (CES) between traded and non-traded goods was derived by Anderson (1979). Bergstrand (1985 & 1989) found that gravity model is the reduce form of general equilibrium of demand and supply. Derivation of Deardoff (1995) gravity model is from H-O model of complete specialization.

Frankel and Romer (1999) analyzed the impact of international trade on living standards. They conducted a cross-country analysis for 1985 and for 63 countries. This study focused on using the geographical factors to find the direction of causation between income and trade. The results indicated that trade and income has positive relation and within country trade increases through physical and human capital formation and geographical factors. Anderson and Wincoop (2003) justified the theoretical foundation of gravity model. McCallum's gravity equation was used to find the relation between trade cost and benefits of trade both for inter-provincial and state-provincial trade by using pool data of about 30 states of US and Canada. The findings of the study indicated that national boarders reduce trade between US and Canada in greater magnitude as compared to with other states.

2.1 Literature on Export, Import and Total Trade Determinant

Karemera et al. (1990) modify the traditional gravity model to find the benefits and determinants of trade flows in Pacific Rim. The study used the pool data ranging from 1984 to 1993 by

incorporating gross domestic product, exchange rates, domestic whole sales price indices, population, dollar volume of trade flows, Import and export unit values, distance as a proxy for transportation cost and geographical factors impeding trade flows, spot exchange rate, inflation and dummy variables. The results indicate that all variables included in gravity model are significant and determinants of trade in Pacific Rim. Lai and Zhu (2004) found the determinants of bilateral trade by using panel and cross-sectional data of 34 countries by incorporating distance, average tariffs, time-varying tariffs, labor productivity adjusted wages and total factor productivity-adjusted wages. The results demonstrate that tariff liberalization is more beneficial for poor countries as compared to rich countries and trade shifts from continental preferential trading areas to intercontinental trading partners.

Rahman (2005) worked for theoretical justification of gravity model and analyzed the trade performance of Bangladesh with its major trading partners. This panel data study comprises on 23 countries from SAARC, ASEAN, NAFTA, EEC and Middle East for the period of 1972 to 1999. Results of the study are consistent with theoretical foundation of gravity model. He found that major determinants of Bangladesh's trade are economic size, distance, trade openness and demand for imports. Wang et al. (2010) worked on trade flows in 19 OECD countries by modifying gravity equation. They incorporated the FDI stocks and domestics R&D in the traditional gravity model for the period ranging from 1980 to 1998 to find the log run relationship. The results obtained show that although distance is the most important determinant of trade flows, inward FDI stocks and total domestic R&D also play an important role in determining the trade flows in OECD countries.

Roy and Rayhan (2011) examined the factors effecting Bangladesh's import structure. They analyzed time series, cross sectional and pool data in order to present an over view of different methodologies related to gravity model for the period ranging from 1991 to 2007 across 14 countries. The study found that GDP of home and partner countries, exchange rate and distance are the main determinants of Bangladesh's imports. The results obtained from cross sectional gravity model approach demonstrate that Bangladesh has import potential for SAARC region especially with India. Raimondi and Olper (2011) examined the impact of elimination of tariff on trade in food industry and used cross-sectional data for 193 exporter and 99 importer countries for 18 food industries. Through standard CES and gravity equation they proved that trade

liberalization has greatly increased the food export particularly more in developed countries and less in under-developed countries who are suffering with loss of market share. The results are consistent with current evidence obtained from general equilibrium analysis.

Malik and Chaudhry (2012) critically evaluate the import policy during 1990s of Pakistan and find the import determinants of Pakistan with some Asian countries. They estimated the gravity model with generalized least square method by using panel data from 1996 to 2006. The study focused on macroeconomic determinants to resolve the trade problems. The study found that exchange rate and income of partner country are the major determinant of imports as well as the openness of the partner country is the major reason of increased import volume of Pakistan. Iqbal et al. (2014) worked on regional integration to analyze the import structure of Pakistan. The study used time series data for the period from 1971 to 2012. For long run relationship, they estimated the demand model of imports of Pakistan by Autoregressive distributed lag (ARDL) methodology. The study found that import prices and real income are the major determinants of import demand. They also indicate that regional agreements are not successful in making sources for imports from partner countries for Pakistan.

2.2 Literature on Export, Import and Total Trade Potential

Hirantha (2004) examined the progress of SAPTA and prospects for SAFTA by using gravity model. He estimated the gravity model by conducting a separate analysis for cross sectional (1996, 1999 and 2002) and panel data (1996-2002) by applying generalized least square method. The results of the study support trade creation argument for SAPTA and no evidence found for trade diversion with the rest of world. The results encourage further regional integration because it may bring about more trade prospects to SAARC region. Moreover, with the reduction of tariff and other non-tariff barriers among members, intra-regional trade can be increased. Benedictis and Vicarelli (2005) aimed to get better specification through gravity model by including time-invariant country specific static and dynamic effects in terms of potential trade. The study estimated exports of goods and services for 11 exporter and 32 importer countries for a period ranging from 1991-2000. The study found that dynamic specification provides more accurate results of actual and potential trade than static formulation of gravity model.

Achakzai (2006) estimated intra-ECO trade potential for Pakistan. The purpose of this study is to explore that Pakistan has great trade potential with ECO members but it got lower share than its potential. The study estimated standard gravity model by OLS and used the pool data of 137 countries for the year 2005. The results show that ECO has significant impacts on intra-regional trade. It means that actual trade flows between Pakistan and ECO member countries is lower than what would be predicted by gravity model. This analysis suggest that regional integration among ECO member countries has greater scope especially for those having common geographical border. Fontoura et al. (2006) analyzed trade potential of 25 EU member countries during its eastern enlargement for manufactured products. Gravity model is estimated by Poisson Pseudo-Maximum Likelihood Method as considered to be better than Ordinary Least Square. This study also included the Commodity Composition of Trade. They found that Central and Eastern European Community (CEEC) has exhausted their export potential during this enlargement but the same case does not exist with imports from EU countries.

Rahman et al. (2006) examined trade creation and trade diversion effects of RTAs, particularly SAFTA. They utilized the panel data of 61 countries ranging from 1991 to 2003. Traditional gravity model is augmented by some important variables like bilateral exchange rate, and bilateral free trade agreement. Gravity model with country specific pair and year specific fixed effects is used. They estimated the gravity model by Tobit model and OLS. The study concludes that SAPTA caused export creation effects within the block and net export diversion effects as well. Ruiz and Vilarrubia (2007) attempted to estimate the trade potential in Southern and Eastern Mediterranean countries by including important variables of importer and exporter countries to remove biasness. They use panel data of 102 countries for the period from 1976 to 2005. Gravity model with country-yearly dummies for exporter and importer countries has used. The study found that omission of multilateral trade resistance variable strongly effect the estimation of export potentials and estimation regarding free trade agreements. The study has also found that export expansion opportunities are present with US.

Butt (2008) examined the export potential of Pakistan with global and bilateral trading partners for 19 sectors of the economy. Gravity model is estimated by Pseudo maximum likelihood method. This study employed geographical, historical and cultural factors in gravity model and estimation results are consistent with theoretical background of these variables. He concluded

that trade potential of Pakistan is highest for India, Japan, Hong Kong, China and USA. Pakistan has highest export potential with India in 13 out of 15 sectors. Rahman (2009) estimated the trade potential of Australia. The study utilized cross sectional data of 50 countries for the years 2001 to 2005 and estimated gravity model by OLS. The Australia's bilateral trade determinants are openness, distance, GDP, GDP per capita and common language. The study also found that the highest trade potential of Australia exist with Singapore, Argentina, the Russian Federation, Portugal, Greece, Chile, the Philippines, Norway, Brazil and Bangladesh.

Simwaka (2010) attempted to estimate the expected trade potential from Southern Africa Development Community's FTA and to determine the difference between potential and actual trade among member countries. He estimated gravity model by maximum likelihood method for annual data ranging from 1991 to 2000. The study found that potential trade is more than observed intra-regional trade and there is trade potential in sub-regions. This study has also found that FTA in SADC leads to trade creation in the region. Kaur and Nanda (2010) quantified the export potential of India with SAARC countries. Panel data for seven countries ranging from 1981 to 2005 has used. Gravity model is estimated by fixed effect, random effect and pool estimation. The study found that export potential is high for Nepal, Bhutan, Maldives and Pakistan. India can expand its export with SAARC members by removing trade barriers as it has geographical advantage of having common border with four countries in SAARC region. Salim et al. (2011) tested the hypothesis that whether there is trade enhancement of Gulf Cooperation Council (GCC) member countries. A panel data ranging from 1980 to 2008 is estimated by standard augmented gravity model and stochastic frontier gravity model. The study found significant trade enhancing effects for member countries.

Akhter and Ghani (2010) attempted to analysis the trade potential and benefits of regional integration through SAFTA for member and non-member countries. The study measured the bilateral trade flows and benefits of SAARC countries by Gravity model for the period of 2003 to 2008. They estimated gravity model by cross sectional and pool data. The findings of the study indicated that for SAARC countries regional trade agreement can increase the trade potential and benefits for both member and non-member countries. They specifically indicate the major players of agreements i.e. India, Pakistan, and Sri Lanka. Gul and Yasin (2011) estimated the trade potential of Pakistan with its traditional and other important trading partners. A panel

data for the period of 1981 to 2005 has used for the analysis. Traditional gravity is augmented by introducing cultural effects like dummy for common border, language and regional groupings are included. Due to large number of cross-section random effect model is used to estimate model. The results illustrate the fact that trade volume of Pakistan is low with SAARC region particularly with India. The reason behind this low volume of trade is political and military tension between both countries. The results also showed that Pakistan's highest trade potential exist in Asia-Pacific region followed by ASEAN and EU. Khan et al. (2013) aimed to examine bilateral trade flow of Pakistan with major trading partners. This study utilized panel data sample for the period ranging from 1990 to 2010 with a frequency of two years for analysis. Traditional variables of gravity model like GDP, distance and GDP per capita are significant while cultural similarities are showing negative relationship with trade volume. The results indicate that Pakistan has untapped trade potential with Turkey, Japan, Iran, India and Malaysia.

Although a rich literature is available on trade potential but mostly the studies are conducted to measure total trade potentials. Few studies are conducted in separate analysis of trade (export and import) especially for Pakistan. Total trade flow of a country for a particular market is quite different from export and import markets separately. Picture of total trade potential may be different from export and import potential. Therefore, it is import to explore this side of trade.

3 Model, Methodology and Data

3.1 The Model

This study uses gravity model to find the trade potential of Pakistan with its border sharing and other trading partners. Gravity model is actually derived from Newton gravitational law which states that two heavenly bodies attract each other in proportion to the product of their masses and inversely related to their distance. The basic concept behind this model is that the trade of a country has direct relation with size of partner country and indirect relation with distance between them. Distance is the proxy for transportation and information cost. As the distance decreases trade increases. Tinbergen (1962) was the first one who used this concept in the analysis of bilateral trade flows. The simplest form of gravity model used by Tinbergen (1962) was:

$$E_{ij} = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} \quad \textbf{(1)}$$

Where, **E** is the export, **i** shows exporter country and **j** shows importer country, **Y** is the Gross National Product (GNP), **D** is the distance and **α** is the scaling factor.

Tinbergen (1962) relate the Newtonian's Gravitational force with bilateral exports($\mathbf{E_{ij}}$) and masses are related with GNP of both countries that is the proxy for economic size. He used distance as a proxy for transportation cost that inversely effect trade volume between countries. Tinbergen (1962) modified the gravity equation through the addition of three dummies:

$$E_{ij} = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} N_{ij}^{\alpha_4} P_c^{\alpha_5} P_b^{\alpha_6} \quad \textbf{(2)}$$

Where, $\mathbf{N_{ij}}$ is the border dummy for country **i** and **j**, $\mathbf{P_c}$ is the common wealth preference dummy variable and $\mathbf{P_b}$ is the benelux preference dummy variable.

3.2 Methodology

3.2.1 Econometric Model

This study uses generalized gravity model that states that total trade between pair of countries is a function of GDP or population of countries (proxy of size), their distance (proxy of transportation costs), and a set of dummies that may facilitate or hinder the trade between countries. In addition to basic gravity variables, there may be some other factors effecting bilateral trade. Role of development, factor endowment, geographical location, trade agreements and cultural similarities are taken into account to find the trade potential of Pakistan. This study uses Tinbergen (1962) basic gravity equation along with some additions:

$$Y_{ij} = \alpha_0 X_{1i}^{\alpha_1} X_{2j}^{\alpha_2} X_{3ij}^{\alpha_3} A_{ij}^{\alpha_4} D_{ij}^{\alpha_5} \quad \textbf{(3)}$$

Where, $\mathbf{Y_{ij}}$ is the total trade between country i and country j, $\mathbf{X_{1i}}$ is the GDP of country i, $\mathbf{X_{2j}}$ is the GDP of country j, $\mathbf{X_{3ij}}$ is the distance between i and j countries, $\mathbf{A_{ij}}$ is the vector of all other independent control variables included in the basic gravity model of Tinbergen (1962), $\mathbf{D_{ij}}$ is the vector of all dummy variables for country i and j, and **α** is the vector of coefficient of all independent variables.

To make the model linear from multiplicative form take logarithm of the equation (3) therefore, the model in log-linear form is:

$$\log Y_{ijt} = \alpha_0+\alpha_1 \log X_{1it}+\alpha_2 \log X_{2jt}+\alpha_3 \log X_{3ijt}+\alpha_4 \ln A_{ijt}+\alpha_5 D_{ijt}+U_{ijt} \quad \textbf{(4)}$$

Where, **log** denotes logarithm, $\boldsymbol{A_{ijt}}$ indicates independent control variables of the study that include per capita GDP differential (PCGDPD), total trade/ exports/ imports to GDP ratio, exchange rate (exch) and inflation rate (inf).

PCGDP differential (PCGDPD) of trading partners is taken to prove Heckscher-Ohlin (H-O) or Linder's hypothesis. Total trade/ exports/ imports to GDP ratio is taken as a proxy for trade openness that shows trade intensity of trading partners. Exchange rate between trading partners and inflation rate in both countries are taken to capture the impact of change in currency value and purchasing power (Rahman, 2005). Following the Wang and Winter (1991) this study is including border and language dummies to capture the impacts of cultural similarities between trading partners. Dummies for economic/ regional communities are included in the model to see the effects of regional integration on bilateral trade flow (Gul & Yasin, 2011). This study also includes the dummies ethnicity to capture informal trade barriers (for detail description of variables seen Appendix)

This study estimates three gravity models for Pakistan's bilateral trade with 38 trading partners for the period of 2000 to 2013: (a) the gravity model of total trade (export + import), (b) the gravity model of exports, and (c) gravity model of Pakistan's imports.

Thus, the gravity model for total trade is:

$$log(T_{ijt}) = \alpha_0 + \alpha_1 \log(GDP_{it}) + \alpha_2 \log(GDP_{jt}) + \alpha_3 log(PCGDPD_{ijt}) + \alpha_4 \log(Dis_{ijt}) + \alpha_5 log(T/Y_{it}) + \alpha_6 log(T/Y_{jt}) + \alpha_7 (Border_{ij}) + \alpha_8 (Lan_{ij}) + \alpha_9 (RTA) + \alpha_{10} (Ethn_{ij}) + U_{ijt} \quad \textbf{(5)}$$

Gravity model for total exports:

$$log(EXP_{ijt}) = \alpha_0 + \alpha_1 \log(GDP_{it}) + \alpha_2 \log(GDP_{jt}) + \alpha_3 log(PCGDPD_{ijt}) + \alpha_4 log(Dis_{ijt})$$
$$+ \alpha_5 log(IMP/Y_{jt}) + \alpha_6 log(T/Y_{it}) + \alpha_7 log(Inf_{it}) + \alpha_8 log(Inf_{jt})$$
$$+ \alpha_9 log(Exch_{ijt}) + \alpha_{10}(Border_{ij}) + \alpha_{11}(Lan_{ij}) + \alpha_{12}(RTA) + \alpha_{13}(Ethn_{ij})$$
$$+ U_{ijt} \quad \textbf{(6)}$$

Gravity model for total imports:

$$\log(IMP_{ijt}) = \alpha_0 + \alpha_1 \log(GDP_{it}) + \alpha_2 \log(GDP_{jt}) + \alpha_3 log(PCGDPD_{ijt}) + \alpha_4 log(Dis_{ijt})$$
$$+ \alpha_5 log(EXP/Y_{jt}) + \alpha_6 log(T/Y_{it}) + \alpha_7 log(Inf_{it}) + \alpha_8 log(Inf_{jt})$$
$$+ \alpha_9 log(Exch_{ijt}) + \alpha_{10}(Border_{ij}) + \alpha_{11}(Lan_{ij}) + \alpha_{12}(RTA) + \alpha_{13}(Ethn_{ij})$$
$$+ U_{ijt} \quad \textbf{(7)}$$

Where, T_{ij} is the total trade between country i and country j, EXP_{ij} is the total exports between country i and country j, IMP_{ij} is the total imports between country i and country j, GDP_i is gross domestic product of country i, GDP_j is gross domestic product of country j, $PCGDPD_{ij}$ is per capita gross domestic product differential between country i and j, $Dist_{ij}$ is distance between country i and country j, T/Y_i is the total trade to GDP ratio of country i, T/Y_j, EXP/Y_j, IMP/Y_j is the total trade/export/import to GDP ratio of country j respectively, Inf_i is the inflation rate of country i, Inf_j is the inflation rate of country j, $Exch_{ij}$ is the exchange rate between country i and country j, $Border_{ij}$ is the dummy variable for common border between country i and j, Lan_{ij} is the dummy variable for common language between country i and j, RTA is the dummy variable for regional trade agreements, $Ethn_{ij}$ is the dummy variable for common ethnic group between country i and j.

3.3 Panel Data Framework

Traditionally cross-sectional data is used to estimate bilateral trade flows through gravity model for a particular time period. Cross-sectional and time series data yields biased gravity model estimates due to heterogeneity (Chang & Wall, 2005). However, panel data estimation shows

many advantages over cross-sectional and time series data due to its control for individual heterogeneity. Panel data framework increases the efficiency of econometric estimates by reducing collinearity among independent variables through large degree of freedom. Many estimation techniques have been used in panel data analysis. The most common are fixed effect model (FEM) and random effect model (REM) (Gujrati, 2003). In FEM, both individual and time effects are brought under consideration along with different intercepts for each individual and time period. In FEM, slope coefficients are constant. When individual intercepts may be correlated with one or more explanatory variables the FEM is appropriate (Gujrati, 2003). On the other hand REM assumes that intercept of each cross section is a random variable and are drawn from a large population with constant mean (Gujrati, 2003). The individual intercept then shows deviation from constant mean value. This model is appropriate when random intercept of each cross sectional unit is uncorrelated with explanatory variables. On important benefit of using this approach is that it uses less degree of freedom so that we need not to estimate N cross sectional intercepts.

This study intended to estimate the effects of both time-invariant and time-variant variables in bilateral trade determinants and potential of Pakistan across different countries. Therefore, REM is preferred to FEM (Ozdeser & Ertao, 2010). REM is also preferred as number of cross section are greater than time period (Gujrati, 2003).

3.4 Trade Potentials

Computation of trade potential (export and import) is also associated with gravity model estimation. Different studies use different methods to compute trade potentials predicted by gravity model. The most common one is to apply point estimated coefficients on regressors to compute trade potential predicted by gravity model. The study has computed trade potential with the help of following formula:

Predicted – Actual trade flows **(8)**

Predicted values are obtained from gravity models of total trade, export and import. Positive value indicated that there exist future possibility of trade expansion while negative value

indicates that country has exhausted its trade potential with selected trading partners (Batra, 2004).

3.5 Data

The study has selected 38 trading partners of Pakistan to check the trade potential between trading partners and border sharing countries. This panel data study is conducted for the period of 2000 to 2013 at annual frequency. The data for bilateral trade (exports and imports) is taken from UN Comtrade database, GDP, GDP per capita and inflation is from World Development Indicators (WDI). Data for distance is collected from www.countries-ofthe-world.com and data for exchange rate is taken from Pakistan Economic Survey and International Monetary Fund (IMF) (see Appendix for detail). The selected countries are India, Iran, China, USA, UK, UAE, Germany, Bangladesh, Kuwait, Saudi-Arabia, Malaysia, Indonesia, Spain, Turkey, Italy, Japan, Australia, Canada, New Zealand, Hong Kong, Brazil, Mexico, Belgium, France, Egypt, Switzerland, Greece, Sweden, Sri Lanka, Portugal, Singapore, Hungry, Chile, Norway, Denmark, Thailand, Philippines, and Netherland.

4 Results

4.1 Total trade Determinants

The study has estimated total trade gravity model through random effect model by adopting general to specific model approach. Dependent and independent variables are in log form therefore, the estimated coefficients of explanatory variables are elasticity of corresponding variables. The estimated coefficients measure marginal contribution of independent variable to dependent variable keeping the other variables constants. We have computed five models by applying REM in order to find trade determinants of Pakistan. The study has excluded one by one those variables that are insignificant. The regression results of total trade gravity model are given in table 4.1.

Model 1 includes traditional gravity variables (GDP and distance) of Tinbergen (1962) along with some dummies (to capture cultural effects) and other variables as they are expected to be important determinants of Pakistan's bilateral trade (exports + imports). The results show that in

model 1, GDP of Pakistan and other trading partners (economic size), trade openness of Pakistan and trading partners and distance are statistically significant and carrying expected signs. Dummies included to capture cultural impacts on trade are found to be insignificant. Dummy for regional integration is also found to be insignificant.

Table 4.1: Gravity Model of Total trade

Variables	Model 1	Model 2	Model 3	Model 4	Model5
C	2.3301 (4.22)	2.9099 (4.0)	2.3566 (4.0)	3.0269 (3.56)	2.8934 (3.53)
LGDPI	0.1074 (0.07)	0.1155 (0.07)	0.1171 (0.07)	0.1178*** (0.07)	0.1303** (0.06)
LGDPJ	0.6887* (0.08)	0.6860* (0.08)	0.6858* (0.08)	0.6969* (0.08)	0.6950* (0.08)
LPCGDPD	0.1124** (0.05)	0.1097** (0.05)	0.1053*** (0.05)	0.0969*** (0.05)	0.0999** (0.05)
LTOPI	0.9658* (0.13)	0.9668* (0.13)	0.9708* (0.13)	0.9671* (0.13)	0.9574* (0.13)
LTOPJ	0.3364* (0.09)	0.3290* (0.09)	0.3266* (0.09)	0.3241* (0.09)	0.3190* (0.09)
LDIST	-1.4260* (0.47)	-1.4885* (0.45)	-1.4008* (0.45)	-1.4785* (0.39)	-1.4685* (0.39)
LEXCH	0.0269 (0.04)	0.0218 (0.04)	0.0254 (0.04)	0.0204 (0.04)	---------
ETHN	1.1411 (0.74)	1.1405 (0.73)	1.3529*** (0.73)	1.3744** (0.71)	1.3968** (0.71)
BORDER	0.0933 (0.78)	0.2340 (0.71)	0.2700 (0.72)	----------	----------
RTA	0.3400 (0.64)	----------	----------	----------	----------
LNG	0.5855 (0.40)	0.5980 (0.39)	-------	--------	----------
R^2	0.73	0.73	0.73	0.73	0.73

Note: Standard errors are reported in parenthesis.
*, ** and *** indicates 1%, 5% and 10% level of significance respectively.

We exclude insignificant variables one by one to see the impact on other variables. Starting with dummy variables, model 2 excludes RTA dummy variable keeping all other variables of model 1. There is only a slight change in the magnitude of estimated coefficients of model 2 as

compared to model 1. In model 3, LNG (language) dummy is excluded that makes PCGDPD variable significant at 10% level. Model 4 excludes border dummy that makes GDP_i significant at 10% level. Model 5, is the final estimated model having GDP of Pakistan and other trading partners, PCGDP differential supporting H-O hypothesis that means countries having different factor of endowment usually trade more, trade openness of country i and j, distance and ethnicity variables. All these variables are statistically significant and having expected signs. All models have approximately same explanatory power.

The final augmented gravity model for determining determinants of Pakistan's total trade is:

$$\log(T_{ijt}) = \alpha_0 + \beta_1 log\ (GDP_{it}) + \beta_2 log\ (GDP_{jt}) + \beta_3\ log\ (PCGDPD_{ijt}) + \beta_4 \log(Dis_{ijt}) + \beta_5 log(T/Y_{it}) + \beta_6\ log\ (T/Y_{jt})\ + \beta_7\ (Ethn_{ij}) + U_{ijt}$$

The estimated results for gravity model of total trade are:

$$log(T_{ij}) = 2.839 + 0.130\ log(GDP_i) + 0.695 \log(GDP_j) + 0.099\ log(PCGDPD_{ij}) - 1.46\ log(Dis_{ij}) + 0.957\ log(T/Y_i) + 0.319\ log(T/Y_j) + 1.396(Ethn_{ij})$$

GDP of trading countries (proxy for economic size) is the traditional and core variable of gravity model, carrying expected sign and also statistically significant. The result supports the positive relation between economics size of trading partners and trade flows. The estimated coefficient of per capita GDP differential (country i and country j) has positive sign and statistically significant at 10% level. Positive sign of estimated coefficient indicates that H-O hypothesis dominates Linder's hypothesis which means that those countries usually trade more who has different factor of endowment. Distance is another core variable of gravity model that found to be statistically significant at 1% level and carrying expected negative sign. Distance is the proxy for transportation cost and other time related costs. There is negative relation between trade flows and distance between trading countries. It means as the distance increases trade between countries decreases due to higher transportation cost. Thus there exist theoretical consistency of distance variable with hypothesis of gravity model. Trade to GDP ratio (proxy for openness) for country i and j have expected positive sign and also statistically significant at 1 % level. The results are supporting theoretical reasoning of this variable that more the open economy of

trading countries more will be the trade between them. Exchange rate among countries have strong impact on trade flows. There exists negative relation between exchange rate and net exports. Thus, depreciation encourage exports and discourage imports. The results indicate that exchange rate has no impact on total bilateral trade flow.

This study has included some dummy variables to capture cultural effects on trade flow. Border is the dummy that takes the value 1 for India, Iran and China. It is however, believed that countries having common borders usually share common customs, traditions and consumption pattern. So, there is expected positive relation between common border and trade flows. But results are contradicting with theoretical reasoning of this variable. These results are may be because of substantial trade volume between Pakistan and India due to military and political tension. Language is another dummy variable included to capture cultural effects. This variable carries expected positive sign but it is statistically insignificant. RTA dummy is included to see the impact of regional integration on trade flow. Results show that regional integration has no impact on international trade. Only the ethnicity (dummy variable) has expected positive sign and found to be statistically significant at 5% level. This variable is included to capture informal barriers. It is usually believed that the migrants in a country sometimes change the traditions and consumption patron of host country. Sometimes people from other countries come with a skill that may has an impact on international trade. The results are consistent with the findings of Rahman (2005).

4.2 Total Trade Potential of Pakistan

Another useful aspect of gravity model is to predict future trade flows or export and import flows. In other words, it is used to compute trade potentials i.e. the difference between predicted value (as computed by gravity model estimates) and actual bilateral trade flows. The study has estimated the total trade potentials of Pakistan with 38 partner countries for the period 2000 to 2013.

Table 4.2 presents total trade potentials (average) by taking the difference between predicted value (P) and actual trade flows (A) i.e. value of P-A. A positive value shows future possibilities of total trade expansion. On the other hand a negative value shows that Pakistan has exceeded its total trade potential with particular trading partner (Batra, 2004).

Table 4.2: Total Trade Potential of Pakistan (Average)

Indicator Countries	(P-A) 2000 – 2004	(P-A) 2005 – 2009	(P-A) 2010 - 2013
Australia	-0.9059	-0.4813	-0.3337
Bangladesh	-2.4820	-2.7680	-4.5070
Belgium	-1.3956	-0.0141**	-0.1692
Brazil	0.6421	-0.2069	0.1660
Canada	0.0219	-0.0356**	0.0961
Chile	-0.4604	-0.0909**	-0.1826**
China	-0.2868**	-0.6658	-0.8027
Denmark	1.2227*	1.0475	0.3866
Egypt	0.0208	-0.2617	-0.0849**
France	0.4656	0.5600	0.5394
Germany	0.2239	0.1857	0.1499
Greece	0.9465	1.1241*	1.4476*
Hong Kong	0.0151	0.3854	0.8065
Hungry	1.6647*	1.2313*	1.8901*
India	-0.1188**	-0.5568	-0.4386
Indonesia	-1.5610	-1.6940	-1.4644
Iran	0.3994	0.4032	1.3119
Italy	0.3259	0.1468	0.2062
Japan	0.6008	0.3458	0.3544
Kuwait	-1.5316	-1.2853	-1.6180
Malaysia	-0.2906**	-0.3797	-0.7773
Mexico	1.1592*	0.9442	0.7741
Netherland	0.0718	0.2856	0.2881
New Zealand	-0.1502	-0.2164	-0.0244**
Norway	1.9535*	1.7561*	2.0506*
Philippines	1.3428	0.9201	0.7977
Portugal	0.1814	0.2759	0.2845
Saudi Arabia	-1.4028	-1.4065	-1.1920
Singapore	0.2310	0.6079	0.5665
Spain	0.2721	0.2557	0.0497
Sri Lanka	-1.5037	-1.5624	-1.5478
Sweden	1.1192	0.3806	0.8617
Switzerland	0.1184	0.2848	0.8133
Thailand	-0.8127	-0.9495	-0.8972
Turkey	0.4191	0.3650	0.3251
UAE	-1.9285	-1.8329	-2.1663
UK	-0.4436**	-0.3286	-0.4223
USA	-1.0036	-1.0730	-0.9049

Note: * shows highest trade potential and ** shows exhausted trade potential

The study has computed the average of 5 years in order to handle the results, while last average is of 4 years. The average trade potential (P-A) of Pakistan was highest for Norway followed by Hungry, Philippines, Denmark and Mexico during 2000 to 2004 showing that Pakistan had maximum trade potential with these countries while for those (China, India, Malaysia, UK etc.)

countries having negative value Pakistan had exceeded its total trade potential. For the period 2005 to 2009 average value of total trade potential was highest for Norway, Hungry and Greece while with many countries like Belgium, Canada and Chile Pakistan has exceeded its total trade potential. During the recent years from 2010 to 2013 Pakistan has highest trade potential with Norway and Hungry as P-A value is highest for these countries. During this time period Pakistan has exceeded its trade potential with many countries like New Zealand and Egypt.

4.3 Export Determinants

We have also estimated export and import model independently. In these models we have included some other variables like exchange rate, import and export openness of trading countries and inflation to capture their impact on bilateral trade. The regression results of export model are given in table 4.3.

We have estimated seven gravity models of exports of Pakistan with 38 trading partners. Model 1, has all variables that are assumed to have impact on exports. Regression results of model 1, indicates that GDP of partner countries, import openness of importing countries, prices in importing countries, distance, language, regional integration and geographical adjacency (common border) have significant impact on exports of Pakistan. In model 2, ethnicity dummy is excluded as it is insignificant in model 1. PCGDP differential becomes significant at 10% level due to the exclusion of ethnicity variable. In model 3, border dummy is excluded and leaving a small change in the magnitude of estimated coefficients of variables. In model 4, price of goods in Pakistan is excluded, as it is insignificant in model 3. Exclusion of this variables makes trade openness of Pakistan significant at 10% level. In model 5, study has excluded GDP of Pakistan, as this variable in insignificant and carrying opposite sign in all estimated models. In model 6, study has excluded RTA dummy variables that makes trade openness variable of Pakistan insignificant. In model 7, trade openness of Pakistan is excluded. This is the final estimable gravity model of bilateral exports of Pakistan. In this model all variables are statistically significant and carrying expected sign.

Table 4.3: Gravity model of Export

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model7
C	0.3180 (3.65)	-0.4282 (3.56)	-2.1818 (3.36)	-1.8137 (3.26)	-1.7808 (3.47)	0.1185 (3.22)	0.5785 (3.16)
LGDPI	-0.0811 (0.08)	-0.0791 (0.80)	-0.0637 (0.80)	-0.0832 (0.07)	------	-------	--------
LGDPJ	0.8947* (0.10)	0.8791* (0.09)	0.8166 (0.09)	0.8178* (0.80)	0.7596* (0.07)	0.7829* (0.06)	0.8167* (0.06)
LPCGDPD	0.0954 (0.06)	0.1033*** (0.06)	0.1396* (0.05)	0.1395* (0.05)	0.1404* (0.05)	0.1230** (0.05)	0.1183** (0.05)
LIOPJ	0.5315* (0.11)	0.5566* (0.11)	0.5451* (0.11)	0.5464* (0.11)	0.4899* (0.10)	0.4826* (0.10)	0.5241* (0.10)
LINFJ	-0.0763* (0.02)	-0.0775* (0.02)	-0.0767* (0.02)	-0.0777* (0.02)	-0.0760* (0.02)	-0.0738* (0.02)	-0.0695* (0.02)
LDIST	-1.0992* (0.39)	-1.0146* (0.38)	-0.7993** (0.36)	-0.7994** (0.36)	-0.7958** (0.38)	-1.0101* (0.35)	-1.0189* (0.35)
LEXCH	-0.0735 (0.04)	-0.0671 (0.04)	-0.0527 (0.04)	-0.054439 (0.04)	-0.0794*** (0.04)	-0.0941** (0.04)	-0.1008** (0.04)
LINFI	-0.0206 (0.04)	-0.0210 (0.04)	-0.0230 (-0.04)	-------	--------	-------	-------
LTOPI	0.3045 (0.20)	0.3071 (0.20)	0.3340*** (0.20)	0.2768*** (0.15)	0.2682*** (0.15)	0.2633 (0.15)	-------
RTA	1.1147** (0.54)	1.1133** (0.53)	0.8331 (0.50)	0.8305*** (0.50)	0.6974 (0.52)	------	---------
LNG	0.6955** (0.33)	0.7721* (0.32)	0.7628* (0.32)	0.7631* (0.32)	0.7671** (0.34)	0.8015** (0.35)	0.8031** (0.34)
BORDER	-1.1276*** (0.67)	-1.0439 (0.66)	-------	------	-------	-------	------
ETHN	0.787628 (0.62)	-------	--------	------	-------	-----	-------
R^2	0.61	0.61	0.61	0.61	0.61	0.61	0.61

Note: Standard errors are reported in parenthesis.

*, ** and *** indicates 1%, 5% and 10% level of significance respectively.

Thus the final model for determining export determinants of Pakistan is:

$$\log(\mathrm{Exp}_{ijt}) = \alpha_0 + \beta_1 \log(\mathrm{GDP}_{jt}) + \beta_2 \log(\mathrm{PCGDPD}_{ijt}) + \beta_3 \log(\mathrm{IOP}_{jt}) + \beta_4 \log(\mathrm{Dist}_{ij}) + \beta_5 \log(\mathrm{Inf}_{jt}) + \beta_6 \log(\mathrm{Exch}_{ijt}) + \beta_7 (\mathrm{Lng}_{ij}) + U_{ijt}$$

The estimated equation for gravity model of export is:

$$\log(\mathrm{Exp}_{ij}) = 0.578 + 0.816 \log(\mathrm{GDP}_{j}) + 0.118 \log(\mathrm{PCGDPD}_{ij}) + 0.524 \log(\mathrm{IOP}_{j}) - 1.018 \log(\mathrm{Dist}_{ij}) - 0.069 \log(\mathrm{Inf}_{j}) - 0.100 \log(\mathrm{Exch}_{ij}) + 0.803(\mathrm{Lng}_{ij})$$

The export determinants of Pakistan are GDP of importing country, per capita GDP differential, import openness, distance, inflation, exchange rate and language. The other variables included in Model 1, are not showing a significant impact on exports of Pakistan. GDP of importing countries is statistically significant and having positive relation with export flow. This is the traditional gravity variable and having a positive relation with export flow. The results are consistent with the hypothesis of gravity model. PCGDP differential is again supporting H-O hypothesis of different factor of endowment leads to more trade among countries. Import openness of importing countries has significant impact on exports of Pakistan and showing expected positive relation with it. The country having less import restriction or import tariffs will trade more. Thus the results are consistent with theoretical reasoning of this variable.

Distance variable is showing expected negative and significant impact on exports of Pakistan. Distance is negatively related with trade flow in gravity model. The results are same in export model as in total trade model. Inflation rate is included in gravity model of exports to see its impact. There is inverse relation between exports of country i and prices in country j. The results show expected negative relation and statistically significant impact on exports of Pakistan. While prices of exporting country are not showing significant impact on export flow. Exchange rate among countries have strong impact on export flows. There exists negative relation between exchange rate and net exports. If there is depreciation in the currency of a country then its exports become cheaper and imports become costly. Thus, depreciation encourage exports and discourage imports. The results are consistent with the theoretical justification of this variable.

Dummies included to capture cultural similarity effects on export flow are not showing significant impact expect common language. This variable has expected positive relation with export flow. Border dummy is not showing expected results as it may be due to the fact that Pakistan's exports are negligible with border sharing countries especially with India. Thus the export determinants of Pakistan are GDP of importing countries, Per Capita GDP differential (supporting H-O hypothesis), Import openness, Inflation rate in importing countries, Distance, Exchange rate among trading countries and common language. The results of study are consistent with the findings of Rahman (2005), Kaur and Nanda (2010) and Gul and Yasin (2011).

4.4 Export Potential of Pakistan

Table 4.3 presents export potentials by taking the difference between predicted value (P) and actual trade flows (A) i.e. value of P-A.

Table 4.3: Export Potential of Pakistan (Average)

Indicator Countries	(P-A) 2000 - 2004	(P-A) 2005 – 2009	(P-A) 2010 – 2013
Australia	0.0304	0.5216	0.5061
Bangladesh	-1.4010	-1.5980	-1.5790
Belgium	-0.6611	-0.7314	-1.0627
Brazil	1.9978*	0.9254	0.5995
Canada	0.4221	0.7515	0.7327
Chile	----------	----------	-0.5625
China	-0.0040**	-0.0032**	-0.6075
Denmark	0.9602	0.8843	0.5967
Egypt	-0.4938	-0.4712	-0.6323
France	-0.1815	0.0801	0.0545
Germany	-0.2586	-0.1587**	-0.4340**
Greece	0.0937	0.2781	0.6139
Hong Kong	----------	0.2327	0.6352
Hungry	1.4000*	1.5990*	2.0387*
India	0.6664	0.3492	0.8966
Indonesia	-0.1705**	0.692	0.4973
Iran	0.9738	0.1765	1.0331*
Italy	-0.3417	-0.5849	-0.5899
Japan	----------	2.0833*	----------
Kuwait	-0.4807	-0.2708	-0.0053**
Malaysia	-0.0643**	-0.0500**	-0.5018
Mexico	0.6318	0.4296	0.1597
Netherland	-0.5834	-0.5152	-0.5459
New Zealand	-0.1405	0.1566	0.2883
Norway	0.8453	0.6633	0.9367
Philippines	1.2450*	0.7651	0.4739
Portugal	-1.0050	-1.0668	-1.0140
Saudi Arabia	-1.4566	-0.9002	-0.7057
Singapore	-1.0565	-0.9735	-1.0701
Spain	-0.6079	-0.8349	-1.0013
Sri Lanka	-2.0041	-2.3197	-2.2673
Sweden	0.3098	0.3789	0.4036
Switzerland	1.2755*	1.6400*	2.5136*
Thailand	0.2387	0.5087	----------
Turkey	-0.7997	-0.9687	-0.9797
UAE	----------	--------	-1.7528
UK	-0.2246	-0.1921	-0.4776**
USA	-0.6680	-0.8307	-0.6641

Note: * shows highest trade potential and ** shows exhausted trade potential

The average export potential (P-A) of Pakistan was highest for Brazil followed by Hungry, Switzerland and Philippines during 2000 to 2004 showing that Pakistan had maximum export potential with these countries while for those (China, Malaysia, Indonesia etc.) countries having negative value Pakistan had exceeded its export potential. For the period 2005 to 2009 average value of export potential was highest for Japan, Switzerland and Hungry while with many countries like Chile, Malaysia and Germany Pakistan has exhausted its export potential. During the recent years from 2010 to 2013 Pakistan has highest export potential with Switzerland and Hungry as P-A value is highest for these countries. During this time period Pakistan has exhausted its export potential with many countries like Kuwait, Germany and U.K. Thus Pakistan should expand its exports with these countries for which it has highest potential.

4.5 Import Determinants

Study has estimated eight gravity models to find import determinant of Pakistan. The first import model contains variables similar to first export model except import openness. Import models have export openness of country j. The regression results are given in table 4.5.

Model 1, has all variables that are assumed to have impact on imports. Regression results of model 1, indicates that GDP of trading countries, trade openness in Pakistan, export openness of exporting countries, prices in Pakistan, distance and exchange rate have significant impact on exports of Pakistan. All dummy variables are insignificant and showing no impact on imports of Pakistan with selected trading countries. These dummies are excluded one by one from model to its impact on other variable. In model 2, ethnicity dummy is excluded as it is insignificant in model 1. In model 3, border dummy is excluded that causes a small change in the magnitude of estimated coefficients of variables. In model 4, language dummy is excluded. In model 5, RTA dummy is excluded. In model 6, exchange rate is excluded. In model 7 and 8 inflation rate in country j and PCGDP differential are excluded respectively. Model 8, is the final estimable gravity model of bilateral imports of Pakistan. In this model all variables are statistically significant and carrying expected sign.

Thus, the final model for determining import determinants of Pakistan is:

$$\log(\mathrm{IMP}_{ijt}) = \alpha_0 + \beta_1 \log(\mathrm{GDP}_{it}) + \beta_2 \log(\mathrm{GDP}_{jt}) + \beta_3 \log(\mathrm{EOP}_{jt}) + \beta_4 \log(\mathrm{Dist}_{ijt}) + \beta_5 \log(\mathrm{T/Y}_{it}) + \beta_6 \log(\mathrm{Inf}_{it}) + \mathrm{U}_{ijt}$$

The estimated equation for gravity model of export is

$$log(IMP_{ij}) = 4.140 + 0.266 \log(GDP_{it}) + 0.672 \log(GDP_{jt}) + 0.328 \log(EOP_{jt}) - 1.792\, log(Dist_{ij}) + 1.061 \log(T/Y_{it}) + 0.143 \log(Inf_{it})$$

Table 4.5: Gravity model of Import

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
C	2.6833 (6.20)	2.2275 (6.02)	4.3301 (5.64)	3.4866 (5.62)	4.0134 (5.04)	3.5132 (4.95)	4.6472 (4.96)	4.1406 (4.73)
LGDPI	0.2805** (0.12)	0.2787** (0.12)	0.2622** (0.12)	0.2669** (0.12)	0.2706** (0.12)	0.3036* (0.12)	0.2746** (0.11)	0.2669** (0.11)
LGDPJ	0.4740* (0.14)	0.4723* (0.14)	0.5379* (0.13)	0.5322* (0.13)	0.5394* (0.13)	0.5387* (0.13)	0.6420* (0.12)	0.6721* (0.09)
LPCGDPD	0.0893 (0.08)	0.0912 (0.08)	0.0540 (0.08)	0.0503 (0.08)	0.0427 (0.08)	0.0544 (0.07)	0.0408 (0.07)	---
LTOPI	1.2818* (0.27)	1.2795* (0.27)	1.2511* (0.27)	1.2580* (0.27)	1.2540* (0.27)	1.2028* (0.26)	1.0264* (0.26)	1.0617* (0.25)
LINFI	0.1329** (0.06)	0.1332** (0.06)	0.1355** (0.06)	0.1350** (0.06)	0.1354** (0.06)	0.1423** (0.06)	0.1425** (0.06)	0.1431** (0.06)
LINFJ	-0.0466 (0.03)	-0.04745 (0.03)	-0.0483 (0.03)	-0.0474 (0.03)	-0.0469 (0.03)	-0.0504 (0.03)	-------	-----
LDIST	-1.570** (0.68)	-1.520** (0.66)	-1.7739* (0.61)	-1.6500* (0.61)	-1.7098* (0.54)	-1.6653* (0.53)	-1.8505* (0.53)	-1.7942* (0.51)
LEOPJ	0.2900** (0.13)	0.3027** (0.13)	0.3116* (0.13)	0.3089** (0.13)	0.3050* (0.12)	0.2970** (0.12)	0.3437* (0.12)	0.3286* (0.12)
LEXCH	0.0918 (0.07)	0.0928 (0.07)	0.0769 (0.07)	0.0830 (0.07)	0.0774 (0.06)	--------	--------	-------
RTA	-0.2213 (0.93)	-0.222 (0.92)	0.1407 (0.84)	0.2042 (0.85)	------	------	-------	-------
LNG	0.5562 (0.58)	0.6180 (0.56)	0.6321 (0.55)	------	-------	--------	-----	----
BORDER	1.2538 (1.14)	1.2725 (1.11)	------	-----	-----	------	--------	-------
ETHN	0.5685 (1.07)	------	------	------	-------	--------	-------	------
R^2	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61

Note: standard errors are reported in parenthesis.

*, ** and *** indicates 1%, 5% and 10% level of significance respectively.

Thus the import determinants of Pakistan are GDP of trading countries, export openness (country j), distance, inflation (country i) and trade openness of Pakistan. The other variables included in model 1, are not showing significant impact on imports of Pakistan. GDP of trading countries

(proxy for economic size) is the traditional and core variable of gravity model, carries expected sign and also statistically significant. The result supports the positive relation between economics size of trading partners and trade flows. Distance variable is showing expected negative and significant impact on exports of Pakistan. Distance is negatively related with trade flow in gravity model. The results are same in export model as in total trade model. Trade to GDP ratio (proxy for openness) for country i and export to GDP ratio for country j have expected positive sign and also statistically significant at 1 % level. The results are supporting theoretical reasoning of this variable that more the open economy of trading countries more will be the trade between them.

Inflation rate is included in gravity model of imports to see its impact. There is direct relation between imports of country i and prices in country j. The results show expected positive relation and statistically significant impact on imports of Pakistan. While prices of exporting countries is not showing significant impact on import flow of Pakistan. Study has also included export openness of county j in the gravity model of imports. This variable is found to be significant and carrying expected positive sign. These results support the theoretical justification of this variable. The findings of the study are consistent with Iqbal et al. (2014) and Roy and Rayhan (2011).

4.6 Import Potential of Pakistan

Table 4.6, presents import potentials by taking the difference between predicted value (P) and actual trade flows (A) i.e. value of P-A. The study has computed the average of 5 years in order to handle the results. Last average is of 4 years. The average import potential (P-A) of Pakistan was highest for Norway followed Philippines, Portugal and Greece during 2000 to 2004 showing that Pakistan had maximum import potential with these countries while for those (Netherland, Germany and India etc.) countries having negative value Pakistan had exceeded its import potential.

For the period 2005 to 2009 average value of import potential was highest for Norway followed Norway, Portugal, Philippines and Greece while with many countries like Germany, Sweden and Egypt Pakistan has exhausted its import potential. During the recent years from 2010 to 2013 Pakistan has highest import potential with for Norway followed Philippines, Portugal and Greece as P-A value is again highest for these countries. During this time period Pakistan has exhausted

its import potential with many countries like Denmark, U.K and Canada. The results of Pakistan's maximum import potential are almost same during the whole period. Thus Pakistan can expand its imports with these countries.

Table 4.6: Import Potential of Pakistan (Average)

Indicator Countries	(P-A) 2000 - 2004	(P-A) 2005 - 2009	(P-A) 2010 – 2013
Australia	-1.7709	-1.2502	-1.2502
Bangladesh	0.4134	0.5990	1.0183
Belgium	-0.6174	0.0101	0.1921
Brazil	-0.2483	-0.9189	-0.4197
Canada	-0.2118	-0.6349	-0.3468**
Chile	2.5221	1.9260	0.6207
China	-0.5952	-0.9697	-1.0809
Denmark	1.1001	0.8064	-0.0566**
Egypt	0.0748	-0.3146**	0.1229
France	0.4047	0.2581	0.2589
Germany	-0.0650**	-0.1669**	0.0248
Greece	1.8809*	1.4794*	1.9181*
Hong Kong	1.0895	1.2519	1.7836
Hungry	1.5995	0.8766	1.6771
India	-0.0722**	-0.5551	-0.5628
Indonesia	-1.9595	-2.1968	-1.9903
Iran	0.2486	0.5807	1.5489
Italy	0.1276	0.0165	0.1866
Japan	-0.2336	-0.4080	-0.3916
Kuwait	-2.1080	-1.6941	-2.0121
Malaysia	-2.4440	-2.8707	-2.7901
Mexico	1.7729	1.2277	1.4077
Netherland	-0.0248**	0.3704	0.5003
New Zealand	-0.1429	-0.6964	-0.4585
Norway	2.6445*	2.1364*	2.4699*
Philippines	2.2807*	1.5877*	1.8206*
Portugal	2.2234*	1.8663*	1.7608*
Saudi Arabia	-1.8214	-1.7653	-1.5647
Singapore	-0.4071	0.8452	0.7576
Spain	0.6609	0.8879	0.6167
Sri Lanka	-0.8952	-0.6087	-0.3466
Sweden	0.9826	-0.1843**	0.4997
Switzerland	-0.8772	-0.5501	-0.0202
Thailand	-1.3247	-1.4036	-1.3820
Turkey	0.6812	0.9726	1.1307
UAE	-2.3272	-2.0640	-2.4939
UK	-0.5477	-0.5159	-0.2608**
USA	-1.0178	-1.2016	-0.8730

Note: * shows highest trade potential and ** shows exhausted trade potential

4.7 Trade Potential with Border Sharing Countries

Highest export potential of Pakistan is mostly with EU member countries like Norway, Philippines, Switzerland and Greece. Pakistan's total trade potential has exhausted with its border sharing country China but there exist potential with India (0.89) and Iran (1.03). On the hand Import potential with China (-1.08) and India (-0.56) has exhausted but imports can be expanded with Iran (1.54). Pakistan has exhausted its both export and import potential with China. This may be due to the fact that China is the only country where the largest exporting and importing market for Pakistan exist. In case of India, Pakistan has export potential but Pakistan is still unable to utilize this untapped potential due to political and military tension. Pakistan also has import potential with Iran. Pakistan should focus these markets as they incurred low transportation cost as compared to other countries.

5 Conclusion

The objective of the study is to quantify Pakistan's trade potential with border sharing and other trading partners with a special focus on export and import potential. The study also aimed to find total trade, export and import determinants of Pakistan. The time period for data analysis is from 2000 to 2013 at annual frequency. The study has used augmented gravity model in order to achieve the objectives of the study.

Determinants of total trade are different from export and import determinants. Because trade is sum of export and import. Results drawn on the basis of total trade are somehow ambiguous because they are not explaining that whether they are effecting imports or exports. It's hard to find that which variable effect export and which import. For boosting exports and targeting imports country should has clear idea about which variable cause export and import. In total trade analysis the impact of some variables is not clear like exchange rate and inflation. Due to this reason this study has conducted a separate analysis for export and import determinants of Pakistan.

Moreover, during the recent years from 2010 to 2013 Pakistan has highest trade potential with Norway and Hungry while for exports the highest potential exist with Switzerland and Hungry and in case of imports Pakistan has highest potential with Norway followed by Philippines, Portugal and Greece. By comparing the results of total trade potential with export and import

potentials it's clear that conclusion drawn on the basis of total trade is not making the picture clear. Pakistan has highest total trade potential with Norway, but it is not clear this potential is for export, import or both. In order to find that with which country Pakistan should expand its export and imports this study has computed export and import potentials separately along with total trade potentials. Similarly with which country Pakistan has exhausted its trade potential is clear in separate analysis of export and import.

Distance is the core and traditional variable of gravity model. This variable has indirect relation with trade volume. Border sharing countries offer lower transportation cost due to minimum distance as compared to non-border sharing countries. In case of Pakistan, China and India are two major border sharing countries but only with China, Pakistan has exhausted its trade potential (both export and import potential). While in case of India, Pakistan has export potential. India has land routes with Pakistan that offers lower transportation cost but due to political tension both countries are not trading with each other.

Therefore, it is concluded that Pakistan has untapped export as well as import potential with its border sharing and other trading partners. Moreover, export and import determinants are different from total trade determinants. The results are similar to Iqbal et al. (2014), Roy and Rayhan (2011), Rahman (2005), Kaur and Nanda (2010), and Gul and Yasin (2011).

The policy implications based on our findings are that all kinds of trade barriers should be removed to enhance trade relations. Government of Pakistan should pay attention on industrial development in order to increase producer supply in the local markets. Supply side policies like investment on infrastructure for transportation, investment on technical education to increase research and development, technological advancement for enhancing productivity. Pakistan has export potential with EU member countries. As EU has granted GSP plus status to Pakistan. Pakistan should focus on the quality of its exports. Extensive efforts are required on political as well as diplomatic and social fronts in order to keep existing export markets and discover new ones. Particularly Pakistan should focus on NAFTA (Canada and Mexico) and EU where sufficient export potential exists.

References

Achakzai, J. K. (2006). Intra-ECO Trade: A Potential Region for Pakistan's Future Trade. *The Pakistan Development Review*, 45 (3), 425-437.

Akhtar, S., & Malik, F. (2000). Pakistan's trade performance vis-a-vis its major trading partners. *The Pakistan Development Review*, 39 (1), 37-50.

Akhter, N., & Ghani, E. (2010). Regional Integration in South Asia: An Analysis of Trade Flows Using the Gravity Model. *The Pakistan Development Review*, 49 (2), 105-118.

Anderson, J. E. (1979). A theoretical foundation for the gravity equation. *The American Economic Review*, 69 (1), 106-116.

Anderson, J. E., & van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. *The American Economic Review*, 93(1), 170-192.

Baltagi, B.H. (2000). *Econometric Analysis of Panel Data*. Chapter 14. Englewood Cliffs, NJ: Prentice-Hall.

Batra, A. (2006). India's Global Trade Potential: The Gravity Model Approach. *Global Economic Review*, 35(3), 327-361.

Bergstrand, J. H. (1985). The gravity equation in international trade: some microeconomic foundations and empirical evidence. *The review of economics and statistics*, 67 (3), 474-481.

Bergstrand, J. H. (1989).The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade. *The Review of Economics and Statistics,* 71(1):143-153.

Butt, W. A., & Riazuddin, R. (2008). Pakistan's Export Potential: A Gravity Model Analysis. *State Bank of Pakistan Working paper No.23.*

C P, Jomit (2014). Export Potential of Environmental Goods in India: A Gravity Model Analysis. *Transnational Corporations Review*, 6(2):115-131.

Chang, I.M. and H.J. Wall (2005), "Controlling for Heterogeneity in Gravity Models of Trade Integration", *Federal Reserve Bank of St. Louis Review*, Vol. 87, Issue 1, pp. 49-63.

Chaudhry, I. S., Malik, A., & Faridi, M. Z. (2010). Exploring the causality relationship between trade liberalization, human capital and economic growth: Empirical evidence from Pakistan. *Journal of Economics and International Finance*, 2(8), 175-182.

Darku, A. B. (2009). The gravity model and the test for the regional integration effect: the case of Tanzania. *The Journal of Developing Areas*, 43(1), 25-44.

De Benedictis, L., & Vicarelli, C. (2005). Trade potentials in gravity panel data models. *The BE Journal of Economic Analysis & Policy*, *5*(1).

Deardorff, A. V. (1995). Determinants of Bilateral Trade: Does Gravity Work in a Neo-Classical World? *NBER Working Paper No.* 5377.

Dufrenot, G., Mignon, V., & Tsangarides, C. (2010). The trade-growth nexus in the developing countries: A quantile regression approach. *Review of World Economics*, 146 (4), 731-761.

Deme, R. (2002). An Examination of Trade-Led Growth Hypothesis in Nigeria: A Co-integration, Causality and Impulse Response Analysis. *The Journal of Developing Areas,* 36 (1), 1-15

Frankel, J. A., & Romer, D. (1999). Does trade causes economic growth? *American Economic Review*, 89 (3), 379-399.

Fontoura, M. P., Martinez-Galan, E., & Proença, I. (2006). Trade Potential in an Enlarged European Union: A Recent Approach (No. 2006/08). ISEG-School of Economics and Management, Department of Economics, University of Lisbon.

Gujrati, D.N. (2003). Panel Data Regression Models. In *Basic Econometrics* (4thed.). New York: McGraw-Hill.

Gul, N., & Yasin, H. M. (2011).The Trade Potential of Pakistan: An Application of the Gravity Model. *Lahore Journal of Economics*, 16 (1), 23-62.

Hirantha, Wasam Seekkuwa (2004), "From SAPTA to SAFTA; Gravity Analysis of South Asian Free Trade", Nottingham University. (Available at http://www.etsg.org/ETSG2004/Papers/hirantha.pdf).

Karemera, D., Smith, W. I., Ojah, K., & Cole, J. A. (1999). A Gravity Model Analysis of the Benefits of Economic Integration in the Pacific Rim. *Journal of Economic Integration*, 14(3), 347-367.

Kaur, S., & Nanda, P. (2010). India's Export Potential to Other SAARC Countries: A Gravity Model Analysis. *Journal of Global Economy*, 6 (3), 167-184.

Khan, S., ul Haq, I., & Khan, D. (2013). An empirical analysis of Pakistan's bilateral trade: A gravity model approach. *Romanian Economic Journal*, 16 (48), 103-120.

Lai, H., & Chun Zhu, S. (2004). The determinants of bilateral trade. *Canadian Journal of Economic*, 37 (2), 459-483.

Linneman, H. (1966). An Econometric Study of International Trade Flows. Dissertation, Netherlands School of Economics, Amsterdam.

Malik, S., & Chaudhary, A. R. (2012). The Structure and Behavior of Pakistan's Imports from Selected Asian Countries: An Application of Gravity Model. *Pak. J. Commer. Soc. Sci*, *6*(1), 53-66.

Ogunkola, E. O. (1998). An empirical evaluation of trade potential in the economic community of West African states. *AERC Research Paper No. 84.*

Ozdeser, H., and Dizen, E. (2010). Turkey's Trade Potential with Euro-Zone Countries: A Gravity Study. *European Journal of Scientific Research*, *43(1).*

Raimondi, V., & Olper, A. (2011). Trade elasticity, gravity and trade liberalization: evidence from the food industry. *Journal of Agricultural Economics*, 62 (3), 525-550.

Rahman, M. M. (2005). The Determinants of Bangladesh's Trade: Evidence from the Generalized Gravity Model. *Working Paper* No. 3.

Rahman, M. M. (2009). Australia's global trade potential: evidence from the gravity model analysis. In *Proceedings of the 2009 Oxford Business and Economics Conference (OBEC 2009)* (pp. 1-41). Oxford University Press.

Rahman, M. M. (2010). The factors affecting Bangladesh's exports: evidence from the gravity model analysis. *The Journal of Developing Areas*, 44 (1), 229-244.

Rahman, M., Shadat, W. B., & Das, N. C. (2006). Trade potential in SAFTA: an application of augmented gravity model. *CPD occasional paper series*, 61, 512.

Roy, M., & Rayhan, M. I. (2012). Import flows of Bangladesh: gravity model approach under panel data methodology. *Dhaka University Journal of Science*, 60 (2), 153-157.

Ruiz, J. M., & Vilarrubia, J. M. (2007). The wise use of dummies in gravity models: export potentials in the Euromed region. *Banco de España Research Paper No.* WP-0720.

Simwaka, K. (2010). An Empirical Evaluation of Trade Potential in Southern African Development Community. *AERC Research Paper No.* 235.

Salim, R., & Al-Mawali, N. (2011). What is the Trade Response of the Regional Grouping in the GCC countries? *In The SIBR Conference on Interdisciplinary Business & Economic Research, Bangkok Thailand.*

Smarzynska, B. K. (2001). Does relative location matter for bilateral trade flows? An extension of the gravity model. *Journal of Economic Integration*, 16 (3), 379-398.

Tinbergen, J. (1962). Shaping the world economy; suggestions for an international economic policy. *Books (Jan Tinbergen)*.

Wang, Zhen Kun & Winters, L. Alan, 1991. The Trading Potential of Eastern Europe. *CEPR Discussion Papers 610.*

Wang, C., Wei, Y., & Liu, X. (2010). Determinants of bilateral trade flows in OECD countries: evidence from gravity panel data models. *The World Economy*, 33 (7), 894-915.

Appendix-A

Variable	Description	Source
T_{ij}	Total trade flow between country i and j (export+import) (SITC-3) measured in millions of US$ at current price.	UN Comtrade database
EXP_{ij}	Total export flow between country i and j (SITC-3) measured in millions of US$ at current price.	UN Comtrade database
IMP_{ij}	Total import flow between country i and j (SITC-3) measured in millions of US$ at current price.	UN Comtrade database
GDP	Gross domestic Product (proxy for economic size) expressed in millions of US$ at current price.	World Development Indicator (WDI)
PCGDP	Per capita Gross domestic Product (proxy for economic development) expressed US$ at current price.	World Development Indicator (WDI)
D_{ij}	Distance, great circle distance between the capitals of pair of trading countries (proxy for shipping cost and information cost) measured in kilometers.	www.countries-ofthe-world.com
Inf	Inflation rate of exporter/importer countries	World Development Indicator (WDI)
$Exch_{ij}$	Exchange rate between pair of trading partners expressed in US$	Pakistan Economic Survey (various issues).
Lan_{ij}	Language is a dummy variable that takes the values 0, 0.25, 0.5 and 1 for two languages official (English) and un-official (Urdu) language. If both countries share official language as a common language then it takes the value as 1, if a country share a common language that is official language in one country but un-official language in other country then it takes the value as 0.5, while if both countries share un-official language as a common main language then it takes the value as 0.25 and if both countries don't share any common language then it takes value as 0.	Exporters Encyclopedia 1998/99 and CIA World Fact book.
$Border_{ij}$	Border is a dummy variable that takes the value as 1 if partner country share a common border with Pakistan, zero otherwise.	CIA's The World fact book 2003, www.cia.gov/the-world-factbook
	RTA is the dummy variable that takes the	

RTA	value as 1 if both countries belong to same economic/trading community like SAARC, ECO, NAFTA and ASEAN, zero otherwise.	www.wto.orgs
$Ethn_{ij}$	Ethnicity is also a dummy variable that takes the value as 1 if there is ethnic minority of one country in another country that represent more than 5% of total population of the latter, zero otherwise.	CIA's The World fact book 2003 www.cia.gov/the-world-factbook